SARA-R4/N4 series

Size-optimized LTE Cat M1 / NB1 / GPRS modules

AT Commands Manual

Abstract
Description of standard and proprietary AT commands used with u-blox cellular modules.

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Document Information		
Title	SARA-R4/N4 series	
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Preface

Applicable products

This document applies to the following products:

Name	Type number	Modem version	Application version	PCN reference
SARA-R404M	SARA-R404M-00B-00	K0.0.00.00.07.06	N.A.	UBX-17047084
	SARA-R404M-00B-01	K0.0.00.00.07.08	N.A.	UBX-18053670
SARA-R410M	SARA-R410M-01B-00	L0.0.00.00.02.03	N.A.	UBX-17051617
	SARA-R410M-02B-00	L0.0.00.00.05.06	A02.00	UBX-18010263
	SARA-R410M-52B-00	L0.0.00.00.06.05	A02.06	UBX-18045915
SARA-R412M	SARA-R412M-02B-00	M0.09.00	A.02.11	UBX-19004091
SARA-N410	SARA-N410-02B-00	L0.0.00.00.07.07	A02.09	UBX-18057459

How to use this Manual

The u-blox Cellular Modules AT Commands Manual provides the necessary information to successfully design in and configure the applicable u-blox cellular modules.

This manual has a modular structure. It is not necessary to read it from the beginning to the end.

The following symbols are used to highlight important information within the manual:

☞ An index finger points out key information pertaining to module integration and performance.

⚠ A warning symbol indicates actions that could negatively impact or damage the module.

Summary table

The summary table on the top of each command section is a quick reference for the user.

command_name						
Modules	TOBY-L2 MPCI-L2					
	LISA-U110 LISA-U120 LISA-U130 LISA-U2					
	LEON-G1 SARA-G3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	-

It is composed of two sections:

- **Modules**: lists all the modules that support the command. The modules are grouped in rows by cellular standard (i.e. L for LTE high data rate (Cat 3 and above), R for LTE low data rate (Cat 1 and below), U for UMTS/HSPA, G for GSM/GPRS, N for NB-IoT (LTE Cat NB1 / LTE Cat NB2)). In each row the modules are grouped by: form factor (i.e. SARA, LISA), platform technology (e.g. SARA-G), platform generation (e.g. SARA-G3), product name (e.g. SARA-G350) and ordering code (e.g. SARA-G350-00S). In example: if 'LISA-U2' is reported, the command applies to all the modules having LISA form factor, second chipset version provided with any release of firmware.
- **Attributes**
  - **Syntax**
    - **full**: the command syntax is fully compatible among all the products listed in the "Modules" section
    - **partial**: the products support different syntaxes (usually backward compatible with respect to previous cellular standards)
  - **PIN required**
    - **Yes**: it is necessary to insert the PIN before the set and/or read command execution
    - **No**: the PIN insertion is not needed to execute the command
  - **Settings saved**
    - **Profile**: the command setting can be saved in a personal profile as specified in Chapter 1.2
    - **NVM**: the command setting is saved in the non-volatile memory as specified in Chapter 1.2

  - **No**: the current command setting is volatile and cannot be saved
- **Can be aborted**
  - **Yes**: the command execution can be aborted if a character is sent to the DCE during the command execution
  - **No**: the command cannot be aborted during the command execution
- **Response time**: estimated maximum time to get the final result code for the AT command execution. More precisely, the command response time measures the time from the complete acquisition of the command line to the issuing of the command result code. This kind of response time is generally lower than the time measured by the application on the DTE, because the issuing of the command on the DTE is influenced by the AT interface characteristics (e.g. the synchronous/asynchronous transfer type, the selected baudrate, etc.), by power saving and flow control, which introduce a variable latency in the command acquisition by the DCE.

  For example, the maximum expected response time shall be extended if the communication with the module is carried out on a MUX virtual port, because in this case the command line and the result code are transferred via a specific protocol running on the physical port, that might introduce additional communication delay due to framing and retransmissions.

  Similarly, the maximum expected response time of AT commands accessing the SIM shall be extended if the module is using a remote SIM card via SAP instead of the local SIM card.

  If the response time for a command is left blank (actually "-"), it is an "immediate" response. It means that the command is executed without asynchronous requests to the protocol stack or the internal applications, which usually require time to be answered: the command execution is synchronous (implying that no long blocking processing is done) and lasts a negligible time (the command response is issued by the module in typically less than 10 ms, and in any case less than 1 s).

  The response time shall be extended if the issued AT command triggers a service that cannot be served immediately due to concurrent access to the same service or resource via AT commands issued on a different communication port or from internal applications; typical examples are registration commands and SIM access, that can be also autonomously triggered by the module (e.g. auto-COPS) and can therefore postpone the execution of the AT commands issued by the user.
- **Error reference**: reference to the error result codes listed in the Appendix A

The attributes listed in the summary table apply by default to all u-blox modules supporting the specific AT command. If a u-blox module or module series does not comply to the default behavior, the exception is highlighted in Chapter 1.2 for the saving of settings, in Chapter 1.1.6 for the abortability, and in a product specific note in the AT command description for the PIN check.

u-blox Technical Documentation

As part of our commitment to customer support, u-blox maintains an extensive volume of technical documentation for our products. In addition to our product-specific technical data sheets, the following manuals are available to assist u-blox customers in product design and development.

AT Commands Manual: This document provides the description of the AT commands supported by u-blox cellular modules.

System Integration Manual: This document describes u-blox cellular modules from the hardware and the software point of view. It provides hardware design guidelines for the optimal integration of the cellular module in the application device and it provides information on how to set up production and final product tests on application devices integrating the cellular module.

Application Notes: These documents provide guidelines and information on specific u-blox cellular module hardware or software topics. See Related documents for application notes related to your cellular module.

Questions

If you have any questions about u-blox Cellular Hardware Integration, please:

- Read this manual carefully
- Contact our information service on our homepage www.u-blox.com
- Read the questions and answers on our FAQ database

Technical Support

Worldwide Web

Our website (www.u-blox.com) is a rich pool of information. Product information, technical documents and helpful FAQ can be accessed 24h a day.

By E-mail

If you have technical problems or cannot find the required information in the provided documents, contact the nearest of the Technical Support offices by email. Use our service pool email addresses rather than any personal email address of our staff. This makes sure that your request is processed as soon as possible. You will find the contact details at the end of the document.

Helpful Information when Contacting Technical Support

When contacting Technical Support please have the following information ready:

- Module type (e.g. SARA-G350-00S-00) and firmware version (e.g. 08.49)
- Module configuration
- Clear description of your question or the problem
- A short description of the application
- Your complete contact details

Contents

1 AT command settings

u-blox cellular modules provide at least one physical serial interface that is compliant to V.24 [26]. When the module is powered on, it enters the command mode. For more details on command mode, see Chapter 1.1.

For module and hyper terminal connection and settings see the corresponding evaluation kit user guide.

1.1 Definitions

In this document the following naming conventions are used:

- MT (Mobile Terminal) or DCE (Data Communications Equipment): u-blox cellular module
- TE (Terminal Equipment) or DTE (Data Terminal Equipment): terminal that issues the command to the module
- TA (Terminal Adaptor): the function, integrated in the MT, of supporting AT command interface according to the applicable standards
- ME (Mobile Equipment): equivalent to MT, it is used to refer to the device itself regardless of the inserted SIM card

The terms DCE and DTE are used in the serial interface context.

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u-blox cellular modules can implement more than one interface between the DTE and the DCE, either virtual interfaces (multiplexer channels) or physical interfaces (UART, USB, SPI, etc., when available). Each interface works as specified by the followings definitions. If not differently stated, all the subsequent descriptions are applicable to each interface. Appendix B.5 describes the different behaviour among the interfaces in reference to the AT command interface.

See the corresponding module data sheet for the list of available AT command interfaces.

The DCE/MT interface can operate in these modes:

- **Command mode**: the DCE waits for AT command instructions. The DCE interprets all the characters received as commands to execute. The DCE may send responses back to the DTE indicating the outcome of the command or further information without having received any commands by the DTE (e.g. unsolicited response code - URC). Any communication in the command mode (in both directions) is terminated by the command line termination character.
- **Data mode**: the DCE transfers data after having sent the "CONNECT" string; all the characters sent to the DCE are intended to be transmitted to the remote party. Any further characters received over the serial link are deemed to be from the remote party, and any characters sent are transmitted to the remote party. The DCE enters data mode immediately after it makes a Circuit Switched Data (CSD) or Packet Switched Data (PSD) connection.
- **Online command mode**: the DCE has a data connection established with a remote party, but treats signals from the DTE as command lines and sends back responses and unsolicited indications to the DTE.
- **AT commands over an IP connection**: the DCE is accepting a TCP connection on a specific TCP port. The DTE can connect via TCP protocol to the port and can send commands over this TCP connection. The DCE may send responses back to the DTE via the same TCP connection. The communication over IP connection is denoted by a set of two ports: 1) AT command port; 2) binary data port. The binary data port is used for the exchange of binary data between the DCE and DTE. For more details, on the configuration of the TCP ports see +UIFCONF.

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The AT commands over IP connection is not supported.

1.1.1 Switch from data mode to online command mode

It is possible to switch from data mode to online command mode (when a data connection is established) in the following ways:

- with the escape sequence: for more details see the S2 command description
- via a DTR transition: during data mode, the current DTR state is not important, but only its transition. Furthermore, only the DTR transition from ON to OFF is detected; it can be used to control the switch to online command mode, or to command mode (the data connection is released). For more details see the Table 6 and the Table 7

To switch back to data mode from online command mode the O command is used. For more details see also the &D command.

1.1.2 Command description

The AT commands configure and enable the cellular module functionalities according to 3GPP normative and u-blox specifications. The AT commands are issued to the module via a hyper terminal through a command line and are described in the following sections. A general description of each command is provided including the functionalities, the correct syntax to be provided by the TE/DTE, the allowed responses and an example. The command description defines each named parameter with its type, its range (valid / acceptable values), the default value (when available) and the factory-programmed value (when applicable).

For default value it is intended the value automatically set if the parameter is omitted and at the module power-on (if the command setting is not stored in NVM/profile). For factory-programmed value it is intended the value set at the module power-on when the setting is not modified respect with the manufacturer setting; it is valid for the commands that store the setting in NVM/profile.

The summary table on the top of each command section and the Appendix B lists all the u-blox cellular modules that support that command.

☞ The example provided in the command description refers only to the handling provided by the command. It may be not valid for all the products which the document is applied to. The list of allowed values for a specific product is provided in the corresponding "Defined values" section.

☞ In this document <CR><LF> are intentionally omitted in the command syntax.

☞ If a parameter is omitted, no value will be inserted between the two commas indicating the interested parameter in the command line sent by the DTE.

1.1.3 Default values

If the command parameters are optional, they can be left out in the command line. If not otherwise specified, the default values are assumed as follows:

- For parameters of type Number, the default value is 0
- For parameters of type String, the default value is an empty string

1.1.4 Command line

The AT commands are typically issued to the cellular modules using a command line with the following generic syntax:

```
"AT"<command_name><string><S3_character>
```

Where:

- "AT": prefix to be set at the beginning of each command line
- <command_name>: command name string; it can have a "+" character as prefix
- <string>: string consisting of the parameters value following the syntax provided in this manual
  The following rules are used when describing the command syntax:
  - <...>: the name in angle brackets is a parameter. The brackets themselves do not appear in the command line
  - [...]: the square brackets represent the optional parameters of a command or an optional part of the DCE information text response. Brackets themselves do not appear in the command line. When a parameter is not given, the value will be set to the default value provided in the command description

  Parameter types:
  - Number: positive and negative counting numbers, as well as zero {..., -2, -1, 0, 1, 2,...}.
  - String: sequence of characters enclosed within quotation marks (" ").
- <S3_character>: command line termination character; the factory-programmed termination character is <CR>

☞ The maximum length of the command line is the maximum number of characters which can be accepted on a single command line (including the command line termination character).

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The command line is not case sensitive unless autobauding is enabled; in this case the prefix "AT" must be typed either as "AT" or "at"; other combinations ("aT" or "Ta") are not allowed.

☞ When writing or sending an SMS, Ctrl-Z or ESC terminates the command; <CR> is used between the two parts of the SMS (address and text).

The serial interface driver generally does not allow a new command until the previous one has been terminated by "OK" final result code or by an error result code. In specific cases (see the abortability attribute), the command execution may be aborted if a character is sent to DCE before the command has ended.

1.1.4.1 Concatenation of AT commands

More than one AT command can be entered on the same command line. The "AT" prefix must be provided only at the beginning of the command line. Each command must be separated by using a semicolon as delimiter only if the command has a "+" character as prefix.

```
Example: ATI;+CGATT?;+COPS?<CR>
```

If a command in the command line causes an error, or is not recognized as a valid command, then the execution is terminated, the remaining commands in the command line are ignored and an error result code is returned.

If all the commands are correctly executed, only the "OK" final result code of the last command is returned.

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Not all the commands can be entered with other commands on the same command line: +CMGW, +CMGS, +USOWR, +USOST, +UDWNFILE must be used by themselves.

1.1.5 Notes

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- The maximum length of the command line is 1024 characters.
- String parameter type limitations - The following characters are not allowed in the parameter string:
  - 0x00 (NUL)
  - 0x0D (CR)
  - 0x15 (NAK)
  - 0x22 (")
  - 0x2C (,)

1.1.6 Information text responses and result codes

The AT command response comprises an optional information text string and a final result code that can assume the format as follows:

- **Verbose format:**
  Information text response(s): <S3_character><S4_character><text><S3_character><S4_character>
  Final result code: <S3_character><S4_character><verbose code><S3_character><S4_character>
- **Numerical format:**
  Information text response(s): <text><S3_character><S4_character>
  Final result code: <numerical_code><S3_character>

where

- <S3_character> is the command line termination character
- <S4_character> is the linefeed character

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The V AT command configures the result code in numeric or verbose format.
The command line termination character can be set with S3 AT command.
The linefeed character can be set with S4 AT command.

Table 1 lists the allowed result codes.

Verbose	Numeric	Result code type	Description
OK	0	Final	Command line successfully processed and the command is correctly executed
CONNECT	1	Intermediate	Data connection established
RING	2	Unsolicited	Incoming call signal from the network

Verbose	Numeric	Result code type	Description
NO CARRIER	3	Final	Connection terminated from the remote part or attempt to establish a connection failed
ERROR	4	Final	General failure. The AT+CMEE command configures the error result format
NO DIALTONE	6	Final	No dialtone detected
BUSY	7	Final	Engaged signal detected (the called number is busy)
NO ANSWER	8	Final	No hang up detected after a fixed network timeout
CONNECT<data rate>	9	Intermediate	Same as CONNECT including also the data rate (data call). In case of data/fax call, see Circuit 108/2, +++ behaviour for the different &D: summarizing table to return in command mode and disconnect the call.
Command aborted	3000	Final	Command execution aborted issuing a character to the DCE

Table 1: Allowed result codes

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The AT commands can not be aborted, except if explicitly stated in the corresponding AT command description.

Intermediate outputs as well as descriptive outputs of a command are formatted as information text responses; if more than one string has to be printed out (see for example the +CGDCONT command description), additional command line termination and linefeed characters may be inserted for sake of readability.

If the command is not accepted by the MT an error result code will be displayed. The AT+CMEE command configures the error result code format as follows:

- "+CMS ERROR: <err>" for SMS-related AT commands
- "+CME ERROR: <err>" for any other AT commands

where <err> represents the verbose or numeric error result code depending on the +CMEE AT command setting.

The most typical error result codes are the following:

- If the command is not supported or unknown, either "+CME ERROR: unknown" or "+CME ERROR: operation not supported" is sent
- If the command syntax is wrong, "+CME ERROR: operation not supported" is sent ("+CMS ERROR: operation not supported" for SMS related commands)

The list of all the possible error result codes is available in Appendix A.1 and Appendix A.2. For some commands only the "ERROR" final result code is displayed and is documented in the command description.

The proprietary AT commands supporting the following features implement a different error management and provide different error result codes:

- Firmware update Over The Air: see the Appendix A.3
- Firmware update Over AT command: see the Appendix A.4
- TCP and UDP connections, FTP and HTTP: see the Appendix A.5, Appendix A.6, Appendix A.6.1, Appendix A.6.2

The corresponding sections provide more details for retrieving the error result codes for these operations.

1.2 Storing of AT commands setting

Several user settings may be stored in the cellular module's memory. Some are directly stored in the non volatile memory (NVM), while the others are organized into two personal profiles. The first profile is the default profile, whose data is by default loaded during the module's power on.

Appendix B.2 lists the complete settings that can be directly stored in NVM and the corresponding commands.

Appendix B.1 lists the complete settings stored in the profiles and the corresponding commands.

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The module does not store the AT commands setting in the profiles.

1.3 S-parameters

The S-parameters, as specified in ITU-T recommendation V250 [20], constitute a group of commands that begin with the string "ATS". They are generally indicated as S registers and are used to configure the way the module operates. Their syntax is:

```
ATS<parameter_number>?
```

```
ATS<parameter_number>=<value>
```

The number following the "ATS" is the referenced S parameter.

u-blox cellular modules support the following set of S-parameters (<parameter_number>):

AT command	S Number	Description
S0	0	Automatic answer setting
S2	2	Escape character setting
S3	3	Command line termination character setting
S4	4	Response formatting character setting
S5	5	Command line editing character setting
S6	6	Pause before blind dialling setting
S7	7	Connection completion timeout setting
S8	8	Command dial modifier time setting
S10	10	Automatic disconnect delay setting
S12	12	Escape prompt delay setting

☞ If a <parameter_number> other than those listed above is introduced, the S command returns an error result code (+CME ERROR: operation not supported).

2 General operation

2.1 Start up and initialization

The characteristics of the boot of the cellular device vary from module to module and are described in the corresponding System Integration Manual; during this phase the module might be not responsive on the AT interface until all necessary SW modules have been installed (e.g. USB drivers); monitoring of the greeting text, where supported, can help in detecting the successful end of the boot phase.

A complete start up to be able to operate on the cellular network can take place only with a SIM card.

If the SIM card has enabled the PIN check, some commands answer with "+CME ERROR: SIM PIN required" and most cellular functionalities are not started. After entering the required PIN via the +CPIN command, or if booting with a SIM with disabled PIN check, SIM initialization is carried out and a lot of SIM files are read: it is possible that some commands (e.g. phonebook AT commands) are affected by this preliminary phase, resulting in a temporary error response.

2.1.1 Auto-registration

If the +COPS <mode> parameter in the profiles or in NVM is left to its factory-programmed value 0 or set to 1, after SIM initialization, all u-blox modules will automatically perform PLMN selection and registration for circuit switched/non EPS services as well as packet switched/EPS services. Auto-registration (sometimes called also "auto-COPS", not to be confused with automatic <mode>=0) will be triggered also at SIM insertion, for modules supporting SIM hot insertion, or at SIM driver recovery, occurring when the communication with the SIM card is re-established by the module after an unrecoverable error, caused e.g. by mechanical vibrations or electrical interference. If no SIM is inserted in the module, the module will anyway select a cell of the cellular network and try to maintain synchronization with it in limited service.

The radio access technology selected by the module at start up is defined by the <PreferredAct> parameter of the +URAT command; afterwards the module will reselect the RAT based on the requirements of the cellular standards it complies with and it is not possible to force it to remain in a given RAT unless it is locked on it via +URAT or on a specific cell via +UCELLLOCK (if supported).

The user can retrieve the result of the auto-registration by polling the registration status commands (e.g. +CREG/+CGREG/+CEREG/+CIREG) or enabling their unsolicited notifications. If auto-COPS is running, at boot time or at SIM insertion, network service commands issued by the user might have a longer response time than expected; this is particularly visible when the module is switched on in a jammed condition, or with a roaming SIM card that shall perform several registration attempts before gaining access to a VPLMN. In case of failures of the automatic registration whose cause cannot be retrieved via +CEER, it is suggested to disable auto-COPS starting the module in +COPS:2 or in airplane mode +CFUN:4 and trigger registration with AT commands.

2.1.2 Operational restrictions

Operational restrictions may derive from several settings: PIN required, SIM lock, invalidation of the IMEI or SIM credentials by the Mobile Network Operator (MNO) during the registration procedure, FDN enabled. Restrictions to access the network are also applied by the module in any one of these conditions:

- In eCall only state (for all modules supporting the eCall feature)
- In minimum functionality power modes (+CFUN: 0, +CFUN: 4, +CFUN: 19, +CFUN: 127), and even if the module is restarted in +CFUN: 4 or +CFUN: 19 modes, because they are persistent

In case the module is in operational restricted state, it may reject all or specific service requests (e.g. operator selection, connection establishment).

2.2 AT commands types

2.2.1 Action command

An action command forces the DCE to print information text or execute a specific action for the command. A typical example of this command type is the provision of the factory-programmed settings of the DCE like manufacturer name, firmware version, etc.

2.2.2 Set command

A set command configures the preferred settings for the specified command. The set command is the only way to set the preferred settings in the DCE. For some commands it is possible to store the current settings in the profile or in the non volatile memory and retrieve them in another connection.

2.2.3 Read command

A read command provides the current setting of the command parameters. It is used to find out the current command configuration.

2.2.4 Test command

A test command provides the list of the values allowed by each parameter of the command.

2.2.5 Unsolicited Result Code (URC)

An unsolicited result code is a string message (provided by the DCE) that is not triggered as a information text response to a previous AT command and can be output, when enabled, at any time to inform the DTE of a specific event or status change.

The URC can have the same name of the command that enables it (e.g. +CREG) or can be enabled by another command (e.g. the +CMTI URC must be enabled by AT+CNMI AT command).

2.2.5.1 URCs presentation deferring

Since the URCs are text responses issued by the DCE without being requested by the DTE, their occurrence is completely uncorrelated to an AT command execution. Therefore, a collision between a URC and an AT command response might occur and it may lead the DTE to misunderstand the URC as part of the AT command's text response or viceversa.

The module avoids this collision by delaying the URCs presentation in case the AT command interface is busy. The AT command interface can be busy in the following cases:

- During a data call (data mode)
- During the execution of an AT command in command or online command mode

The command execution starts when the command line is completed by the command line termination character and the AT interpreter in the module accepts it; the command execution ends when the final result code for the command is sent out. Inside this period, the module is not allowed to send the not buffered URCs. For most of the messages, the DCE needs to be configured whether or not to send a URC. After enabling, for most of the URCs, if the AT command interface is busy, the pending URCs are buffered and their sending to the DCE is deferred. The RING indication is always generated as an unsolicited result code. The NO CARRIER indication is generated as an unsolicited result code when it has not to be considered the final response for the executing command (e.g.: ATH); in case it is handled as an unsolicited result code, it follows the rule of the other URCs.

Generally, the buffered URCs are sent to the terminal as soon as the terminal exits the data mode or the command execution is terminated. An exception to this behavior is implemented for the following URCs classes:

Class	AT command to configure the class
Reception of a new SMS related URCs	AT+CNMI AT command
+CIEV URCs	AT+CMER AT command

For the above classes, it is possible to select the presentation strategy in case of AT interface busy according the 3GPP TS 27.007 [2]; the buffering or discarding are the two possible choices (URCs are lost in the latter case). This is done by means of the corresponding AT command (see the AT command listed in the table above). If the URCs are enabled or for the three described classes of URCs, the buffered URCs are sent out only when the AT interface is in idle again; this occurs as soon as:

- The data mode is released (the data call is disconnected)
- The final result code for an AT command is issued

☞ The DTE should wait some time (the recommended value is at least 20 ms) after the reception of an AT command final result code or URC before issuing a new AT command to give the DCE the opportunity to

transmit the buffered URCs. Otherwise the collision of the URCs with the subsequent AT command is still possible.

☞ In case multiple AT interfaces are available, it should be advisable to use one of the different AT interfaces to manage all the user enabled URCs, while use the others ones to send AT commands and receive their responses.
Anyway URCs related to external causes (e.g. RING) are issued on all interfaces.

2.2.6 Intermediate Result Code (IRC)

An intermediate result code is a string message (provided by the DCE) which provides to the DTE some information about the processing status of the pending AT command.

3 IPC - Inter Processor Communication

3.1 Multiplexing mode +CMUX

+CMUX						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

3.1.1 Description

Enables the multiplexing protocol control channel as defined in 3GPP TS 27.010 [46]. The command sets the parameters for the control channel. The result code is returned using the old interface speed. The parameters become active only after sending the OK result code.

The usage of +CMUX command during the multiplexing is not allowed.

The multiplexer configuration is as follows:

Channel	Control channel	AT commands / data connection	GNSS tunneling	SAP (SIM Access Profile)
SARA-R404M-00B / SARA-R410M-01B	Channel 0	Channel 1 - 3		
SARA-R410M-02B / SARA-R410M-52B / SARA-N4	Channel 0	Channel 1 - 2	Channel 3	

Table 2: Multiplexer configuration

3.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+CMUX=<mode>[,<subset>[,<port_speed>[,<N1>[,<T1>[,<N2>[,<T2>[,<T3>[,<k>]]]]]]]	OK	AT+CMUX=0,0,,1500,50,3,90 OK
Read	AT+CMUX?	+CMUX: <mode>,[<subset>],<port_speed>,<N1>,<T1>,<N2>,<T2>,<T3>[,<k>] OK	+CMUX: 0,0,0,1500,253,3,254,0,0 OK
Test	AT+CMUX=?	+CMUX: (list of supported <mode>s),(list of supported <subset>s),(list of supported <port_speed>s),(list of supported <N1>s),(list of supported <T1>s),(list of supported <N2>s),(list of supported <T2>s),(list of supported <T3>s),(list of supported <k>s) OK	+CMUX: (0),(0),,(1-1509),(1-255),(0-5),(2-255),, OK

3.1.3 Defined values

Parameter	Type	Description
<mode>	Number	Multiplexer transparency mechanism: • 0: basic option
<subset>	Number	The way in which the multiplexer control channel is set up: • 0 (default value): UIH frames used only • 1: UI frames used only See Notes for the parameter applicability.
<port_speed>	Number	Transmission rate. The allowed range is 0-7.

Parameter	Type	Description
		This parameter is ignored and the value 0 is always displayed in case of read command.
<N1>	Number	Maximum frame size: • Allowed range is 1-1509. • The default value is 31.
<T1>	Number	Acknowledgement timer in units of ten milliseconds. The allowed range is 1-255. This parameter is ignored and the value 253 is always set.
<N2>	Number	Maximum number of re-transmissions: • Allowed range is 0-5. • The default value is 3.
<T2>	Number	Response timer for the multiplexer control channel in units of ten milliseconds. The allowed range is 2-255. This parameter is ignored and the value 254 is always set.
<T3>	Number	Wake up response timer. The allowed range is 0-255. This parameter is ignored and the value 0 is always displayed in case of the read command.
<k>	Number	Window size, for advanced operation with Error Recovery options. The allowed range is 0-255. This parameter is ignored and the value 0 is always displayed in case of the read command.

3.1.4 Notes

- If the multiplexer protocol is not started (the +CMUX set command has not been issued or returned an error result code) and AT+CMEE is set to 2, the +CMUX read command returns the following error result code: +CME ERROR: operation not allowed.
- For complete compatibility between u-blox products, leave the unsupported/unused parameters blank (which are reported as blank by the +CMUX test command).
- <T1> must be lower than or equal to <T2>.

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- <subset> can only assume the value 0.
- <T1>, <T2>, <N2> values are ignored, since the related timers are not implemented.
- The command is only supported on the UART interface. It cannot be used on the USB port.

4 General

4.1 Manufacturer identification +CGMI

+CGMI						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.1.1 Description

Text string identifying the manufacturer.

4.1.2 Syntax

Type	Syntax	Response	Example
Action	AT+CGMI	<manufacturer>	u-blox
		OK	OK
Test	AT+CGMI=?	OK	

4.1.3 Defined values

Parameter	Type	Description
<manufacturer>	String	Manufacturer name

4.2 Manufacturer identification +GMI

+GMI						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.2.1 Description

Text string identifying the manufacturer.

4.2.2 Syntax

Type	Syntax	Response	Example
Action	AT+GMI	<manufacturer>	u-blox
		OK	OK

4.2.3 Defined values

Parameter	Type	Description
<manufacturer>	String	Manufacturer name

4.3 Model identification +CGMM

+CGMM						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.3.1 Description

Text string identifying the model identification.

4.3.2 Syntax

Type	Syntax	Response	Example
Action	AT+CGMM	<model>	LISA-U200
		OK	OK
Test	AT+CGMM=?	OK	

4.3.3 Defined values

Parameter	Type	Description
<model>	String	Name of model

4.4 Model identification +GMM

+GMM						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.4.1 Description

Text string identifying the model identification.

4.4.2 Syntax

Type	Syntax	Response	Example
Action	AT+GMM	<model>	LISA-U120
		OK	OK

4.4.3 Defined values

Parameter	Type	Description
<model>	String	Name of model

4.5 Firmware version identification +CGMR

+CGMR						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.5.1 Description

Returns the firmware version of the module.

4.5.2 Syntax

Type	Syntax	Response	Example
Action	AT+CGMR	<version>	11.40
		OK	OK
Test	AT+CGMR=?	OK	

4.5.3 Defined values

Parameter	Type	Description
<version>	String	Firmware version

4.6 Firmware version identification +GMR

+GMR						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.6.1 Description

Returns the firmware version of the module.

4.6.2 Syntax

Type	Syntax	Response	Example
Action	AT+GMR	<version>	11.40
		OK	OK

4.6.3 Defined values

Parameter	Type	Description
<version>	String	Firmware version

4.7 IMEI identification +CGSN

+CGSN						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

4.7.1 Description

Returns the product serial number, the International Mobile Equipment Identity (IMEI) of the MT.

4.7.2 Syntax

Type	Syntax	Response	Example
Action	AT+CGSN[=<snt>]	<sn>	004999010640000
		OK	OK
Test	AT+CGSN=?	+CGSN: (list of supported <snt>s)	+CGSN: (0-3,255)
		OK	OK

4.7.3 Defined values

Parameter	Type	Description
<sn>	String	Serial number, by default the IMEI

Parameter	Type	Description
<snt>	Number	It indicates the requested serial number type. Depending on <snt> value, the <sn> parameter in the information text response provides different information: • 0 (default value): International Mobile station Equipment Identity (IMEI) • 1: International Mobile station Equipment Identity (IMEI) • 2: International Mobile station Equipment Identity and Software Version number (IMEISV) • 3: Software Version Number (SVN) • 255: IMEI (not including the spare digit), the check digit and the SVN

4.7.4 Notes

SARA-R4 / SARA-N4

- The <snt> parameter is not supported.
- The response to the test command does not provide the information text response.

4.8 IMEI identification +GSN

+GSN						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.8.1 Description

The commands handling is the same of +CGSN.

4.8.2 Syntax

Type	Syntax	Response	Example
Action	AT+GSN[=<snt>]	<sn>	004999010640000
		OK	OK
Test	AT+GSN=?	OK	

4.8.3 Defined values

See +CGSN AT command.

4.9 Identification information I

I						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

4.9.1 Description

Returns some module information as the module type number and some details about the firmware version.

The information text response of ATI9 contains the modem version and the application version of the module where applicable; it returns "Undefined" where not applicable.

4.9.2 Syntax

Type	Syntax	Response	Example
Action	**Ordering code request** ATI	Manufacturer: <manufacturer>	ATI0
		Model: <type_number>	Manufacturer: u-blox
		Revision: <modem_version>	Model: SARA-R412M-02B

Type	Syntax	Response	Example
		SVN: <SVN> IMEI: <IMEI> OK	Revision: M0.05.00 [Jul 06 2018 10:01:55] SVN: 02 IMEI: 354679090015846 OK
	Ordering code request ATI[0]	<type_number> OK	ATI0 SARA-R412M-02B OK
	Modem and application version request ATI9	<modem_version>,<applications_version> OK	ATI9 M0.09.00,A.02.11 OK

4.9.3 Defined values

Parameter	Type	Description
<manufacturer>	String	Manufacturer name
<type_number>	String	Product type number
<modem_version>	String	Module modem version
<applications_version>	String	Module application version. Where not applicable the module provides "Undefined"
<SVN>	String	Software Version Number
<IMEI>	String	International Mobile Equipment Identity (IMEI) of the MT

4.10 TE character set configuration +CSCS

+CSCS						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.10.1 Description

Selects the TE character set.

The selected character set is actually used for encoding/decoding of only the AT commands' string type parameters whose description explicitly references the +CSCS setting itself.

4.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSCS=<chset>	OK	AT+CSCS="IRA" OK
Read	AT+CSCS?	+CSCS: <chset> OK	+CSCS: "IRA" OK
Test	AT+CSCS=?	+CSCS: (list of supported <chset>'s) OK	+CSCS: ("IRA","GSM","PCCP437","8859-1","UCS2","HEX") OK

4.10.3 Defined values

Parameter	Type	Description
<chset>	String	• "IRA" (factory-programmed value): International Reference Alphabet (ITU-T T.50) • "GSM": GSM default alphabet (3GPP TS 23.038) • "PCCP437": PC character set Code Page 437 • "8859-1": ISO 8859 Latin 1 character set

Parameter	Type	Description
		• "UCS2": 16-bit universal multiple-octet coded character set (USO/IEC10646); UCS2 character strings are converted to hexadecimal numbers from 0000 to FFFF; e.g. "004100620063" equals three 16-bit characters with decimal values 65, 98 and 99 • "HEX": character strings consist only of hexadecimal numbers from 00 to FF; e.g. "032FE6" equals three 8-bit characters with decimal values 3, 47 and 230; no conversions to the original MT character set shall be done

4.10.4 Notes

SARA-R4 / SARA-N4

- <chset>="PCCP437", "8859-1", "UCS2" and "HEX" are not supported.

4.11 International mobile subscriber identification +CIMI

+CIMI						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

4.11.1 Description

Request the IMSI (International Mobile Subscriber Identity).

4.11.2 Syntax

Type	Syntax	Response	Example
Action	AT+CIMI	<IMSI>	222107701772423
		OK	OK
Test	AT+CIMI=?	OK	

4.11.3 Defined values

Parameter	Type	Description
<IMSI>	Number	International Mobile Subscriber Identity

4.12 Card identification +CCID

+CCID						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.12.1 Description

Returns the ICCID (Integrated Circuit Card ID) of the SIM-card. ICCID is a serial number identifying the SIM.

4.12.2 Syntax

Type	Syntax	Response	Example
Action	AT+CCID	+CCID: <ICCID>	+CCID: 8939107800023416395
		OK	OK
Read	AT+CCID?	+CCID: <ICCID>	+CCID: 8939107900010087330
		OK	OK
Test	AT+CCID=?	OK	

4.12.3 Defined values

Parameter	Type	Description
<ICCID>	String	ICCID of the SIM card

4.12.4 Notes

- The command needs of the SIM to correctly work.

4.13 Repeat last command A/

A/						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.13.1 Description

Repeats the previously executed command again. Only the A/ command cannot be repeated.

☞ If autobauding is active, the MT is not able to recognize the command and the command A/ cannot be used.

4.13.2 Syntax

Type	Syntax	Response	Example
Action	A/		

5 Mobile equipment control and status

5.1 Module switch off +CPWROFF

+CPWROFF						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 40 s	+CME Error

5.1.1 Description

Switches off the MT. During shut-down current settings are saved in module's non-volatile memory.

Using this command can result in the following command line being ignored.

See the corresponding System Integration Manual for the timing and the electrical details of the module power-off sequence via the +CPWROFF command.

5.1.2 Syntax

Type	Syntax	Response	Example
Action	AT+CPWROFF	OK	
Test	AT+CPWROFF=?	OK	

5.2 Set module functionality +CFUN

+CFUN						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	Up to 3 min	+CME Error

5.2.1 Description

Selects the level of functionality <fun> in the MT.

SARA-R4 / SARA-N4
If the syntax +CFUN=15 or +CFUN=16 (resets) or +CFUN=127 is used, the rest of the command line, placed after that will be ignored.

SARA-R4 / SARA-N4
A SW reset started via AT+CFUN=x,1 or AT+CFUN=16 triggers signalling attempts whose number is internally counted by the FW and limited based on mobile network operators' thresholds. The AT&T RPM feature (see also the +URPM AT command) limits the number of SW resets per hour, and might cause the AT command to return an error result code.

5.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+CFUN=<fun>[,<rst>]	OK	AT+CFUN=1 OK
Read	AT+CFUN?	+CFUN: <power_mode>,<STK_mode> OK	+CFUN: 1,0 OK
Test	AT+CFUN=?	+CFUN: (list of supported <fun>'s),(list of supported <rst>'s) OK	+CFUN: (0,1,4,6,7,8,15,16),(0-1) OK

5.2.3 Defined values

Parameter	Type	Description
<fun>	Number	Selected functionality: • 0: sets the MT to minimum functionality (disable both transmit and receive RF circuits by deactivating both CS and PS services) • 1 (factory-programmed value): sets the MT to full functionality, e.g. from airplane mode or minimum functionality • 4: disables both transmit and receive RF circuits by deactivating both CS and PS services and sets the MT into airplane mode. Airplane mode is persistent between power cycles triggered by +CFUN=16 or +CPWROFF (where supported) • 6: enables the SIM-toolkit interface in dedicated mode and fetching of proactive commands by SIM-APPL from the SIM-card • 7 or 8: disables the SIM-toolkit interface and fetching of proactive commands by SIM-APPL from the SIM-card • 9: enables the SIM-toolkit interface in raw mode and fetching of proactive commands by SIM-APPL from the SIM-card • 15: MT silent reset (with detach from network and saving of NVM parameters), without reset of the SIM card • 16: MT silent reset (with detach from network and saving of NVM parameters), with reset of the SIM card • 19: sets the MT to minimum functionality by deactivating CS and PS services and the SIM card • 127: sets the MT in a deep low power state "HALT" (with detach from the network and saving of the NVM parameters); the only way to wake up the module is a power cycle or a module reset
<rst>	Number	Reset mode. This parameter can be used only when <fun> is 1, 4 or 19. • 0 (default value): do not reset the MT before setting it to the selected <fun> • 1: performs a MT silent reset (with detach from network and saving of NVM parameters) with reset of the SIM card before setting it to the selected <fun>
<power_mode>	Number	• 0: MT is switched on with minimum functionality • 1: MT is switched on • 4: MT is in "airplane mode" • 19: MT is in minimum functionality with SIM deactivated
<STK_mode>	Number	• 6: the SIM-toolkit interface in dedicated mode and fetching of proactive commands by SIM-APPL from the SIM-card are enabled • 0, 7 or 8: the SIM-toolkit interface is disabled; fetching of proactive commands by SIM-APPL from the SIM-card is enabled • 9: the SIM-toolkit interface in raw mode and fetching of proactive commands by SIM-APPL from the SIM-card are enabled

5.2.4 Notes

SARA-R4 / SARA-N4

- <fun>=16, 19 and 127 are not supported.
- <fun>=5 identifies the factory test mode (FTM). The <fun> parameter is set to 5 after the module enters the non-signalling mode (AT+UTEST=1).
- <fun>=15 resets the SIM card.
- To reset the module issue the AT+CFUN=15 command.
- The command will provide an error result code while in Online Command Mode (OLCM).

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- <fun>=6, 7, 8 and 9 are not supported.

5.3 Indicator control +CIND

+CIND						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

5.3.1 Description

Provides indication states related to network status, battery information and so on.

The set command does not allow setting the values for those indications which are set according to module state (see <descr> parameter).

The list of indications for set and read commands follows the indexes reported in the <descr> parameter, so that the first <ind> corresponds to "battchg" and so on.

For more details see the 3GPP TS 27.007 [2].

5.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+CIND=[<ind>[,<ind>[,...]]]	OK	AT+CIND= OK
Read	AT+CIND?	+CIND: <ind>[,<ind>[,...]] OK	+CIND: 5,0,0,0,0,0,0,0,0,0,0 OK
Test	AT+CIND=?	+CIND: (list of <descr>s) OK	+CIND: ("battchg",(0-5)),("signal",(0-5)),("service",(0,1)),("sounder",(0,1)),("message",(0,1)),("call",(0,1)),("roam",(0,1)),("smsfull",(0,1)),("gprs",(0-2)),("callsetup",(0-3)),("callheld",(0,1)),("simind",(0-2)) OK

5.3.3 Defined values

Parameter	Type	Description
<ind>	Number	Range of corresponding <descr> used to identify the service when an unsolicited indication is provided
<descr>	String	Reserved by the norm and their <ind> ranges; it may have the values: • "battchg": battery charge level (0-5) • "signal": signal quality. See mapping in the note below • "service": network service availability o 0: not registered to any network o 1: registered to the network o 65535: indication not available • "sounder": sounder activity, indicating when the module is generating a sound o 0: no sound o 1: sound is generated • "message": unread message available in <mem1> storage o 0: no messages o 1: unread message available • "call": call in progress o 0: no call in progress o 1: call in progress • "roam": registration on a roaming network o 0: not in roaming or not registered o 1: roaming o 65535: indication not available

Parameter	Type	Description
		• "smsfull": indication that an SMS has been rejected with the cause of SMS storage full o 0: SMS storage not full o 1: SMS storage full • "gprs": PS indication status: o 0: no PS available in the network o 1: PS available in the network but not registered o 2: registered to PS o 65535: indication not available • "callsetup": call set-up: o 0: no call set-up o 1: incoming call not accepted or rejected o 2: outgoing call in dialling state o 3: outgoing call in remote party alerting state • "callheld": call on hold: o 0: no calls on hold o 1: at least one call on hold • "simind": SIM detection o 0: no SIM detected o 1: SIM detected o 2: not available

5.3.4 Notes

- If the battery charging is not supported, "battchg" always returns 5 (full charge).
- The <descr> values cannot be changed with +CIND set.
- The following mapping of "signal" value to the power level exists:

"signal" value	Power level
0	(< -105 dBm or unknown)
1	(< -93 dBm)
2	(< -81 dBm)
3	(< -69 dBm)
4	(< -57 dBm)
5	(>= -57 dBm)

5.4 Configuration of indicator control +UCIND

+UCIND						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	+CME Error

5.4.1 Description

Allows the configuration of unsolicited results for indications with +CIEV.

5.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCIND=[<conf>]	OK	AT+UCIND=7 OK
Read	AT+UCIND?	+UCIND: <conf> OK	+UCIND: 7 OK
Test	AT+UCIND=?	OK	

5.4.3 Defined values

Parameter	Type	Description
<conf>	Number	The unsigned integer (0 to 4095) is a bitmask representing the list of the indications active for +CIEV URC reporting. The bit position corresponds to the indicator order number (see the <descr> parameter of +CMER). The least significant bit is used for the first indicator. The bits corresponding to unused indicator order numbers (greater than 13) must be set to 0 (setting a <conf> greater than 4095 causes an error). The default value is 40 95 (all the indications are enabled).

5.5 Mobile termination event reporting +CMER

+CMER						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

5.5.1 Description

Configures sending of URCs from MT to DTE for indications. The <mode> parameter controls the processing of URCs specified within this command.

The URC is generated each time an indicator which is defined in +CIND command changes status. The code is actually submitted to MT according to the +CMER settings.

The command +UCIND allows enabling or disabling indicators.

5.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+CMER=[<mode>[,<keyp>[,<disp>[,<ind>[,<bfr>]]]]]	OK	AT+CMER=1,0,0,2,1 OK
Read	AT+CMER?	+CMER: <mode>,<keyp>,<disp>,<ind>,<bfr> OK	+CMER: 1,0,0,0,1 OK
Test	AT+CMER=?	+CMER: (list of supported <mode>'s),(list of supported <keyp>'s),(list of supported <disp>'s),(list of supported <ind>'s),(list of supported <bfr>'s) OK	+CMER: (0-3),(0),(0),(0-2),(0,1) OK
URC		+CIEV: <descr>,<value>	

5.5.3 Defined values

Parameter	Type	Description
<mode>	Number	• 0 (default value): buffer URCs in the MT • 1: discard URCs when the V.24 interface is reserved for data; otherwise directly display them on the DTE • 2: buffer URCs in MT when the V.24 interface is reserved and flush them after reservation; otherwise directly display them on the DTE • 3: same as 1
<keyp>	Number	• 0: no keypad event reporting
<disp>	Number	• 0: no display event reporting
<ind>	Number	• 0: no indicator event reporting • 1: indicator event reporting using the +CIEV URC. Only the indicator events which are not caused by +CIND shall be indicated by the MT to the DTE. • 2: indicator event reporting using the +CIEV URC. All the indicator events shall be directed from MT to DTE.

Parameter	Type	Description
<bfr>	Number	• 0: MT buffer of URCs defined within this command is cleared when <mode> 1...3 is entered • 1: MT buffer of URCs defined within this command is flushed to the DTE when <mode> 1...3 is entered (the OK final result code shall be given before flushing the codes).
<descr>	Number	Indicates the indicator order number. The name in the brackets indicates the corresponding <descr> parameter of +CIND; <value> is the new value of indicator: • 1 ("battchg"): <value> provides the battery charge level (0-5) • 2 ("signal"): <value> provides the signal quality o 0: < -105 dBm o 1: < -93 dBm o 2: < -81 dBm o 3: < -69 dBm o 4: < - 57 dBm o 5: >= -57 dBm • 3 ("service"): <value> provides the network service availability: o 0: not registered to the network o 1: registered to the network • 4 ("sounder"): <value> provides the sounder activity: o 0: no sound o 1: sound is generated • 5 ("message"): <value> provides the unread message available in <mem1> storage: o 0: no messages o 1: unread message available • 6 ("call"): <value> provides the call in progress: o 0: no call in progress o 1: call in progress • 7 ("roam"): <value> provides the registration on a roaming network: o 0: not in roaming o 1: roaming • 8 ("smsfull"): <value> provides the SMS storage status: o 0: SMS storage not full o 1: SMS Storage full (an SMS has been rejected with the cause of SMS storage full) • 9 ("gprs"): <value> provides the GPRS indication status: o 0: no GPRS available in the network o 1: GPRS available in the network but not registered o 2: registered to GPRS o 65535: PS service indication is not available • 10 ("callsetup"): <value> provides the call set-up: o 0: no call set-up o 1: incoming call not accepted or rejected o 2: outgoing call in dialing state o 3: outgoing call in remote party alerting state • 11 ("callheld"): <value> provides the call on hold: o 0: no calls on hold o 1: at least one call on hold • 12 ("simind"): <value> provides the SIM detection: o 0: no SIM detected o 1: SIM detected o 2: not available

5.6 Clock +CCLK

+CCLK						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

5.6.1 Description

Sets and reads the real-time clock of the MT.

5.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+CCLK=<time>	OK	AT+CCLK="14/07/01,15:00:00+01" OK
Read	AT+CCLK?	+CCLK: <time> OK	+CCLK: "14/07/01,15:00:00+01" OK
Test	AT+CCLK=?	OK	

5.6.3 Defined values

Parameter	Type	Description
<time>	String	Format is "yy/MM/dd,hh:mm:ss+TZ". Characters indicate year, month, day, hours, minutes, seconds, time zone. The factory-programmed value is "04/01/01,00:00:00+00". Values prior to the factory-programmed value are not allowed.

5.6.4 Notes

- If the parameter value is out of range, then the "+CME ERROR: operation not supported" or "+CME ERROR: 4" will be provided (depending on the +CMEE AT command setting).
- "TZ": The Time Zone information is represented by two digits. The value is updated during the registration procedure when the automatic time zone update is enabled (using +CTZU command) and the network supports the time zone information.
- The Time Zone information is expressed in steps of 15 minutes and it can assume a value in the range that goes from -96 to +96.

5.7 Set greeting text +CSGT

+CSGT						
Modules	SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

5.7.1 Description

Configures and activates/deactivates the greeting text. The greeting text configuration's change will be applied at the subsequent boot. If active, the greeting text is shown at boot once, on any AT interface, the first time the TE sets the DTR line to ON state.

Take care about restrictions related to the baud rate described in the Autobauding description.

5.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSGT=<mode>[,<text>]	OK	AT+CSGT=1,"Hello user" OK
Read	AT+CSGT?	+CSGT: <text>,<mode>	+CSGT: "Hello",0

Type	Syntax	Response	Example
		OK	OK
Test	AT+CSGT=?	+CSGT: (list of supported <mode>s), <ltext> OK	+CSGT: (0-1),49 OK

5.7.3 Defined values

Parameter	Type	Description
<text>	String	Greeting text. The factory-programmed value is the empty string.
<mode>	Number	• 0: turn off the greeting text • 1: turn on the greeting text
<ltext>	Number	Maximum length of the <text> parameter.

5.8 Automatic time zone update +CTZU

+CTZU						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

5.8.1 Description

Configures the automatic time zone update via NITZ.

The Time Zone information is provided after the network registration (if the network supports the time zone information).

5.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+CTZU=<on_off>	OK	AT+CTZU=1 OK
Read	AT+CTZU?	+CTZU: <on_off> OK	+CTZU: 0 OK
Test	AT+CTZU=?	+CTZU: (list of supported <on_off>s) OK	+CTZU: (0-1) OK

5.8.3 Defined values

Parameter	Type	Description
<on_off>	Number	Allowed values (see Notes for the factory-programmed value): • 0: automatic time zone via NITZ disabled • 1: automatic time zone update via NITZ enabled; if the network supports the service, the local time of the module is changed (not only time zone)

5.8.4 Notes

SARA-R4 / SARA-N4

- The factory-programmed value of the <on_off> parameter is 0.

5.9 Report mobile termination error +CMEE

+CMEE						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

5.9.1 Description

Configures the formatting of the result code +CME ERROR: <err> as an indication of an error relating to the functionality of the MT. When enabled, MT related errors cause +CME ERROR: <err> final result code instead of the regular ERROR final result code. The error result code is returned normally when an error is related to syntax, invalid parameters or MT functionality.

5.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+CMEE=[<n>]	OK	AT+CMEE=2 OK
Read	AT+CMEE?	+CMEE: <n> OK	+CMEE: 0 OK
Test	AT+CMEE=?	+CMEE: (list of supported <n>s) OK	+CMEE: (0-2) OK

5.9.3 Defined values

Parameter	Type	Description
<n>	Number	• 0: +CME ERROR: <err> result code disabled and ERROR used • 1: +CME ERROR: <err> result code enabled and numeric <err> values used • 2: +CME ERROR: <err> result code enabled and verbose <err> values used

5.9.4 Notes

- The following convention is valid:

Numeric error code	Verbose error code	Description
3	"operation not allowed"	The MT is in a state which does not allow performing the entered command.
4	"operation not supported"	The error result code is related to a parameter not covered by the GSM/ETSI or u-blox specification

6 Call control

6.1 Dial command D

D						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 3 min	+CME Error

6.1.1 Description

Lists characters that may be used in a dialling string for making a call (voice, data or fax call) or controlling supplementary services in accordance with 3GPP TS 22.030 [5] and initiates the indicated kind of call. No further commands may follow in the command line in case of data or fax calls.

6.1.2 Syntax

Type	Syntax	Response	Example
Action	ATD<number>[<I>][<G>][;]	See Result codes	**Voice call** ATD123456; OK **Data / fax call** ATD123456 CONNECT 9600 **Supplementary services** ATD*#43# +CCWA: 0,1 +CCWA: 0,2 OK

6.1.3 Defined values

Parameter	Type	Description
<number>	Number	Dial string; the allowed characters are: 1 2 3 4 5 6 7 8 9 0 * # + A B C D , T P ! W @ (see the 3GPP TS 27.007 [2]). The following characters are ignored: , T ! W @. The first occurrence of P is interpreted as pause and separator between the dialling number and the DTMF string. The following occurrences are interpreted only as pause. The use of P as pause has been introduced for AT&T certification.
<I>	String	Set the CLI status; the allowed values are: • I (ASCII code 49 Hex): CLI presentation restricted • i: CLI presentation allowed The CLIR supplementary service subscription is overridden for this call.
<G>	String	Configures the CUG supplementary service for the specific call: • G: CUG activated • g: CUG deactivated The index and the information parameters used during the call will be the same previously set with +CCUG command.

6.1.4 Notes

SARA-R404M / SARA-R410M-01B / SARA-R410M-02B / SARA-R410M-52B

- Voice calls are not supported.

6.2 Call answer A

A						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 20 s	+CME Error

6.2.1 Description

Instructs the DCE to immediately connect to the line and start the answer sequence as specified for the underlying DCE. Any additional command that appears after A on the same command line is ignored. The command is abortable.

SARA-R4
The user is informed that an incoming call is waiting, by the RING IRC.

6.2.2 Syntax

Type	Syntax	Response	Example
Action	ATA	RING OK	

6.3 Hook control H

H						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 20 s	-

6.3.1 Description

Disconnects the remote user. In case of multiple calls, all the active calls and held calls are released while the waiting calls are not.

In case of dual service calls, the command will switch the call from data (if different from fax) to voice.

If the module has a PDP context activated and is in On-Line Command Mode (OLCM), the command deactivates the context. During the PSD OLCM an incoming CS call can be accepted with an ATA command. Subsequent ATH command releases the current CS call while leaving the PDP context activated. In this state a second ATH command also deactivates the PDP context.

6.3.2 Syntax

Type	Syntax	Response	Example
Action	ATH	OK	

6.4 Automatic answer S0

S0						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

6.4.1 Description

Controls the automatic answering feature of the DCE. If set to 0, the automatic answering is disabled, otherwise it causes the DCE to answer when the incoming call indication (RING) has occurred the number of times indicated by the value.

For an incoming CSD call, if the autoanswering is enabled and the <value> parameter of &D command is set to 2, the autoanswering only works if the DTR line of the AT interface with activated autoanswering

is set to ON. Otherwise, if DTR is OFF, then the call is rejected. If the <value> parameter of &D command is not set to 2, the DTR state has no impact on autoanswering.

6.4.2 Syntax

Type	Syntax	Response	Example
Set	ATS0=<value>	OK	ATS0=2 OK
Read	ATS0?	<value> OK	000 OK

6.4.3 Defined values

Parameter	Type	Description
<value>	Number	Value in the range 0-255; the answer to the read command is in "xxx" format. • 0 (factory-programmed value): disables automatic answer mode • 1-255: enables automatic answering after specified number of rings

6.4.4 Notes

SARA-R404M / SARA-R410M-01B / SARA-R410M-02B / SARA-R410M-52B

- The voice call autoanswering is not supported and the command is therefore not effective.

7 Network service

7.1 Subscriber number +CNUM

+CNUM						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	< 10 s	+CME Error

7.1.1 Description

Returns the MSISDNs related to this subscriber. If the subscriber has different MSISDN for different services, each MSISDN is returned in a separate line.

☞ MSISDN is read from the SIM.

7.1.2 Syntax

Type	Syntax	Response	Example
Action	AT+CNUM	+CNUM: [<alpha1>],<number1>,<type1> [+CNUM: [<alpha2>],<number2>,<type2> [...]] OK or OK	+CNUM: "Mario Rossi","+39320821708",145 +CNUM: "ABCD . AAA","123456789012",129 OK
Test	AT+CNUM=?	OK	

7.1.3 Defined values

Parameter	Type	Description
<alphax>	String	Associated with <numberx>
<numberx>	String	Phone number of format specified by <typex>
<typex>	Number	Type of address, octet in Number format (145 when <numberx> string includes '+', otherwise 129)

7.2 Signal quality +CSQ

+CSQ						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

7.2.1 Description

Returns the radio signal strength <signal_power> and <qual> from the MT.

☞ SARA-R4 / SARA-N4
The radio signal strength <signal_power> will be also used to build and display the indicator "signal" i.e. signal quality in the information text response of +CIND and in the +CIEV URC (see the +CMER command description).

In dedicated mode, during the radio channel reconfiguration (e.g. handover), invalid measurements may be returned for a short transitory because the MT must compute them on the newly assigned channel.

7.2.2 Syntax

Type	Syntax	Response	Example
Action	AT+CSQ	+CSQ: <signal_power>,<qual> OK	+CSQ: 2,5 OK
Test	AT+CSQ=?	+CSQ: (list of supported <signal_power>s),(list of supported <qual>s) OK	+CSQ: (0-31,99),(0-7,99) OK

7.2.3 Defined values

Parameter	Type	Description
<signal_power>	Number	The allowed range is 0-31 and 99. Remapped indication of the following parameters: • the Received Signal Strength Indication (RSSI) in GSM RAT • the Received Signal Code Power (RSCP) in UMTS RAT • the Reference Signal Received Power (RSRP) in LTE RAT When the RF power level of the received signal is the highest possible, the value 31 is reported. When it is not known, not detectable or currently not available, 99 is returned.
<qual>	Number	The allowed range is 0-7 and 99. The information provided depends on the selected RAT: • In 2G RAT CS dedicated and GPRS packet transfer mode indicates the Bit Error Rate (BER) as specified in 3GPP TS 45.008 [148] • In 2G RAT EGPRS packet transfer mode indicates the Mean Bit Error Probability (BEP) of a radio block. 3GPP TS 45.008 [148] specifies the range 0-31 for the Mean BEP which is mapped to the range 0-7 of <qual> • In UMTS RAT indicates the Energy per Chip/Noise (ECN0) ratio in dB levels of the current cell. 3GPP TS 25.133 [106] specifies the range 0-49 for EcN0 which is mapped to the range 0-7 of <qual> • In LTE RAT indicates the Reference Signal Received Quality (RSRQ). TS 36.133 [105] specifies the range 0-34 for RSRQ which is mapped to the range 0-7 of <qual> See Table 3 for the complete parameter mapping

7.2.4 Notes

<qual>	2G RAT CS and GPRS	2G RAT EGPRS	UMTS RAT	LTE RAT
0	BER < 0.2%	28 <= MEAN_BEP <= 31	ECN0_LEV >= 44	RSRQ_LEV < 5
1	0.2% < BER < 0.4%	24 <= MEAN_BEP <= 27	38 <= ECNO_LEV < 44	5 <= RSRQ_LEV < 10
2	0.4% < BER < 0.8%	20 <= MEAN_BEP <= 23	32 <= ECNO_LEV < 38	10 <= RSRQ_LEV < 14
3	0.8% < BER < 1.6%	16 <= MEAN_BEP <= 19	26 <= ECNO_LEV < 32	14 <= RSRQ_LEV < 18
4	1.6% < BER < 3.2%	12 <= MEAN_BEP <= 15	20 <= ECNO_LEV < 26	18 <= RSRQ_LEV < 22
5	3.2% < BER < 6.4%	8 <= MEAN_BEP <= 11	14 <= ECNO_LEV < 20	22 <= RSRQ_LEV < 26
6	6.4% < BER < 12.8%	4 <= MEAN_BEP <= 7	8 <= ECNO_LEV < 14	26 <= RSRQ_LEV < 30
7	BER > 12.8%	0 <= MEAN_BEP <= 3	ECNO_LEV < 8	RSRQ _LEV >= 30
99	Not known or not detectable			

Table 3: <qual> parameter mapping for each supported RAT

SARA-R4 / SARA-N4

- The <qual> parameter is not supported, and will be always set to 99.
- In LTE RAT, the <signal_power> returned by the command is the RSSI. Table 4 maps <signal_power> values reported from UE and the RSSI. RSSI includes the signal transmitted by the network plus noise.

<signal_power>	RSSI
31	-51 dBm <= RSSI of the network
30...2	-53...-109 dBm
1	-111 dBm
99	Not known or not detectable

Table 4: Mapping between <signal_power> reported from UE and the RSSI

SARA-R404M / SARA-R410M / SARA-N4

- Only LTE RAT is supported.

7.3 Extended signal quality +CESQ

+CESQ						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

7.3.1 Description

Returns the received signal quality and level:

- If the current serving cell is not a GERAN cell, the <rxlev> and <ber> parameters are set to value 99
- If the current serving cell is not a UTRA FDD cell, the <rscp> and the <ecn0> parameters are set to 255
- If the current serving cell is not an E-UTRA cell, the <rsrq> and <rsrp> parameters are set to 255.

☞ The Reference Signal Received Power (RSRP) is a LTE specific measure that averages the power received on the subcarriers carrying the reference signal. The RSRP measurement bandwidth is equivalent to a single LTE subcarrier: its value is therefore much lower than the total received power usually referred to as RSSI. In LTE the RSSI depends on the currently allocated bandwidth, which is not pre-determined. Therefore the RSSI is not useful to describe the signal level in the cell.

7.3.2 Syntax

Type	Syntax	Response	Example
Action	AT+CESQ	+CESQ: <rxlev>,<ber>,<rscp>,<ecn0>,<rsrq>,<rsrp> OK	+CESQ: 99,99,255,255,20,80 OK
Test	AT+CESQ=?	+CESQ: (list of supported <rxlev>s),(list of supported <ber>s),(list of supported <rscp>s),(list of supported <ecn0>s),(list of supported <rsrq>s),(list of supported <rsrp>s) OK	+CESQ: (0-63,99),(0-7,99),(0-96,255),(0-49,255),(0-34,255),(0-97,255) OK

7.3.3 Defined values

Parameter	Type	Description
<rxlev>	Number	Received Signal Strength Indication (RSSI): • 0: less than -110 dBm • 1..62: from -110 to -49 dBm with 1 dBm steps • 63: -48 dBm or greater • 99: not known or not detectable
<ber>	Number	Bit Error Rate (BER): • 0..7: as the RXQUAL values described in GSM TS 05.08 [28] • 99: not known or not detectable
<rscp>	Number	Received Signal Code Power (RSCP): • 0: -121 dBm or less • 1..95: from -120 dBm to -24 dBm with 1 dBm steps • 96: -25 dBm or greater • 255: not known or not detectable
<ecn0>	Number	Ratio of received energy per PN chip to the total received power spectral density (see 3GPP TS 25.133 [106] subclause): • 0: less than -24 dB • 1..48: from -24 dB to -0.5 dBm with 0.5 dB steps (i.e. 1: -24 dB <= Ec/Io < -23.5 dB) • 49: 0 dB or greater • 255: not known or not detectable

Parameter	Type	Description
<rsrq>	Number	Reference Signal Received Quality (RSRQ): • 0: -19 dB or less • 1..33: from -19.5 dB to -3.5 dB with 0.5 dB steps • 34: -3 dB or greater • 255: not known or not detectable
<rsrp>	Number	Reference Signal Received Power (RSRP): • 0: -141 dBm or less • 1..96: from -140 dBm to -45 dBm with 1 dBm steps • 97: -44 dBm or greater • 255: not known or not detectable

7.4 Operator selection +COPS

+COPS						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	Yes	Up to 3 min	+CME Error

7.4.1 Description

Forces an attempt to select and register with the GSM/LTE network operator, that can be chosen in the list of network operators returned by the test command, that triggers a PLMN scan on all supported bands. Through <mode> parameter the network selection can automatically be performed or forced by this command: the access technology is indicated in <AcT> parameter (where supported).

☞ In manual PLMN selection mode, if the optional <AcT> parameter is not specified, the modules will select the default access technology with the following priority order: LTE and GSM (not supported technologies will be ignored).

☞ u-blox cellular modules are certified according to all the capabilities and options stated in the Protocol Implementation Conformance Statement document (PICS) of the module. The PICS, according to 3GPP TS 51.010-2 [84], 3GPP TS 34.121-2 [85], 3GPP TS 36.521-2 [115] and 3GPP TS 36.523-2 [116], is a statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

To be able to exploit all command functionalities, the SIM card verification is required. The command is accessible also without an inserted SIM. In this case the command AT+COPS=0 always returns an error result code because the network registration cannot be performed without the SIM, while the configuration (i.e. automatic registration) is correctly set. The set value can be checked with the command AT+COPS? or by verifying the active profile with AT&V command if supported (parameter <format> is then also visible).

The set command handling depends on the <mode> parameter value:

- **<mode>=0 and <mode>=1**: the AT command setting is immediately stored in the current activated profile. If the MT is set in automatic selection mode (<mode>= 0), only the mode will be saved. If the MT is set in manual mode (<mode>= 1), also the format (<format>) and operator (<oper>) will be stored in the profile.
- **<mode>=4**: the module starts a manual selection of the specified operator; if this operation is not successful, the module will start an automatic network selection and will remain in automatic mode.

If the set command with <mode>=0 is issued, a further set command with <mode>=0 is managed as a user reselection (see the 3GPP TS 23.122 [70]), i.e. the module triggers a search for the HPLMN or a higher order PLMN. This is useful when roaming in areas where the HPLMN or a higher order PLMN is available. If no HPLMN or higher order PLMN is found, the module remains in the state it was in prior to the search (e.g. camped and/or registered on the PLMN before the search).

The PLMN search cannot be performed in RRC connected state when the RAT is 3G or 4G, hence no PLMN list will be returned at the end of the PLMN scan attempt.

☞ The manual PLMN selection can fail due to the MNO control on the network selection procedure via EF_{CSP} setting; for further details see +PACSP.

☞ The user should not enter colliding requests (e.g. AT+COPS=0 and AT+COPS=2) on different communication ports, because this might cause interoperability issues in case overlapping registration and deregistration requests are not handled by the network, and could result in an unpredictable registration state. Similarly, when notified of a GPRS mobile terminated detach event (e.g. via +CGEV URC), it is recommended to wait a few seconds before entering AT+COPS=2 in order to let the pending registration procedure (automatically triggered by the module in most cases) successfully end.

☞ The user should not rely only on the set command "OK" final result code as a confirmation that the network selection has been performed. To determine the current network registration status, +CEREG should be also checked.

7.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+COPS=[<mode>[,<format>[,<oper>[,<AcT>]]]]	OK	AT+COPS=0,0 OK
Read	AT+COPS?	+COPS: <mode>[,<format>,<oper>[,<AcT>]] OK	+COPS: 0,0,"vodafone IT" OK
Test	AT+COPS=?	+COPS: [(<stat>, long <oper>, short <oper>, numeric <oper>[,<AcT>])[,(<stat>, long <oper>, short <oper>, numeric <oper>[,<AcT>]),[...]]],(list of supported <mode>s),(list of supported <format>s) OK	+COPS: (2,"vodafone IT","voda IT","22210"),(1,"SI vodafone","vodafone SI","29340"),(1,"I WIND","I WIND","22288"),(1,"I TIM","TIM","22201"),(1,"MOBITEL","MOBITEL","29341"),,(0-4),(0-2) OK

7.4.3 Defined values

Parameter	Type	Description
<mode>	Number	Is used to chose whether the network selection is automatically done by the MT or is forced by this command to the operator <oper> given in the format <format>: • 0 (default value and factory-programmed value): automatic (<oper> field is ignored) • 1: manual • 2: deregister from network • 3: set only <format> • 4: manual/automatic
<format>	Number	• 0 (factory-programmed value): long alphanumeric <oper> • 1: short format alphanumeric <oper> • 2: numeric <oper>
<oper>	String	Given in format <format> this field may be up to 24 characters long for long alphanumeric format, up to 10 characters for short alphanumeric format and 5 or 6 characters long for numeric format (MCC/MNC codes). The factory-programmed value is FFFF (undefined).
<stat>	Number	• 0: unknown • 1: available • 2: current • 3: forbidden
<AcT>	Number	Indicates the radio access technology: • 7: LTE • 8: EC-GSM-IoT (A/Gb mode) • 9: E-UTRAN (NB-S1 mode) Allowed values: • SARA-R404M - 7 • SARA-R410M-01B / SARA-R410M-02B - 8, 9 • SARA-R410M-52B - 7, 9 • SARA-N4 - 9

7.4.4 Notes

SARA-R404M / SARA-R410M-01B / SARA-R410M-02B / SARA-R410M-52B / SARA-R412M / SARA-N4

- <format> and <oper> parameters are optional only if the value of <mode> parameter is 0, 2 or 3.
- If the antenna is not connected, then the information text response to the test command is: +COPS: ,, (0-4),(0-2)
- The test command cannot be aborted.

SARA-R410M-01B / SARA-R410M-02B

- <AcT>=8 is used for LTE Cat M1.

7.5 Radio Access Technology (RAT) selection +URAT

+URAT						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

7.5.1 Description

Forces the selection of the Radio Access Technology (RAT) in the protocol stack. On the subsequent network registration (+COPS, +CGATT) the selected RAT is used.

If dual or tri mode is selected, it is also possible to select the preferred RAT, which determines which RAT is selected first (if available). If the preferred RAT is omitted, it will be set by default to the higher RAT available. If tri mode is selected, it is also possible to select the second preferred RAT (if the preferred RAT was also selected). This parameter determines which RAT is selected if the first preferred RAT is not available.

☞ Any change in the RAT selection must be done in the detached state issuing the AT+COPS=2 AT command.

☞ u-blox cellular modules are certified according to all the capabilities and options stated in the Protocol Implementation Conformance Statement document (PICS) of the module. The PICS, according to 3GPP TS 51.010-2 [84], 3GPP TS 34.121-2 [85], 3GPP TS 36.521-2 [115] and 3GPP TS 36.523-2 [116], is a statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

☞ In dual mode and tri mode, all the requested Access Stratum protocols are active and Inter-RAT measurements as well as Inter-RAT handovers may be performed (if ordered by the network).

☞ SARA-R4 / SARA-N4
Reboot the module (AT+CFUN=15) to make the setting effective.

7.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+URAT=<SelectedAcT>[, <PreferredAct>[, <2ndPreferredAct>]]	OK	AT+URAT=1,0 OK
Read	AT+URAT?	+URAT: <SelectedAcT>[, <PreferredAct>[, <2ndPreferredAct>]] OK	+URAT: 1,2 OK
Test	AT+URAT=?	+URAT: (list of the supported <SelectedAcT>s),(list of the supported <PreferredAct>s),(list of the supported <2ndPreferredAct>s) OK	+URAT: (0-6),(0,2,3),(0,2,3) OK

7.5.3 Defined values

Parameter	Type	Description
<SelectedAcT>	Number	Indicates the radio access technology and may be: • 0: GSM / GPRS / eGPRS (single mode) • 1: GSM / UMTS (dual mode) • 2: UMTS (single mode) • 3: LTE (single mode) • 4: GSM / UMTS / LTE (tri mode) • 5: GSM / LTE (dual mode) • 6: UMTS / LTE (dual mode) • 7: LTE Cat.M1 • 8: LTE Cat.NB1 • 9: GPRS / eGPRS
<PreferredAct>	Number	Indicates the preferred access technology; it is ignored if dual mode or tri mode are not selected. • 0: GSM / GPRS / eGPRS • 2: UTRAN • 3: LTE • 7: LTE Cat.M1 • 8: LTE Cat.NB1 • 9: GPRS / eGPRS
<2ndPreferredAct>	Number	Indicates the second preferred access technology; it is ignored if tri mode is not selected. • 0: GSM / GPRS / eGPRS • 2: UTRAN • 3: LTE • 7: LTE Cat.M1 • 8: LTE Cat.NB1 • 9: GPRS / eGPRS

7.5.4 Notes

- AT&T's EF_{RAT} mode contains the RAT mode setting, the RAT mode setting is the mode that the module shall be set to. Thus this setting may override +URAT's <SelectedAcT> and <PreferredAct> loaded at boot time.

SARA-R404M / SARA-R410M-01B

- <SelectedAcT>=0, 1, 2, 4, 5, 6, 7, 8, 9 are not supported. The factory-programmed value of <SelectedAcT> is 3.

SARA-R410M-02B / SARA-R410M-52B

- <SelectedAcT> is the first AcT the module will search. In the case a suitable cell can't be found on this AcT, the module will search the <PreferredAct> if defined.
- <PreferredAct> is the next AcT the module will search if no suitable cell can be found on the <SelectedAcT>. In the case a suitable cell can't be found on this AcT, the module will search the <2ndPreferredAct> if defined.
- <SelectedAcT>=0, 1, 2, 3, 4, 5, 6, 9 are not supported. The factory-programmed value of <SelectedAcT> is 7.
- <PreferredAct>=0, 2, 3, 9 are not supported. The factory-programmed value of <PreferredAct> is 8.
- <2ndPreferredAct>=0, 2, 3, 9 are not supported. The factory-programmed value of <PreferredAct> is NULL.

SARA-N4

- <SelectedAcT>=0, 1, 2, 3, 4, 5, 6, 7, 9 are not supported. The factory-programmed value of <SelectedAcT> is 8.

7.6 Network registration status +CREG

+CREG						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

7.6.1 Description

Configures the network registration URC related to CS domain. Depending on the <n> parameter value, a URC can be issued:

- +CREG: <stat> if <n>=1 and there is a change in the MT's circuit switched mode network registration status in GERAN/UTRAN/E-UTRAN
- +CREG: <stat>[,<lac>,<ci>[,<AcTStatus>]] if <n>=2 and there is a change of the network cell in GERAN/UTRAN/E-UTRAN

The parameters <AcTStatus>, <lac>, <ci> are provided only if available.

The read command provides the same information issued by the URC together with the current value of the <n> parameter. The location information elements <lac>, <ci> and <AcTStatus>, if available, are returned only when <n>=2 and the MT is registered with the network.

When <n>=2, in UMTS RAT, unsolicited location information can be received if the network sends the UTRAN INFORMATION MOBILITY message during dedicated connections; in the latter cases the reported <ci> might be not correct because the UE in DCH state cannot read broadcast system information before the change of serving cell. In contrast, in GSM RAT no unsolicited location information is received during a CS connection.

The DTE application should set a reasonable timer (10 s) when receiving the +CREG: 3 URC, since this might be due to the fact that the LTE registration was rejected (SIM not enabled for LTE RAT, wrong APN during the initial default bearer setup in the EPS attach procedure and other temporary reject causes).

If the MT also supports GPRS services and/or EPS services in E-UTRAN, the +CGREG / +CEREG set and read command result codes apply to the registration status and location information for those services.

7.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+CREG=[<n>]	OK	AT+CREG=1 OK
Read	AT+CREG?	+CREG: <n>,<stat>[,<lac>,<ci>[,<AcTStatus>]] OK	+CREG: 0,0 OK
Test	AT+CREG=?	+CREG: (list of the supported <n>s) OK	+CREG: (0-2) OK
URC		+CREG: <stat>[,<lac>,<ci>[,<AcTStatus>]]	+CREG: 1,"4E54","44A5"

7.6.3 Defined values

Parameter	Type	Description
<n>	Number	• 0 (default value and factory-programmed value): network registration URC disabled • 1: network registration URC +CREG: <stat> enabled • 2: network registration and location information URC +CREG: <stat>[,<lac>,<ci>[,<AcTStatus>]] enabled
<stat>	Number	• 0: not registered, the MT is not currently searching a new operator to register to • 1: registered, home network • 2: not registered, but the MT is currently searching a new operator to register to • 3: registration denied • 4: unknown (e.g. out of GERAN/UTRAN/E-UTRAN coverage) • 5: registered, roaming

Parameter	Type	Description
		• 6: registered for "SMS only", home network (applicable only when <AcTStatus> indicates E-UTRAN) • 7: registered for "SMS only", roaming (applicable only when <AcTStatus> indicates E-UTRAN) • 9: registered for "CSFB not preferred", home network (applicable only when <AcTStatus> indicates E-UTRAN) • 10: registered for "CSFB not preferred", roaming (applicable only when <AcTStatus> indicates E-UTRAN)
<lac>	String	Two bytes location area code or tracking area code (if <AcTStatus>=7) in hexadecimal format (e.g. "00C3"). The value FFFF means that the current <lac> value is invalid.
<ci>	String	From 2 to 4 bytes cell ID in hexadecimal format (e.g. "A13F" or "129080B"). The value FFFFFFFF means that the current <ci> value is invalid.
<AcTStatus>	Number	Indicates the radio access technology • 0: GSM • 1: GSM COMPACT • 2: UTRAN • 3: GSM with EDGE availability • 4: UTRAN with HSDPA availability • 5: UTRAN with HSUPA availability • 6: UTRAN with HSDPA and HSUPA availability • 7: E-UTRAN • 255: the current <AcTStatus> value is invalid

7.6.4 Notes

The following is an overview of the values assumed by the <stat> parameter:

- 0: a technical problem could have occurred, the user is requested to intervene. It is still possible to make emergency calls if some network is available. Possible causes:
  - PIN not entered
  - Invalid HPLMN found on the SIM (SIM read error)
  - SIM card not present

  The registration is not started
- 1: the MT is registered for circuit-switched services on the HPLMN (or on one of the equivalent HPLMN's, whose list is provided by the SIM)
- 2: the module is searching a network to register on. Possible causes:
  - No network available
  - Available networks have insufficient Rx level
  - HPLMN or allowed PLMN are available but the registration is rejected, e.g. roaming is not allowed in this Location Area

  It is still possible to make emergency calls if network coverage is available
- 3: the CS registration failed after a Location Update Reject; possible causes are:
  - Illegal MS
  - Illegal ME
  - IMSI unknown at HLR
  - PLMN not allowed
  - Location area not allowed
  - Roaming not allowed in this location area
  - Network failure
  - Network congestion

  It is still possible to make emergency calls if network coverage is available.

  If the registration type is manual, then no further attempt is made to search for a new PLMN or register with it. If the registration type is automatic, the MS may look for an allowed PLMN if the rejection cause was roaming restriction. In case of illegal MS /ME, there could be possible problems with either the SIM card or with the ME's identity (IMEI): user intervention may be required
- 4: this value, usually transitory, is returned if the registration state does not belong to any of the following:

  - Normal
  - Limited
  - No service
  - Service detached
  - Service disabled

  It may be issued after the failure of a registration procedure, before starting a PLMN search, when <stat>=2.
- 5: the MT is registered for circuit-switched services on a VPLMN, in national or international roaming
- 6: in LTE, the MT is registered only for the SMS circuit-switched service on the HPLMN (ore on one of the equivalent HPLMN's)
- 7: in LTE, the MT is registered only for the SMS circuit-switched service on a VPLMN, in national or international roaming

7.7 Network selection control +PACSP

+PACSP						
Modules	SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

7.7.1 Description

If the EF_{CSP} (Customer Service Profile) is available the +PACSP URC is provided in the following cases:

- SARA-R4 / SARA-N4 - at the module registration
- SARA-R4 / SARA-N4 - whenever the SIM/USIM issues the REFRESH proactive command related to the EF_{CSP}

For further information, see the AT&T Device Requirements [61].

☞ The EF_{CSP} is available on SIM/USIM cards from AT&T mobile network operator.

7.7.2 Syntax

Type	Syntax	Response	Example
Read	AT+PACSP?	+PACSP<bit_value>	+PACSP1
		OK	OK
URC		+PACSP<bit_value>	+PACSP0

7.7.3 Defined values

Parameter	Type	Description
<bit_value>	Number	PLMN mode bit value: • 0: automatic network selection is forced (see Notes) • 1: network selection mode unchanged (see Notes)

7.7.4 Notes

- If EF_{CSP} is available, the PLMN mode bit forces the automatic network registration, according to the +COPS <mode> value which is loaded at boot from the selected profile (see the Appendix B.1 and &V). The following table explains the behavior:

Autoregistration <mode>	PLMN mode bit <bit_value>	Autoregistration behavior
0	0	Automatic network selection
1	0	Automatic network selection
2	0	Disabled
0	1	Automatic network selection
1	1	Manual network selection (search for the PLMN stored in the selected profile)
2	1	Disabled

SARA-R4 / SARA-N4

- The read command is not supported.

7.8 Channel and network environment description +UCGED

+UCGED						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

7.8.1 Description

Enables the protocol stack and network environment information collection.

The information text response of the read command reports only the current RAT (if any) parameters, determined by the <rat> parameter value.

Table 5 lists the supported <mode> parameter values:

Channel	<mode>=0	<mode>=2	<mode>=3	<mode>=5
SARA-N4	*			*
SARA-R4	*			*

Table 5: <mode> parameter applicability

7.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCGED=<mode>	[+UCGED: <svc> <arfcn>,<Gmcc>,<Gmnc>,<GcellId>,<BSIC>,<rxlev> <uarfcn>,<Wband>,<Wmcc>,<Wmnc>,<WcellId>,<Wrrc>,<rssi>,<ecn0_lev> <earfcn>,<Lband>,<ul_BW>,<dl_BW>,<Lmcc>,<Lmnc>,<tac>,<LcellId>,<P-CID>,<rsrp>,<rsrq>,<Lsinr>,<Lrrc>] OK	AT+UCGED=2 OK AT+UCGED=3 +UCGED: 0 65535,fff,fff,0000,ff,99 10588,1,222,88,1281d24,255,11,40 65535,255,255,255,fff,fff,ffff,0000000,65535,255,255,255,255 OK AT+UCGED=5 OK
Read	AT+UCGED?	**<mode>= 0:** +UCGED: 0 OK	+UCGED: 0 OK
		<mode>= 2, <rat>= 2: +UCGED: 2 2,<svc>,<MCC>,<MNC> <arfcn>,<band1900>,<GcellId>,<BSIC>,<Glac>,<Grac>,<rxlev>,<grr>,<t_adv>,<Gspeech_mode> OK	+UCGED: 2 2,4,001,01 810,1,0000,01,0000,80,63,255,255,255 OK
		<mode>= 2, <rat>= 3: +UCGED: 2 3,<svc>,<MCC>,<MNC> <uarfcn>,<Wband>,<WcellId>,<Wlac>,<Wrac>,<scrambling_code>,<Wrrc>,<rssi>,<ecn0_lev>,<Wspeech_mode>	+UCGED: 2 3,4,001,01 4400,5,0000000,0000,80,9,4,62,42,255 OK

Type	Syntax	Response	Example
		OK	
		<mode>= 2, <rat>= 4: +UCGED: 2 4,<svc>,<MCC>,<MNC> <earfcn>,<Lband>,<ul_BW>,<dl_BW>,<tac>,<LcellId>,<P-CID>,<mTmsi>,<mmeGrId>,<mmeCode>, <rsrp>,<rsrq>,<Lsinr>,<Lrrc>,<RI>,<CQI>,<avg_rsrp>,<totalPuschPwr>,<avgPucchPwr>,<drx>, <l2w>,<volte_mode>[,<meas_gap>,<tti_bundling>] OK	+UCGED: 2 4,0,001,01 2525,5,25,50,2b67,69f6bc7,111,00000000,ffff,ff,67,19,0.00,255,255,255,67,11,255,0,255,255,0,0 OK
		<mode>= 2, <rat>= 5: +UCGED: 2 5,<svc> OK	+UCGED: 2 5,1 OK
		<mode>= 0: +UCGED: MODE_5_DISABLED OK	+UCGED: MODE_5_DISABLED OK
		<mode>= 5: +RSRP: <P-CID>,<earfcn>,"<RSRP>", +RSRQ: <P-CID>,<earfcn>,"<RSRQ>", OK	+RSRP: 162,5110,"-075.00", +RSRQ: 162,5110,"-14.20", OK
Test	AT+UCGED=?	+UCGED: (list of supported <mode>s) OK	+UCGED: (0,2) OK

7.8.3 Defined values

Parameter	Type	Description
<mode>	Number	• 0: reporting disabled • 2: short form reporting enabled • 3: retrieve the short form text information report • 5: RSRP and RSRQ reporting enabled
<rat>	Number	Current Radio Access Technology: • 2: 2G • 3: 3G • 4: 4G • 5: unknown. The parameter is set to a 5 until a network information update is not successfully performed through +UCGED=2 or when the MT is set to minimum functionality (+CFUN=4, +CFUN=19).
<svc>	Number	Current radio service state: • 0: not known or not detectable • 1: radio off • 2: searching • 3: no service • 4: registered The radio service state is updated at each change from a valid network service state (2G, 3G or 4G) to another valid network service state (2G, 3G or 4G). To retrieve the network registration status information refer to +CREG, +CGREG and +CEREG AT commands.
<MCC>	Number	Mobile Country Code; the range is 0-999 (3 digits), FFF if not known or not detectable.

Parameter	Type	Description
<MNC>	Number	Mobile Network Code; the range is 0-999 (1 to 3 digits), FFF if not known or not detectable.
<arfcn>	Number	Absolute Radio Frequency Channel Number (ARFCN); the range is 0-1023, 65535 if not known or not detectable.
<band1900>	Number	Indicates whether the given <arfcn> in the range 512-810 is part of band 1900 or not, to avoid ambiguity between bands 1800 and 1900: • 0: the given <arfcn> is not part of band 1900 • 1: the given <arfcn> is part of band 1900
<GcellId>	Number	GERAN Cell Identifier (CI) in hexadecimal format; the range is 0h-FFFFh (2 octets).
<BSIC>	Number	Base Station Identity Code (BSIC) of the GERAN cell in hexadecimal format; the range is 0h-3Fh (6 bits), FF if not known or not detectable.
<Glac>	Number	Two bytes location area of the GERAN cell in hexadecimal format; FFFF if not known or not detectable.
<Grac>	Number	One byte routing area of the GERAN cell in hexadecimal format; FF if not known or not detectable.
<rxlev>	Number	GERAN cell Received Signal Strength Indicator (RSSI) index as defined in 3GPP TS 45.008 [28]: • 0: less than -110 dBm • 1..62: from -110 to -48 dBm with 1 dBm steps • 63: -48 dBm or greater • 255: not known or not detectable
<grr>	Number	Reserved for future use.
<t_adv>	Number	Reserved for future use.
<Gspeech_mode>	Number	Reports the latest obtained value of the GSM speech code. Allowed values: • 0: GSM Enhanced Full Rate (12.2 kb/s) • 1: GSM Full Rate (13.0 kb/s) • 2: GSM Half Rate (5.6 kb/s) • 3..10: AMR NB FR (from 4.75 kb/s to 12.2 kb/s) the value indicates the first codec type chosen from the DUT; see the corresponding value of <Wspeech_mode> parameter for the baud rate mapping • 3..8: AMR NB HR (from 4.75 kb/s to 7.95 kb/s) the value indicates the first codec type chosen from the DUT; see the corresponding value of <Wspeech_mode> parameter for the baud rate mapping • 11..13: AMR WB FR (from 6.60 kb/s to 12.65 kb/s) the value indicates the first codec type chosen from the DUT; see the corresponding value of <Wspeech_mode> parameter for the baud rate mapping • 255: not known or not detectable See 3GPP TS 26.201 [113] for more details on GSM codecs used during a voice call In case a set of speech codecs is assigned by the network, then the parameter reports the lowest one and this one is not necessary the one used.
<uarfcn>	Number	UTRAN Absolute Radio Frequency Channel Number (UARFCN); the range is 1537-10 838, 65535 if not known or not detectable.
<Wband>	Number	UTRAN band: • 1: band 1 (2 GHz) • 2: band 2 (1900 MHz) • 4: band 4 (2100 MHz) • 5: band 5 (800 MHz) • 8: band 8 (900 MHz) • 255: not known or not detectable
<WcellId>	Number	UTRAN CI (cell identifier) in hexadecimal format; the range is 0h-FFFFFFFh (28 bits), 0000000 if not known or not detectable.
<Wlac>	Number	Two bytes location area of the UTRAN cell in hexadecimal format; FFFF if not known or not detectable.
<Wrac>	Number	One byte routing area of the GERAN cell in hexadecimal format; FF if not known or not detectable.
<scrambling_code>	Number	Primary Scrambling Code; range 0-512, 0 if not known or not detectable.
<Wrrc>	Number	3G RRC state: • 0: idle • 1: URA_PCH

Parameter	Type	Description
		• 2: CELL_PCH • 3: CELL_FACH • 4: CELL_DCH • 255: not known or not detectable
<rssi>	Number	UTRAN cell Received Signal Strength Indicator as defined in 3GPP TS 25.133 [106]: • 0: less than -100 dBm • 1..75: from -100 to -25 dBm with 1 dBm steps • 76: -25 dBm or greater • 255: not known or not detectable
<ecn0_lev>	Number	UTRAN cell Ratio of received energy per PN chip to the total received power spectral density as defined in 3GPP TS 25.133 [106]: • 0: less than -24 dB • 1..48: from -24 dB to 0 dB with 0.5 dB steps • 49: 0 dB or greater • 255: not known or not detectable
<Wspeech_mode>	Number	Reports the latest obtained value of the UMTS speech code. Allowed values: • 3: AMR NB (4.75 kb/s) • 4: AMR NB (5.15 kb/s) • 5: AMR NB (5.90 kb/s) • 6: AMR NB (6.70 kb/s) • 7: AMR NB (7.40 kb/s) • 8: AMR NB (7.95 kb/s) • 9: AMR NB (10.2 kb/s) • 10: AMR NB (12.2 kb/s) • 11: AMR WB (6.60 kb/s) • 12: AMR WB (8.85 kb/s) • 13: AMR WB (12.65 kb/s) • 14: AMR WB (14.25 kb/s) • 15: AMR WB (15.85 kb/s) • 16: AMR WB (18.25 kb/s) • 17: AMR WB (19.85 kb/s) • 18: AMR WB (23.05 kb/s) • 19: AMR WB (23.85 kb/s) • 255: not known or not detectable See 3GPP TS 26.201 [113] for more details on UMTS codecs used during a voice call. In case a set of speech codecs is assigned by the network, then the parameter reports the lowest one and this one is not necessary the one used.
<earfcn>	Number	E-UTRAN Absolute radio frequency channel number; the range is 0-6449, 65535 if not known or not detectable.
<Lband>	Number	E-UTRAN band (see 3GPP TS 36.101 Table 5.5-1 [99]); the range is 0-44, 255 if not known or not detectable.
<ul_BW>	Number	Number of Uplink Resource Blocks (see 3GPP TS 36.101 Table 5.6-1 [99]), 255 if not known or not detectable.
<dl_BW>	Number	Number of Downlink Resource Blocks (see 3GPP TS 36.101 Table 5.6-1 [99]), 255 if not known or not detectable.
<tac>	Number	E-UTRAN cell Tracking area code in hexadecimal format; the range is 0h-FFFFh (2 octets), FFFF if not known or not detectable.
<LcellId>	Number	E-UTRAN CI (cell identifier) in hexadecimal format; the range is 0h-FFFFFFFh (28 bits), 0000000 if not known or not detectable.
<P-CID>	Number	E-UTRAN cell Physical Cell ID; the range is 0-503, 65535 if not known or not detectable.
<mTmsi>	Number	4 bytes MME Temporary Mobile Subscriber Identity in hexadecimal format; 00000000 if not known or not detectable.
<mmeGrId>	Number	2 bytes MME Group Identifier in hexadecimal format; FFFF if not known or not detectable.
<mmeCode>	Number	1 byte MME Code in hexadecimal format; FF if not known or not detectable.
<rsrp>	Number	Reference Signal Received Power (RSRP) as defined in 3GPP TS 36.133 [105]: • 0: less than -140 dBm

Parameter	Type	Description
		• 1..96: from -140 dBm to -44 dBm with 1 dBm steps • 97: -44 dBm or greater • 255: not known or not detectable
<rsrq>	Number	Reference Signal Received Quality (RSRQ) as defined in 3GPP TS 36.133 [105]: • 0: less than -19.5 dB • 1..33: from -19.5 dB to -3 dB with 0.5 dB steps • 34: -3 dB or greater • 255: not known or not detectable
<Lsinr>	Number	E-UTRAN Signal to Interference and Noise ratio in dB. The range goes from -15,88 to 15,88; 255 if not known or not detectable.
<Lrrc>	Number	4G RRC state: • 0: null • 1: IDLE • 2: ATTEMPT TO CONNECT • 3: CONNECTED • 4: LEAVING CONNECTED STATE • 5: ATTEMPT LEAVING E-UTRA • 6: ATTEMPT ENTERING E-UTRA • 255: not known or not detectable
<RI>	Number	Rank Indicator value; 255 if not known or not detectable. It is updated every 480 ms with the value which has been most often reported to the network in the previous 480 ms period. See 3GPP TS 36.213 [130] section 7.2 and 3GPP TS 36.212 [131] section 5.2.2.6 for more details.
<CQI>	Number	Channel Quality Indicator value; 255 if not known or not detectable. It is updated every 480 ms with the value which has been most often reported to the network in the previous 480 ms period. See 3GPP TS 36.213 [130] section 7.2 for more details.
<avg_rsrp>	Number	Average value of last 10th Reference Signal Received Power (RSRP).
<totalPuschPwr>	Number	Mobile output power for PUSCH transmission averaged over 480 ms in dBm; 255 if not known or not detectable.
<avgPucchPwr>	Number	Mobile output power for PUCCH transmission averaged over 480 ms in dBm; 255 if not known or not detectable.
<drx>	Number	Discontinuous Reception "drx-Inactivity-Timer" value in ms; 0 if not known or not detectable.
<l2w>	Number	SIB3 LTE to WCDMA reselection criteria: (threshServingLow)x2 +(q-RxLevMin)x2; 255 if not known or not detectable.
<volte_mode>	Number	Reserved for future use.
<meas_gap>	Number	Measurement gap configuration: • 0: disabled • 40: 40 ms measurement gap repetition period corresponding to the measurement gap pattern ID 0 (see Table 8.1.2.1-1 of 3GPP TS 36.133 [105]) • 80: 80 ms measurement gap repetition period corresponding to the measurement gap pattern ID 1 (see Table 8.1.2.1-1 of 3GPP TS 36.133 [105])
<tti_bundling>	Number	TTi (Transmission Time interval) bundling status: • 0: off • 1: on
<RSRP>	String	Reference Signal Received Power (RSRP) as defined in 3GPP TS 36.133 [105] expressed in dBm
<RSRQ>	String	Reference Signal Received Quality (RSRQ) as defined in 3GPP TS 36.133 [105] expressed in dB

7.9 Edit Verizon wireless APN table +VZWAPNE

+VZWAPNE						
Modules	SARA-R404M					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

7.9.1 Description

Reads and writes the APN table stored in the NVM:

- The set command causes the APN table on the DUT to be overwritten. Only Class 3, 6 and 7 APNs can be overwritten to any customer defined string.
- The read command queries the APN table that is currently on the DUT, starting from the first entry to the last; it returns each APN entry in a new line.

7.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+VZWAPNE=<wapn>,<apncl>,<apnni>,<apntype>,<apnb>,<apned>,<apntime>	OK	AT+VZWAPNE=1,1,"IMS","IPv6","LTE","Enabled",0 OK
Read	AT+VZWAPNE?	[+VZWAPNE: <apncl>,<apnni>,<apntype>,<apnb>,<apned>,<apntime> [..]] OK	+VZWAPNE: 1,"IMS","IPv4v6","LTE","Enabled",0 +VZWAPNE: 2,"VZWADMIN","IPv4v6","LTE","Enabled",0 OK
Test	AT+VZWAPNE=?	+VZWAPNE: (list of supported <wapn>s),(list of supported <apncl>s),,(range of supported <apntype>s),range of supported <apnb>s),(list of supported <apned>s),(list of supported <apntime>s) OK	+VZWAPNE: (0-4),(1-4),,("IPv6","IPv4v6"),("LTE"),("Enabled","Disabled"),(0-1023) OK

7.9.3 Defined values

Parameter	Type	Description
<wapn>	Number	APN list entry
<apncl>	Number	APN class
<apnni>	String	Network identifier: • "IMS" or "VZWIMS": Verizon IMS PDN, factory-programmed value for <apncl>=1 entry • "VZWADMIN": Verizon Administrative PDN, factory-programmed for <apncl>=2 entry • "VZWINTERNET": Verizon Internet PDN, factory-programmed for <apncl>=3 entry • "VZWAPP": Verizon Application PDN, factory-programmed for <apncl>=4 entry • "ENTERPRISE": Verizon Enterprise PDN, factory-programmed for <apncl>=6 entry • "THINGSPACE": Verizon Thingspace PDN, factory-programmed for <apncl>=7 entry
<apntype>	String	• "IPv6": IPv6 type • "IPv4v6" (factory-programmed value): IPv4 and IPv6 type
<apnb>	String	APN bearer: • "LTE" (factory-programmed value): LTE bearer used
<apned>	String	Enable/disable the APN: • "Enabled" (factory-programmed value): APN enabled • "Disabled": APN disabled
<apntime>	Number	APN inactivity timer value in minutes. The range goes from 0 to 5. Value '0' (factory-programmed value) sets the timer to infinity.

7.9.4 Notes

SARA-R4

- <apncl>=7 is not supported.

SARA-R404M

- The class 1 APN NI is "VZWIMS".
- <apncl>=6 is not supported.

7.10 Read RSRP values +VZWRSRP

+VZWRSRP						
Modules	SARA-R404M					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

7.10.1 Description

Returns the RSRP (Reference Signal Received Power) values for all LTE cells which the module is measuring.

7.10.2 Syntax

Type	Syntax	Response	Example
Read	AT+VZWRSRP?	+VZWRSRP: [<cellID1>,<EARFCN1>,<RSRP1>[, <cellID2>,<EARFCN2>,<RSRP2>[, ...]]] OK	+VZWRSRP: 000,2175,"-61.00" OK

7.10.3 Defined values

Parameter	Type	Description
<cellIDn>	Number	nth cell physical cell identifier in "xxx" format. The range goes from 0 to 503.
<EARFCNn>	Number	nth cell EARFCN in decimal format. The range goes from 0 to 65535.
<RSRPn>	String	nth cell RSRP value in dBm/15 kHz where the format is "-XX.XX".

7.11 Read RSRQ values +VZWRSRQ

+VZWRSRQ						
Modules	SARA-R404M					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

7.11.1 Description

Returns the RSRQ (Reference Signal Received Quality) values for all the LTE cells which the module is measuring.

7.11.2 Syntax

Type	Syntax	Response	Example
Read	AT+VZWRSRQ?	+VZWRSRQ: [<cellID1>,<EARFCN1>,<RSRQ1>[, <cellID2>,<EARFCN2>,<RSRQ2>[, ...]]] OK	+VZWRSRQ: 000,2175,"-11.00" OK

7.11.3 Defined values

Parameter	Type	Description
<cellID>	Number	nth cell physical cell identifier in "xxx" format. The range goes from 0 to 503.
<EARFCN>	Number	nth cell EARFCN in decimal format. The range goes from 0 to 65535.
<RSRP>	String	nth cell RSRP value in dBm/15 kHz where the format is "-XX.XX".

7.12 Signalling connection status +CSCON

+CSCON						
Modules	SARA-R412M					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

7.12.1 Description

Returns details of the current terminal's perceived radio connection status (i.e. to the base-station). The set command configures the +CSCON URC. When enabled, the URC is sent from the MT at each change of the MT connection mode.

☞ The state is only updated when radio events, such as send and receive, take place. This means that the current state may be out of data. The terminal may think it is "Connected" yet cannot currently use a base station due to a change in the link quality.

7.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSCON=<n>	OK	AT+CSCON=1 OK
Read	AT+CSCON?	+CSCON: <n>,<mode> OK	+CSCON:1,1 OK
Test	AT+CSCON=?	+CSCON: (list of supported <n>s) OK	+CSCON: (0,1) OK
URC		+CSCON: <mode>	+CSCON: 0

7.12.3 Defined values

Parameter	Type	Description
<n>	Number	• 0 (default value): +CSCON URC disabled • 1: +CSCON URC enabled
<mode>	Number	Indicates the signaling connection status: • 0: idle • 1: connected

7.13 eDRX setting +CEDRXS

+CEDRXS						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

7.13.1 Description

Configures the UEs extended discontinuous reception (eDRX) parameters. The command controls whether the UE wants to apply the eDRX or not, as well as the requested eDRX value for each specified type of radio access technology. If the requested eDRX value is not provided in set command, then the UE will use the eDRX value provided by the network.

The set command also enables the +CEDRXP URC, that is issued on any change in the eDRX parameters, when enabled by the network.

The set command with <mode>=3, will disable the use of eDRX and reset all parameters to factory-programmed values. Optional parameters are not provided in this form of command.

7.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+CEDRXS=<mode>[,<AcT_type>[,<Requested_eDRX_value>]]	OK	AT+CEDRXS=1,4,"0101" OK
Read	AT+CEDRXS?	[+CEDRXS: <AcT_type>, <Requested_eDRX_value> [...] [+CEDRXS: <AcT_type>, <Requested_eDRX_value>]] OK	+CEDRXS: 4,"0101" OK
Test	AT+CEDRXS=?	+CEDRXS: (list of supported <mode>s),(list of supported <AcT_type>s),(list of supported <Requested_eDRX_value>s) OK	+CEDRXS: (0-3),(4-5),("0000"-"1111") OK
URC		+CEDRXP: <AcT_type>[, <Requested_eDRX_value>[,<NW-provided_eDRX_value>[,<Paging_time_window>]]]	+CEDRXP: 4,"1010","1001","1101"

7.13.3 Defined values

Parameter	Type	Description
<mode>	Number	Indication to disable or enable the use of eDRX in the UE. Allowed values: • 0 (factory-programmed value): use of eDRX disabled • 1: use of eDRX enabled • 2: enable the use of eDRX and enable the URC • 3: disable the use of eDRX and reset all other parameters for eDRX to factory-programmed values
<AcT_type>	Number	Indicates the type of access technology. Allowed values: • 2: GPRS/eGPRS • 4: E-UTRAN (WB-S1 mode) • 5: E-UTRAN (NB-S1 mode)
<Requested_eDRX_value>	String	Requested extended DRX parameters information element, half a byte in a 4 bit format. For the coding and the value range, see the extended DRX parameters information element in Table 10.5.5.32 of 3GPP TS 24.008 [12].
<NW_provided_eDRX_value>	String	New provided extended DRX parameters information element, half a byte in a 4 bit format. For the coding and the value range, see the extended DRX parameters information element in Table 10.5.5.32 of 3GPP TS 24.008 [12].
<Paging_time_window>	String	The paging time window refers to bit 8 to 5 of octet 3 of the extended DRX parameters information element, half a byte in a 4 bit format. For the coding and the value range, see the extended DRX parameters information element in Table 10 .5.5.32 of 3GPP TS 24.008 [12].

7.13.4 Notes

SARA-R4 / SARA-N4

- Only one <AcT_type> is active at any given time. If the <AcT_type> parameter is omitted, the module's active <AcT_type> will be applied.

7.14 eDRX read dynamic parameters +CEDRXRDP

+CEDRXRDP						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

7.14.1 Description

Returns the UEs extended discontinuous reception (eDRX) parameters (<AcT_type> and <Requested_eDRX_value>, <NW_provided_eDRX_value> and <Paging_time_window>) if the eDRX is used for the cell which the MT is currently registered to.

7.14.2 Syntax

Type	Syntax	Response	Example
Action	AT+CEDRXRDP	+CEDRXRDP: <AcT_type>,<Requested_eDRX_value>,<NW_provided_eDRX_value>,<Paging_time_window> OK	+CEDRXRDP: 5,"0010","1110","0101" OK
Test	AT+CEDRXRDP=?	OK	

7.14.3 Defined values

Parameter	Type	Description
<AcT_type>	Number	Indicates the type of radio access technology. Allowed values: • 0: do not use eDRX • 1: EC-GSM-IoT (A/Gb mode) • 2: GSM (A/Gb mode) • 3: UTRAN (Iu mode) • 4: E-UTRAN (WB-S1 mode) • 5: E-UTRAN (NB-S1 mode)
<Requested_eDRX_value>	String	Requested extended DRX parameters information element, half a byte in a 4 bit format. For the coding and the value range, see the extended DRX parameters information element in Table 10.5.5.32 of 3GPP TS 24.008 [12].
<NW_provided_eDRX_value>	String	New provided extended DRX parameters information element, half a byte in a 4 bit format. For the coding and the value range, see the extended DRX parameters information element in Table 10.5.5.32 of 3GPP TS 24.008 [12].
<Paging_time_window>	String	The paging time window refers to bit 8 to 5 of octet 3 of the extended DRX parameters information element, half a byte in a 4 bit format. For the coding and the value range, see the extended DRX parameters information element in Table 10.5.5.32 of 3GPP TS 24.008 [12].

7.15 Set MNO profile +UMNOPROF

+UMNOPROF						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

7.15.1 Description

Automatically configures the module to be compliant to the requirements of various Mobile Network Operators.

☞ Follow this procedure to properly set up the configuration:
- Deregister the module from the network (AT+COPS=2 or perform a AT+CFUN=0 cycle)
- Issue AT+UMNOPROF=<MNO>

- Reboot the module (AT+CFUN=15) in order to apply the new configuration

☞ After setting a new configuration the module reconfigures the PDP context settings (e.g. APN of the initial EPS bearer).

☞ u-blox cellular modules are certified according to all the capabilities and options stated in the Protocol Implementation Conformance Statement document (PICS) of the module. The PICS, according to 3GPP TS 51.010-2 [84], 3GPP TS 34.121-2 [85], 3GPP TS 36.521-2 [115] and 3GPP TS 36.523-2 [116], is a statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

7.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMNOPROF=<MNO>	OK	AT+UMNOPROF=1 OK
Read	AT+UMNOPROF?	+UMNOPROF: <MNO> OK	+UMNOPROF: 3 OK
Test	AT+UMNOPROF=?	+UMNOPROF: (list of supported <mode>s) OK	+UMNOPROF: 0: SW default 1: SIM ICCID select 2: ATT 6: China Telecom 100: Standard Europe 4: Telstra 5: T-Mobile US 19: Vodafone 3: Verizon 31: Deutsche Telekom OK

7.15.3 Defined values

Parameter	Type	Description
<MNO>	Number	Mobile Network Operator (MNO) profile: • 0: SW default • 1: SIM ICCID select • 2: ATT • 6: China Telecom • 100: Standard Europe • 4: Telstra • 5: T-Mobile US • 19: Vodafone • 3: Verizon • 31: Deutsche Telekom

7.15.4 Notes

- Not all profiles are available on all products.
- Setting the profile to the currently set profile does not reset the parameters. To reset the parameters, set a different profile than the current one and then set the the profile back to the original.
- The standard Europe profile should be used as the basis for all other MNOs in Europe outside of Vodafone and Deutsche Telekom. However, there may be changes that need to be applied to the module for proper operation with any given European MNO such as attach type, RAT preference, band selection, etc. Please consult with the preferred network provider.

7.16 Band selection bitmask +UBANDMASK

+UBANDMASK						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

7.16.1 Description

Sets the supported 4G LTE bands for different Radio Access Technologies (RATs). The bands supported are set by means of a bitmask where each bit in an 8 byte integer corresponds to a 4G LTE band.

Reboot the module (+CFUN=15) to make the setting effective.

u-blox cellular modules are certified according to all the capabilities and options stated in the Protocol Implementation Conformance Statement document (PICS) of the module. The PICS, according to 3GPP TS 51.010-2 [84], 3GPP TS 34.121-2 [85], 3GPP TS 36.521-2 [115] and 3GPP TS 36.523-2 [116], is a statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

7.16.2 Syntax

Type	Syntax	Response	Example
Set	AT+UBANDMASK=<RAT>,<bitmask1>[,<bitmask2>]	OK	AT+UBANDMASK=0,2074 OK
Read	AT+UBANDMASK?	+UBANDMASK: <RAT>,<bitmask1>[,<bitmask2>][,<RAT>,<bitmask1>[,<bitmask2>]] OK	+UBANDMASK: 0,168761503,1,168761503 OK
Test	AT+UBANDMASK=?	+UBANDMASK: (list of the supported <RAT>s),<bitmask1>,<bitmask2> OK	+UBANDMASK: (0,1),0 xffffffffffffffff,0xffffffffffffffff OK

7.16.3 Defined values

Parameter	Type	Description
<RAT>	Integer	Indicates the Radio Access Technology (RAT): • 0: LTE Cat M1 • 1: LTE Cat NB1
<bitmask1>	Integer	Indicated the bandmask for 4G LTE bands 1 through 64. Each bit enables/disables a band: • Bit 0: band 1 • Bit 1: band 2 • Bit 2: band 3 • Bit 3: band 4 • .. • Bit 63: band 64
<bitmask2>	Integer	Indicated the bandmask for 4G LTE bands 65 through 128. Each bit enables/disables a band: • Bit 0: band 65 • Bit 1: band 66 • Bit 2: band 67 • Bit 3: band 68 • .. • Bit 63: band 128

7.17 Device service domain configuration +USVCDOMAIN

+USVCDOMAIN						
Modules	SARA-R410M-52B SARA-R412M					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

7.17.1 Description

Configures the service domain (CS/PS) upon network attach.

Setting the Mobile Network Operator (MNO) profile with the +UMNOPROF AT command will overwrite this setting.

Reboot the module in order to apply the new settings.

7.17.2 Syntax

Type	Syntax	Response	Example
Set	AT+USVCDOMAIN=<domain>	OK	AT+USVCDOMAIN=2 OK
Read	AT+USVCDOMAIN?	+USVCDOMAIN: <domain> OK	+USVCDOMAIN: 2 OK
Test	AT+USVCDOMAIN=?	+USVCDOMAIN: (list of supported <domain>s) OK	+USVCDOMAIN: (0-2) OK

7.17.3 Defined values

Parameter	Type	Description
<setting>	Number	Service domain: • 0: CS only • 1: PS only • 2 (factory-programmed value): CS/PS combined

8 Security

8.1 Enter PIN +CPIN

+CPIN						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

8.1.1 Description

Enter PIN. If no PIN request is pending, the corresponding error code is returned. If a wrong PIN is given three times, the PUK must be inserted in place of the PIN, followed by the <newpin> which replaces the old pin in the SIM.

8.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPIN=<pin>[,<newpin>]	OK	AT+CPIN="0933" OK
Read	AT+CPIN?	+CPIN: <code> OK	+CPIN: SIM PIN OK
Test	AT+CPIN=?	OK	

8.1.3 Defined values

Parameter	Type	Description
<pin>, <newpin>	String	4-to-8 characters long string of decimal digits. If only PIN is required, <newpin> is not to be entered. If PUK is required, <pin> must be the PUK and <newpin>, the new PIN code, must be entered as well.
<code>	String	• READY: MT is not pending for any password • SIM PIN: MT is waiting SIM PIN to be given • SIM PUK: MT is waiting SIM PUK to be given • SIM PIN2: MT is waiting SIM PIN2 to be given • SIM PUK2: MT is waiting SIM PUK2 to be given • PH-NET PIN: MT is waiting network personalization password to be given • PH-NETSUB PIN: MT is waiting network subset personalization password to be given • PH-SP PIN: MT is waiting service provider personalization password to be given • PH-CORP PIN: MT is waiting corporate personalization password to be given • PH-SIM PIN: MT is waiting phone to SIM/UICC card password to be given

8.1.4 Notes

- The command needs the SIM module to work correctly
- If PIN is not inserted the following situation can occur:
  AT+CMEE=2

  OK

  AT+COPS=0

  +CME ERROR: SIM PIN required

  AT+CMEE=0

  OK

AT+COPS=0

ERROR

- To change the PIN the user must use the AT+CPWD="SC",<old_pin>,<new_pin> command (see Chapter 8.3 for details).
  Example:

  AT+CPWD="SC","1234","4321"

8.2 Facility lock +CLCK

+CLCK						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 3 min	+CME Error

8.2.1 Description

Locks, unlocks or interrogates an MT or a network facility <fac>. A password is normally needed to do such actions. When querying the status of a network service (<mode>=2) the information text response for "not active" case (<status>=0) is returned only if the service is not active for any <class>. Instead when querying the status of a network service (<mode>=2) asking for a specific <class>, the DUT sends a generic request. The command can be aborted if network facilities are set or interrogated.

For <fac> "PN", "PU", "PP", "PC" and "PS" only <mode>=0 and <mode>=2 (unlock and query status) are always supported.

For <fac> "PN", "PU", "PP", "PC" and "PS" <mode>=1 (lock status) is supported only if proper re-activation characteristic is enabled during personalization.

8.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+CLCK=<fac>,<mode>[,<passwd>[,<class>]]	OK or +CLCK: <status>[,<class1>] [...] [+CLCK: <status>[,<class1>]] OK	AT+CLCK="SC",1,"0933" OK
Test	AT+CLCK=?	+CLCK: (list of supported <fac>s) OK	+CLCK: ("SC","PN","PU","PP","PC","PS","FD","AO","OI","OX","AI","IR","AB","AG","AC") OK

8.2.3 Defined values

Parameter	Type	Description
<fac>	String	Facility values: • "SC": SIM (PIN enabled/disabled) • "PN": Network Personalisation (see the 3GPP TS 22.022 [31]) • "PU": network sUbset Personalisation (see the 3GPP TS 22.022 [31]) • "PP": service Provider Personalisation (see the 3GPP TS 22.022 [31]) • "PC": Corporate Personalisation (see the 3GPP TS 22.022 [31]) • "PS": SIM/USIM Personalisation (see the 3GPP TS 22.022 [31]) • "FD": SIM fixed dialling phonebook feature • "AO": BAR (Bar All Outgoing Calls) • "OI": BOIC (Bar Outgoing International Calls) • "OX": BOIC-exHC(Bar Outgoing International Calls except to Home Country)

Parameter	Type	Description
		• "AI": BAIC (Bar All Incoming Calls) • "IR": BIC-Roam (Bar Incoming Calls when Roaming outside the home country) • "AB": All Barring services (applicable only for <mode>=0) • "AG": All outGoing barring services (applicable only for <mode>=0) • "AC": All inComing barring services (applicable only for <mode>=0) • "CS": CNTRL (lock CoNTRoL surface (e.g. phone keyboard)) (see the 3GPP TS 27.007 [2]) • "PF": Lock Phone to the very First inserted SIM/UICC card (see the 3GPP TS 27.007 [2]) • "NT": Barr incoming calls from numbers Not stored to TA memory (see the 3GPP TS 27.007 [2]) • "NM": Barr incoming calls from numbers Not stored to MT memory (see 3GPP TS 27.007 [2]) • "NS": Barr incoming calls from numbers Not stored to SIM/UICC memory (see the 3GPP TS 27.007 [2]) • "NA": Barr incoming calls from numbers Not stored in any memory (see the 3GPP TS 27.007 [2])
<mode>	Number	• 0: unlock • 1: lock • 2: query status
<status>	Number	• 0: not active • 1: active
<passwd>	String	Shall be the same as password specified for the facility from the MT user interface or with the +CPWD command
<class>	Number	Sum of numbers each representing a class of information. The default value is 7 (voice + data + fax): • 1: voice • 2: data • 4: FAX • 8: short message service • 16: data circuit sync • 32: data circuit async • 64: dedicated packet access • 128: dedicated PAD access

8.3 Change password +CPWD

+CPWD						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 3 min	+CME Error

8.3.1 Description

Sets a new password for the facility lock function defined by the +CLCK AT command. The command is abortable if a character is sent to the DCE during the command execution.

8.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPWD=<fac>,<oldpwd>, <newpwd>	OK	AT+CPWD="SC","0933","0934" OK
Test	AT+CPWD=?	+CPWD: list of available (<fac>, <pwdlength>s) OK	+CPWD: ("SC",8),("P2",8),("AO",4), ("OI",4),("OX",4),("AI",4),("IR",4),("AB", 4),("AG",4),("AC",4) OK

8.3.3 Defined values

Parameter	Type	Description
<fac>	String	"P2" SIM PIN2; see the +CLCK command description for other values
<oldpwd>	String	Old password
<newpwd>	String	New password
<pwdlength>	Number	Length of password (digits)

8.3.4 Notes

- If the PIN is blocked, an error result code will be provided when attempting to change the PIN code if the PIN check is disabled through AT+CLCK command.

9 Short Messages Service

9.1 Introduction

For a complete overview of SMS, see 3GPP TS 23.040 [8] and 3GPP TS 27.005 [16].

In case of errors all the SMS related AT commands return an error result code as defined in Appendix A.2.

9.1.1 Class 0 SMS

The storing of a class 0 SMS depends on the module series:

- SARA-R4 / SARA-N4 - not stored.

9.1.2 <index> parameter range

The <index> parameter range depends on the memory storage type:

ME (ME message), **SM** ((U)SIM message) **MT** (ME + SM):

- SARA-R4 / SARA-N4
  - Values between 0 and 23: SMS stored in ME.
  - Values between 0 and n: SMS stored in SIM (n depends on SIM card used).

BM (Broadcast Message):

- SARA-R4 / SARA-N4 - Broadcast Message storage is not supported.

SR (Status Report)

- SARA-R4 / SARA-N4 - Status Report storage is not supported.

9.1.3 Limitations

The following limitations apply related to the SMS usage:

Single SMS

- 160 characters if <dcs>= "GSM 7 bit default alphabet data"
- 140 octets if <dcs>= "8-bit data"
- 70 UCS2 characters (2 bytes for each one) if <dcs>="16-bit uncompressed UCS2 data"

Concatenated SMS (where supported) - "8-bit reference number" type

- 153 characters if <dcs>= "GSM 7 bit default alphabet data"
- 134 octets if <dcs>= "8-bit data"
- 67 UCS2 characters (2 bytes for each one) if <dcs>="16-bit uncompressed UCS2 data"

Concatenated SMS (where supported) - "16-bit reference number" type

- The limits are the same as the "8-bit reference number" type, but are decreased by one unit.

A concatenated SMS can have as many as 255 parts.

9.2 Select message service +CSMS

+CSMS						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CMS Error

9.2.1 Description

Selects the <service> message service. It returns the types of messages supported by the MT.

9.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSMS=<service>	+CSMS: <mt>,<mo>,<bm> OK	AT+CSMS=1 +CSMS: 1,1,1 OK
Read	AT+CSMS?	+CSMS: <service>,<mt>,<mo>,<bm> OK	+CSMS: 0,1,1,1 OK
Test	AT+CSMS=?	+CSMS: (list of supported <service>s) OK	+CSMS: (0-1) OK

9.2.3 Defined values

Parameter	Type	Description
<service>	Number	• 0: see 3GPP TS 23.040 [8] and 3GPP TS 23.041 [9]; syntax of AT commands is compatible with 3GPP TS 27.005 [16] phase 2; phase 2+ features may be supported if no new command syntax is required • 1: see 3GPP TS 23.040 [8] and 3GPP TS 23.041 [9]; syntax of AT commands is compatible with 3GPP TS 27.005 [16] phase 2+
<mt>	Number	Mobile terminated messages: • 0: not supported • 1: supported
<mo>	Number	Mobile originated messages: • 0: not supported • 1: supported
<bm>	Number	Broadcast messages: • 0: not supported • 1: supported

9.2.4 Notes

SARA-R4 / SARA-N4

- Set <service> to 1 to acknowledge an incoming message (either SMS or Status Report) with +CNMA AT command.
- If <service> is changed from 1 to 0 and one or more parameters of the +CNMI command are in phase 2+, switch the +CNMI parameters to phase 2 specific values before entering phase 2.

9.3 Preferred message storage +CPMS

+CPMS						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	NVM	No	Up to 3 min	+CMS Error

9.3.1 Description

Selects memory storages <mem1>, <mem2> and <mem3>. If the chosen storage is supported by the MT but not suitable, the +CMS ERROR: <err> error result code should be returned.

See the test command for the supported memory types for each memory storage.

9.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPMS=<mem1>[,<mem2>[,<mem3>]]	AT+CPMS: <used1>,<total1>,<used2>,<total2>,<used3>,<total3> OK	AT+CPMS="BM","SM","SM" +CPMS: 0,5,0,50,0,50

Type	Syntax	Response	Example
			OK
Read	AT+CPMS?	+CPMS: <mem1>,<used1>,<total1>, mem2>,<used2>,<total2>, <mem3>,<used3>,<total3> OK	+CPMS: "MT",4,350,"MT",4,350, "MT",4,350 OK
Test	AT+CPMS=?	+CPMS: (list of supported <mem1>s),(list of supported <mem2>s),(list of supported <mem3>s) OK	+CPMS: ("MT","ME","SM","BM", "SR"),("MT","ME","SM"),("MT","ME", "SM") OK

9.3.3 Defined values

Parameter	Type	Description
<mem1>	String	Memory used to read and delete messages. The supported values may vary: • "ME": ME message storage • "SM": (U)SIM message storage • "MT": "ME"+"SM", "ME" preferred • "BM": Broadcast Message storage • "SR": Status Report storage The default value is the currently set value. The factory-programmed value depends on the module series: see Notes for more details.
<mem2>	String	Memory used to write and send SMS. The supported values may vary: • "ME": ME message storage • "SM": (U)SIM message storage • "MT": "ME"+"SM", "ME" preferred The default value is the currently set value. The factory-programmed value depends on the module series: see Notes for more details.
<mem3>	String	Memory preferred to store the received SMS. The supported values may vary: • "ME": ME message storage • "SM": (U)SIM message storage • "MT": "ME"+"SM", "ME" preferred The default value is the currently set value. The factory-programmed value depends on the module series: see Notes for more details.
<used1>	Number	Number of used message locations in <mem1>
<total1>	Number	Total number of message locations in <mem1>
<used2>	Number	Number of used message locations in <mem2>
<total2>	Number	Total number of message locations in <mem2>
<used3>	Number	Number of used message locations in <mem3>
<total3>	Number	Total number of message locations in <mem3>

9.3.4 Notes

- SARA-R4 / SARA-N4 - the factory-programmed value is "ME", "ME" and "ME".

SARA-R4 / SARA-N4

- "MT" message storage is not supported.

9.4 Preferred message format +CMGF

+CMGF						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	Profile	No	-	+CMS Error

9.4.1 Description

Indicates to the MT which input and output format of messages shall be used.

9.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+CMGF=[<mode>]	OK	AT+CMGF=1 OK
Read	AT+CMGF?	+CMGF: <mode> OK	+CMGF: 1 OK
Test	AT+CMGF=?	+CMGF: (list of supported <mode>s) OK	+CMGF: (0-1) OK

9.4.3 Defined values

Parameter	Type	Description
<mode>	Number	Indicates the format of messages used with send, list, read and write commands and URCs resulting from receiving SMSes messages: • 0 (default and factory-programmed value): PDU mode • 1: text mode

9.5 Save settings +CSAS

+CSAS						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CMS Error

9.5.1 Description

Saves active message service settings from the current active memory (RAM) to non-volatile memory (NVM). The settings related to the +CSCA (the current SMSC address stored in RAM), +CSMP and +CSCB commands are stored in a specific SMS profile (only one profile is available).

9.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSAS[=<profile>]	OK	AT+CSAS OK
Test	AT+CSAS=?	+CSAS: (list of supported <profile>s) OK	+CSAS: (0) OK

9.5.3 Defined values

Parameter	Type	Description
<profile>	Number	Specific SMS profile index where to store the active message settings. The factory-programmed value is 0.

9.6 Restore settings +CRES

+CRES						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	< 10 s	+CMS Error

9.6.1 Description

Restores message service settings from a non-volatile memory (NVM) to the current active memory (RAM). The settings related to the +CSCA (the SMSC address in the SIM card is also updated), +CSMP and +CSCB commands are read from a specific SMS profile (only one profile is available).

9.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+CRES[=<profile>]	OK	AT+CRES=0 OK
Test	AT+CRES=?	+CRES: (list of supported <profile>s) OK	+CRES: (0) OK

9.6.3 Defined values

Parameter	Type	Description
<profile>	Number	Specific SMS profile index from where to read the message service settings

9.7 New message indication +CNMI

+CNMI						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	Profile	No	-	+CMS Error

9.7.1 Description

Selects the procedure to indicate the reception of a new SMS in case of the MT is active (the DTR signal is ON). If the MT is inactive (the DTR signal is OFF), the message reception should be done as specified in 3GPP TS 23.038 [7].

The +UCMT URC notifies the SMS-DELIVER status for 3GPP2 Mobile Terminated SMSes; it is equivalent to +CMT but valid only for 3GPP2 SMS (i.e. 3GPP2 SMS over IMS received on Verizon MNO).

9.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+CNMI=[<mode>[,<mt>[,<bm>[,<ds>[,<bfr>]]]]]	OK	AT+CNMI=1,1 OK
Read	AT+CNMI?	+CNMI: <mode>,<mt>,<bm>,<ds>,<bfr> OK	+CNMI: 0,0,0,0,0 OK
Test	AT+CNMI=?	+CNMI: (list of supported <mode>s),(list of supported <mt>s),(list of supported <bm>s),(list of supported <ds>s),(list of supported <bfr>s) OK	+CNMI: (0-2),(0-3),(0-3),(0-2),(0-1) OK
URC		+CMTI: <mem>,<index>	+CMTI: "SM",5
URC		**Text mode (+CMGF=1):**	+CMT: "+393475234652",,"14/11/21,11:58:23+01"

Type	Syntax	Response	Example
		+CMT: <oa>,[<alpha>], <scts>[,<tooa>,<fo>,<pid>, <dcs>,<sca>,<tosca>, <length>]<CR><LF><data>	Hello world
		PDU mode (+CMGF=0): +CMT: ,<length><CR><LF><pdu>	
URC		**Text mode (+CMGF=1):** +UCMT: <message_id>, <oa>,<scts>,[<priority>], [<privacy>],[<callback_number>], <encoding>,[<status>],[<num_ sms>,<part>,<reference>], <length><CR><LF><text>	+UCMT: 1,+1231241241,"18:02:28+08",,,,2,,,,,6 Hello!
		PDU mode (+CMGF=0): +UCMT: <pdu_ length><CR><LF><pdu>	
URC		+CBMI: <mem>,<index>	+CBMI: "BM",48
URC		**Text mode (+CMGF=1):** +CBM: <sn>,<mid>,<dcs>,<page>, <pages><CR><LF><data>	+CBM: 271,1025,1,1,1 The quick brown fox jumps over the lazy dog 0123456789
		PDU mode (+CMGF=0): +CBM: <length><CR><LF><pdu>	
URC		+CDSI: <mem>,<index>	+CDSI: "MT",2
URC		**Text mode (+CMGF=1):** +CDS: <fo>,<mr>,[<ra>],[<tora>], <scts>,<dt>,<st>	+CDS: 6,202,"+393492323583",145,"14/07/25,13:07:16+02","14/07/25,16:35:44+02",0
		PDU mode (+CMGF=0): +CDS: <length><CR><LF><pdu>	

9.7.3 Defined values

Parameter	Type	Description
<mode>	Number	Controls the processing of URCs specified within this command: • 0 (default value): buffer URCs in the MT; if the MT buffer is full, the oldest indication may be discarded and replaced with the new received indications (ring buffer) • 1 (factory-programmed value): discard indication and reject new received message URCs when MT-DTE link is reserved; otherwise forward them directly to the DTE • 2: buffer URCs in the MT when the serial link is busy (e.g. data-transfer); otherwise forward them directly to the DTE • 3: forward URCs directly to the TE. TA-TE link specific inband technique used to embed result codes and data when MT is in on-line data mode
<mt>	Number	Specifies the rules for managing the received SMS according the message's Data Coding Scheme (DCS): • 0 (default and factory-programmed value): No SMS-DELIVER indications are routed to the TE • 1: if SMS-DELIVER is stored in the MT, indication of the memory location is routed to the DTE using the +CMTI URC • 2: SMS-DELIVER (except class 2 SMS) are routed directly to the DTE (but not saved in the module file system or SIM memory) using the +CMT URC. If MT has its own display device then class 0 SMS and SMS in the message waiting indication group (discard message) may be copied to both MT display and to DTE. In this case MT shall send the acknowledgement to the network. Class 2 SMSs and messages in the message waiting indication group (storage message) result in indication as defined in <mt>=1 • 3: Class 3 SMS-DELIVERs are routed directly to DTE using URCs defined in <mt>=2. Messages of other data coding schemes result in indication as defined in <mt>=1
<bm>	Number	Specifies the rules for managing the received Cell Broadcast messages (CBM): • 0 (default and factory-programmed value): no CBM indications to the DTE

Parameter	Type	Description
		• 1: if the CBM is stored in the MT, an indication of the used memory location is routed to DTE using the +CBMI URC • 2: new CBMs are routed directly to the DTE using the +CBM URC • 3: class 3 CBMs are routed directly to DTE using URCs defined in <bm>=2. If CBM storage is supported, messages of other classes result in indication as defined in <bm>=1
<ds>	Number	Specifies the rules for managing the Status Report messages: • 0 (default and factory-programmed value): no SMS-STATUS-REPORTs are routed to the DTE • 1: SMS-STATUS-REPORTs are routed to the DTE using the +CDS URC • 2: if SMS-STATUS-REPORT is stored in the MT, the indication of the memory location is routed to the DTE using the +CDSI URC
<bfr>	Number	Controls the buffering of URCs: • 0 (default and factory-programmed value): MT buffer of URCs defined within this command is flushed to the DTE when <mode> 1...3 is entered (OK final result code shall be given before flushing the codes). • 1: MT buffer of URCs defined within this command is cleared when <mode> 1...3 is entered
<mem>	String	Same as defined in +CPMS Defined Values
<index>	Number	Storage position
<length>	Number	Two meanings: • in text mode: number of characters • in PDU mode: PDU's length in octets without the Service Center's address. In example: 039121430100038166F6000004E374F80D: this is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length>=13.
<pdu>	String	Protocol data unit: each 8-bit octet is presented as two IRA character long hexadecimal numbers, e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)
<oa>	String	Originator address
<scts>	String	Service center time stamp in time-string format, see the <dt>
<data>	String	In the case of SMS: 3GPP TS 23.040 [8] TP-User-Data in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used and <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is not set: o if TE character set other than "HEX" (see the +CSCS command in 3GPP TS 27.007 [2]): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used, or <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is set: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [9] CBM Content of Message in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS in 3GPP TS 27.007 [2]): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<sn>	Number	CBM serial number
<mid>	Number	CBM message identifier
<dcs>	Number	Data Coding Scheme
<page>	Number	CBM Page Parameter bits 4-7 in integer format as described in 3GPP TS 23.041 [9]
<pages>	Number	CBM Page Parameter bits 0-3 in integer format as described in 3GPP TS 23.041 [9]

Parameter	Type	Description
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [8])
<mr>	Number	Message reference
<ra>	String	Recipient address field
<tora>	Number	Type of address of <ra> - octet
<dt>	String	Discharge time in format "yy/MM/dd,hh:mm:ss+zz"; the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<st>	Number	Status of a SMS STATUS-REPORT
<message_id>	Number	Message-ID of the 3GPP2 SMS
<priority>	Number	3GPP2 priority: • 0: normal • 1: interactive • 2: urgent • 3: emergency
<privacy>	Number	3GPP2 privacy: • 0: not restricted • 1: restrictive • 2: confidential • 3: secret
<callback_number>	String	Callback number
<encoding>	Number	Text encoding: • 2: ASCII7 • 3: IA5 • 4: UCS2 • 8: ISO 8859-1 • 9: GSM7
<num_sms>	Number	Total number of SMS
<part>	Number	Fragment part number
<reference>	Number	3GPP2 reference ID

9.7.4 Notes

- The incoming SMS/CBM URC indications will be displayed only on the AT interface where the last +CNMI command was set. As a general rule, the command should be issued by the DTE:
  - After start-up
  - After using the Z and &F command (which reset the command configuration)
  - Whenever the incoming SMS URCs indications are requested on a different AT interface
- <mode> = 3 is not supported.

SARA-R4 / SARA-N4

- The <ds> parameter can be set to 1 only if <mode>=1.

9.8 Read message +CMGR

+CMGR						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	<10 s	+CMS Error

9.8.1 Description

Returns the message with location value <index> from message storage <mem1> to the DTE.

The parameters <tooa>, <fo>, <pid>, <dcs>, <sca>, <tosca>, <length>, <cdata> shall be displayed only if +CSDH=1 is set.

The syntax AT+CMGR=0 allows to display an SMS class 0 if it is signalized to MT, because no MMI is available in the MT (see also the +CNMI AT command notes).

☞ If the <index> value is out of range (it depends on AT+CPMS command setting) or it refers to an empty position, then "+CMS ERROR: invalid memory index" error result code is returned.

9.8.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGR=<index>	**SMS-DELIVER** +CMGR: <stat>,<oa>,[<alpha>], <scts>[,<tooa>,<fo>,<pid>,<dcs>, <sca>,<tosca>,<length>] <data> OK	AT+CMGR=303 +CMGR: "REC READ", "+393488535999",,"07/04/05,18:0 2:28+08",145,4,0,0,"+393492000 466",145,93 You have a missed called. Free information provided by your operator. OK
		SMS-SUBMIT +CMGR: <stat>,<da>,[<alpha>][, <toda>,<fo>,<pid>,<dcs>,[<vp>], <sca>,<tosca>,<length>] <data> OK	
		SMS-STATUS-report +CMGR: <stat>,<fo>,<mr>,[<ra>], [<tora>],<scts>,<dt>,<st> OK	
		SMS-COMMAND +CMGR: <stat>,<fo>,<ct>[,<pid>, [<mn>],[<da>],[<toda>],<length> [<cdata>]] OK	
		CBM storage +CMGR: <stat>,<sn>,<mid>,<dcs>, <page>,<pages> <data> OK	
	PDU mode (+CMGF=0): AT+CMGR=<index>	+CMGR: <stat>,[<alpha>],<length> <pdu> OK	AT+CMGR=1 +CMGR: 1,,40 0791934329002000040 C9193230982661400008070 328045218018D4F29CFE0 6B5CBF379F87C4EBF41E4340 82E7FDBC3 OK
Test	AT+CMGR=?	OK	

9.8.3 Defined values

Parameter	Type	Description
<index>	Number	Storage position
<stat>	Number	• 0: in PDU mode or "REC UNREAD" in text mode: received unread SMS • 1: in PDU mode or "REC READ" in text mode: received read SMS • 2: in PDU mode or "STO UNSENT" in text mode: stored unsent SMS • 3: in PDU mode or "STO SENT" in text mode: stored sent SMS
<oa>	String	Originator address
<alpha>	String	Alphanumeric representation of <da> or <oa> corresponding to the entry found in the phonebook 3GPP TS 24.008 [12]. The parameter is not managed.
<scts>	String	Service center time stamp in time-string format, see <dt>
<tooa>	Number	Type of address of <oa> - octet
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [8])
<pid>	Number	TP-Protocol-Identifier (default 0); see the 3GPP TS 23.040 [8]

Parameter	Type	Description
<dcs>	Number	Data Coding Scheme
<sca>	String	Service center address field
<tosca>	Number	Type of address of <sca> - octet in Number format (for more details see the 3GPP TS 24.008 [12]); default 145 when string includes '+', otherwise default 129
<length>	Number	Two meanings: • in text mode: number of characters • in PDU mode: PDU's length in octets without the Service Center's address. In example 039121430100038166F6000004E374F80D: this is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length> = 13.
<data>	String	In the case of SMS: 3GPP TS 23.040 [8] TP-User-Data in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used and <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is not set: o if TE character set other than "HEX" (see +CSCS command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used, or <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is set: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [9] CBM Content of Message in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see +CSCS command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<vp>	Number	Format depending of the <fo> setting: • Relative format: validity period starting from when the SMS is received by the SMSC, in range 0-255 (default value 167); for more details see the 3GPP TS 23.040 [8] • Absolute format: absolute time of the validity period termination in string format ("yy/MM/dd,hh:mm:ss+zz") (see the 3GPP TS 23.040 [8]); the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56

<vp>	Validity period value
0 to 143	(TP-VP + 1) x 5 minutes (i.e. 5 minutes intervals up to 12 hours)
144 to 167	12 hours + ((TP-VP -143) x 30 minutes)
168 to 196	(TP-VP - 166) x 1 day
197 to 255	(TP-VP - 192) x 1 week

<mr>	Number	Message reference
<ra>	String	Recipient address field
<tora>	Number	Type of address of <ra> - octet
<dt>	String	Discharge time in format "yy/MM/dd,hh:mm:ss+zz"; the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<st>	Number	Status of an SMS STATUS-REPORT
<ct>	Number	TP-Command-Type (default 0)
<mn>	Number	See the 3GPP TS 23.040 [8] TP-Message-Number in integer format
<cdata>	String	TP-Command-Data in text mode responses
<sn>	Number	CBM serial number

Parameter	Type	Description
<mid>	Number	CBM message identifier
<page>	Number	3GPP TS 23.041 [9] CBM Page Parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [9] CBM Page Parameter bits 0-3 in integer format
<pdu>	String	Protocol data unit: each 8-bit octet is presented as two IRA character long hexadecimal numbers, e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)

9.9 New message acknowledgement to MT +CNMA

+CNMA						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	< 150 s	+CMS Error

9.9.1 Description

Confirms the reception of a new message (SMS-DELIVER or SMS-STATUS-REPORT) which is routed directly to the TE (see the +CNMI command). This acknowledgement command shall be used when +CSMS parameter <service> equals 1. The MT shall not send another +CMT or +CDS (see the +CNMI command) unsolicited result codes to the TE before the previous one is acknowledged. If the MT does not get acknowledgement within required time (network timeout), the MT should respond as specified in 3GPP TS 24.011 [13] to the network. The MT shall automatically disable routing to the TE by setting both <mt> and <ds> values of +CNMI to zero. If the command is executed, but no acknowledgement is expected, or some other MT related error occurs, the final result code +CMS ERROR: <err> is returned.

In PDU mode, it is possible to send either positive (RP-ACK) or negative (RP-ERROR) acknowledgement to the network. The <n> parameter defines which one will be sent. Optionally (when <length> is greater than zero) an acknowledgement TPDU (SMS-DELIVER-REPORT for RP-ACK or RP-ERROR) may be sent to the network. The entering of PDU is done similarly as specified in +CMGS command, except that the format of <ackpdu> is used instead of <pdu> (i.e. SMSC address field is not present). The PDU shall not be bounded by double quotes.

9.9.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CNMA	OK	AT+CNMA OK
	PDU mode (+CMGF=0): AT+CNMA[=<n>[,<length> [PDU is given<Ctrl-Z>/<ESC>]]]	OK	AT+CNMA=1,5 >0007000000 <Ctrl-Z> OK
Test	AT+CNMA=?	**Text mode (+CMGF=1):** OK	OK
		PDU mode (+CMGF=0): +CNMA: (list of supported <n>s) OK	+CNMA: (0-2) OK

9.9.3 Defined values

Parameter	Type	Description
<n>	Number	• 0: the command operates similarly as defined for the text mode • 1: sends RP-ACK (or buffered result code received correctly) • 2: sends RP-ERROR (if PDU is not given, ME/TA shall send SMS-DELIVER-REPORT with 3GPP TS 23.040 [8] TP-FCS value set to 'FF' (unspecified error cause))
<length>	Number	PDU's length in octets without the Service Center's address

9.10 List message +CMGL

+CMGL						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	Up to 3 min (<1 s for prompt ">" when present)	+CMS Error

9.10.1 Description

Returns SMS messages with status value <stat> from message storage <mem1> to the DTE. If status of the received message is "received unread", status in the storage changes to "received read".

9.10.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGL[=<stat>]	**Command successful and SMS-DELIVERs:** +CMGL: <index>,<stat>,<oa>,[<alpha>],[<scts>][,<tooa>,<length>] <data> [+CMGL: <index>,<stat>,<oa>,[<alpha>],[<scts>][,<tooa>,<length>]<data>[...]] OK	AT+CMGL +CMGL: 303,"REC READ","+393401234999",,"08/08/06,10:01:38+08" You have a missed called. Free information provided by your operator. OK
		Command successful and SMS-SUBMITs: +CMGL: <index>,<stat>,<da>,[<alpha>],[<toda>, <length>] <data> [+CMGL: <index>,<stat>,<da>,[<alpha>],[<toda>, <length>]<data>[...]] OK	
		Command successful and SMS-STATUS-REPORTs: +CMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> [+CMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st>[...]] OK	
		Command successful and SMS-COMMANDs: +CMGL: <index>,<stat>,<fo>,<ct> [+CMGL: <index>,<stat>,<fo>,<ct>[...]] OK	
		Command successful and CBM storage: +CMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages><data> [+CMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages>,<data>[...]] OK	
	PDU mode (+CMGF=0):	**Command successful:**	AT+CMGL=1

Type	Syntax	Response	Example
	AT+CMGL[=<stat>]	+CMGL: <index>,<stat>,[<alpha>], <length> <pdu> [+CMGL: <index>,<stat>,[<alpha>], <length>] <pdu> [...]	+CMGL: 305,1,,57 079193432900 1185440ED0D637396C7EBBCB0 00090909270802480 2A050 003000303DEA0584CE60 205D974791994769BDF3A90 DB759687E9F534FD0DA2C9603419 OK
Test	AT+CMGL=?	+CMGL: (list of supported <stat>s) OK	+CMGL: ("REC UNREAD","REC READ","STO UNSENT","STO SENT", "ALL") OK

9.10.3 Defined values

Parameter	Type	Description
<stat>	Number or String	Number type in PDU mode (default value: 4), or string type in text mode (default value: "ALL"); indicates the status of message in memory: • 0: in PDU mode or "REC UNREAD" in text mode: received unread SMS messages • 1: in PDU mode or "REC READ" in text mode: received read SMS messages • 2: in PDU mode or "STO UNSENT" in text mode: stored unsent SMS messages • 3: in PDU mode or "STO SENT" in text mode: stored sent SMS messages • 4: in PDU mode or "ALL" in text mode: all SMS messages
<index>	Number	Storage position
<oa>	String	Originator address
<alpha>	String	Alphanumeric representation of <da> or <oa> corresponding to the entry found in the phonebook 3GPP TS 24.008 [12]. The parameter is not managed.
<scts>	String	Service center time stamp in time-string format; see the <dt> parameter
<tooa>	Number	Type of address of <oa> - octet
<length>	Number	Two meanings: • in text mode: number of characters • in PDU mode: PDU's length in octets without the Service Center's address. In example 039121430100038166F6000004E374F80D: this is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length> = 13.
<data>	String	This is the TP-User-Data in text mode; the decoding depends on the DCS (Data Coding Scheme) and the FO (First Octect) of the SMS header 3GPP TS 23.040 [8]; format: • if DCS indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used and FO indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is not set: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if DCS indicates that 8-bit or UCS2 data coding scheme is used, or FO indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is set: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [9] CBM Content of Message in text mode responses; format: • if DCS indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number if DCS indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet

Parameter	Type	Description
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [8])
<mr>	Number	Message reference
<ra>	String	Recipient address field
<tora>	Number	Type of address of <ra> - octet
<dt>	String	Discharge time in format "yy/MM/dd,hh:mm:ss+zz"; the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<st>	Number	Status of an SMS STATUS-REPORT
<ct>	Number	TP-Command-Type (default 0)
<sn>	Number	CBM serial number
<mid>	Number	CBM message identifier
<page>	Number	3GPP TS 23.041 [9] CBM Page Parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [9] CBM Page Parameter bits 0-3 in integer format
<pdu>	String	Protocol data unit: each 8-bit octet is presented as two IRA character long hexadecimal numbers, e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)
<dcs>	Number	Data Coding Scheme

9.11 Send message +CMGS

+CMGS						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	Up to 3 min (<1 s for prompt ">" when present)	+CMS Error

9.11.1 Description

Sends a message from a DTE to the network (SMS-SUBMIT). The message reference value <mr> is returned to the DTE for a successful message delivery. Optionally (when enabled by +CSMS AT command and the network supports) <ackpdu> is returned. Values can be used to identify message upon unsolicited delivery status report result code. <Ctrl-Z> indicates that the SMS shall be sent, while <ESC> indicates aborting of the edited SMS.

☞ The entered text/PDU is preceded by a ">" (Greater-Than sign) character, and this indicates that the interface is in "text/PDU enter" mode. The DCD signal shall be in ON state while the text/PDU is entered.

9.11.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGS=<da>[,<toda>]<CR> > text is entered<Ctrl-Z/ESC>	+CMGS: <mr> OK	AT+CMGS="0171112233"<CR> > This is the text<Ctrl-Z> +CMGS: 2 OK
	PDU mode (+CMGF=0): AT+CMGS=<length><CR> > PDU is given<Ctrl-Z/ESC>	+CMGS: <mr>[,<ackpdu>] OK	AT+CMGS=13<CR> > 0391214301000381 66F6000004E374F80D<Ctrl-Z> +CMGS: 2 OK
Test	AT+CMGS=?	OK	

9.11.3 Defined values

Parameter	Type	Description
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<text>	String	SMS String

Parameter	Type	Description
<mr>	Number	Message reference
<length>	Number	Two meanings: • in text mode: number of characters • in PDU mode: PDU's length in octets without the Service Center's address. In example 039121430100038166F6000004E374F80D: is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length>=13.
<PDU>	String	Protocol Data Unit: each 8-bit octet of the PDU must be written as two IRA character long hexadecimal numbers, e.g. octet with integer value 42 must be written as two characters 2A (IRA 50 and 65)
<ackpdu>	String	See the 3GPP TS 23.040 [8] RP-User-Data element of RP-ACK PDU; the format is same as for <PDU> in case of SMS

9.11.4 Notes

SARA-R4 / SARA-N4

- The <ackpdu> parameter is not supported.

9.12 Write message to memory +CMGW

+CMGW						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	<10 s	+CMS Error

9.12.1 Description

Stores a message (SMS-DELIVER or SMS-SUBMIT) to memory storage <mem2> and returns the memory location <index> of the stored message. <Ctrl-Z> indicates that the SMS shall be stored, while <ESC> indicates aborting of the edited SMS.

☞ The entered text/PDU is preceded by a ">" (Greater-Than sign) character, and this indicates that the interface is in "text/PDU enter" mode. The DCD signal shall be in ON state while the text/PDU is entered.

9.12.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGW[=<oa/da>[,<tooa/toda>[,<stat>]]]<CR> text is entered<Ctrl-Z/ESC>	+CMGW: <index> OK	AT+CMGW="091137880"<CR> > This is the text<Ctrl-Z> +CMGW: 303 OK
	PDU mode (+CMGF=0): AT+CMGW=<length>[,<stat>]<CR> PDU is given<Ctrl-Z/ESC>	+CMGW: <index> OK	AT+CMGW=13<CR> > 039121430100038166F6000004E374F80D<Ctrl-Z> +CMGW: 303 OK
Test	AT+CMGW=?	OK	

9.12.3 Defined values

Parameter	Type	Description
<da>	String	TP-Destination-Address Address-Value field (see the 3GPP TS 23.040 [8]); BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters of the currently selected TE character set (see the +CSCS AT command); type of address given by <toda>
<oa>	String	TP-Originating-Address Address-Value field (see the 3GPP TS 23.040 [8]); BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters

Parameter	Type	Description
		of the currently selected TE character set (see the +CSCS AT command); type of address given by <tooa>
<tooa>	Number	TP-Originating-Address Type-of-Address octet (see the 3GPP TS 24.011 [13]); see the <toda> parameter for the default value
<toda>	Number	TP-Destination-Address Type-of-Address octet (see the 3GPP TS 24.011 [13]); when the first character of <da> is + (IRA 43) the default value is 145, otherwise it is 129)
<stat>	Number or String	Number type in PDU mode (default value: 2), or string type in text mode (default value: "STO UNSENT"); it indicates the message status in memory: • 0: in PDU mode or "REC UNREAD" in text mode: received unread SMS messages • 1: in PDU mode or "REC READ" in text mode: received read SMS messages • 2: in PDU mode or "STO UNSENT" in text mode: stored unsent SMS messages • 3: in PDU mode or "STO SENT" in text mode: stored sent SMS messages
<text>	String	SMS string
<index>	Number	Storage position
<length>	Number	The parameter meaning depends on the message format: • In text mode: number of characters • In PDU mode: PDU's length in octets without the Service Center's address. In example: 039121430100038166F6000004E374F80D is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length>=13.
<PDU>	String	Protocol Data Unit: each 8-bit octet of the PDU must be written as two IRA character long hexadecimal numbers, e.g. an octet with integer value 42 must be written as two characters 2A (IRA 50 and 65)

9.13 Send message from storage +CMSS

+CMSS						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	Up to 3 min	+CMS Error

9.13.1 Description

Sends message with location value <index> from the preferred message storage <mem2> to the network (SMS-SUBMIT or SMS-COMMAND). If a new recipient address <da> is given for SMS-SUBMIT, it will be used instead of the one stored with the message. Reference value <mr> is returned to the DTE on successful message delivery.

9.13.2 Syntax

Type	Syntax	Response	Example
Set	Text mode (+CMGF=1): AT+CMSS=<index>[,<da>[,<toda>]]	+CMSS: <mr> OK	AT+CMSS=302 +CMSS: 3 OK
	PDU mode (+CMGF=0): AT+CMSS=<index>	+CMSS: <mr> OK	AT+CMSS=302 +CMSS: 4 OK
Test	AT+CMSS=?	OK	

9.13.3 Defined values

Parameter	Type	Description
<index>	Number	Storage position
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<mr>	Number	Message reference

9.14 Set text mode parameters +CSMP

+CSMP						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	< 10 s	+CMS Error

9.14.1 Description

Selects values for additional parameters needed when an SMS is sent to the network or placed in a storage when text format message mode is selected. For more details see the 3GPP TS 23.038 [7] and the 3GPP TS 23.040 [8].

9.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSMP=<fo>,<vp>[,<pid>[,<dcs>]]	OK	AT+CSMP=17,167,0,0 OK
Read	AT+CSMP?	+CSMP: <fo>,<vp>,<pid>,<dcs> OK	+CSMP: 17,167,0,0 OK
Test	AT+CSMP=?	OK	

9.14.3 Defined values

Parameter	Type	Description
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [8])
<vp>	Number	Format depending on the values of the bit3/bit4 of the <fo> (SMS-SUBMIT case):

bit 3	bit 4	Format
0	0	Validity period not present
0	1	Validity period present, relative format
1	0	Reserved
1	1	Validity period present, absolute format

- Relative format: validity period, counted from when the SMS-SUBMIT is received by the SMSC, in range 0-255 (the default value is 167); for more details see the 3GPP TS 23.040 [8]

<vp>	Validity period value
0 to 143	(TP-VP + 1) x 5 minutes (i.e. 5 minutes intervals up to 12 hours)
144 to 167	12 hours + ((TP-VP -143) x 30 minutes)
168 to 196	(TP-VP - 166) x 1 day
197 to 255	(TP-VP - 192) x 1 week

- Absolute format: absolute time of the validity period termination in string format ("yy/MM/dd,hh:mm:ss+zz") (see the 3GPP TS 23.040 [8]); the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56

<pid>	Number	TP-Protocol-Identifier (default value: 0); see the 3GPP TS 23.040 [8]
<dcs>	Number	Data Coding Scheme. The default value is 0

9.15 Delete message +CMGD

+CMGD						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 55 s	+CMS Error

9.15.1 Description

Deletes the message from the preferred message storage <mem1>, if <flag>= 0 or not present, in location <index>. Otherwise the messages are deleted following the rules specified by <flag>.

When deleting a message from an empty location, the module returns the "OK" final result code.

If the <index> value is out of range (it depends on AT+CPMS command setting), then the "+CMS ERROR: invalid memory index" error result code is returned.

9.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+CMGD=<index>[,<flag>]	OK	AT+CMGD=3 OK
Test	AT+CMGD=?	+CMGD: (list of supported <index>s),(list of supported <flag>s) OK	+CMGD: (1-350),(0-4) OK

9.15.3 Defined values

Parameter	Type	Description
<index>	Number	Storage position
<flag>	Number	Deletion flag. If present, and different from 0, the <index> parameter is ignored: • 0 (default value): delete the message specified in <index> • 1: delete all the read messages from the preferred message storage, leaving unread messages and stored mobile originated messages (whether sent or not) untouched • 2: delete all the read messages from the preferred message storage and sent mobile originated messages, leaving unread messages and unsent mobile originated messages untouched • 3: delete all the read messages from the preferred message storage, sent and unsent mobile originated messages leaving unread messages untouched • 4: delete all the messages from the preferred message storage including unread messages

9.16 Service center address +CSCA

+CSCA						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	< 10 s	+CMS Error

9.16.1 Description

Updates the SMSC address, through which mobile originated SMSes are transmitted. In text mode the setting is used by send and write commands. In PDU mode the setting is used by the same commands, but only when the length of SMSC address coded into <pdu> parameter equals zero.

SARA-R4 / SARA-N4
This command sets the service center value both in the RAM (this value is actually the SMSC address used) and in the SIM card. Through the read command the value of current service center stored in the RAM is displayed. At the power on, the MT reads the SMSC address in the SIM card and the same value is set in RAM.

9.16.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSCA=<sca>[,<tosca>]	OK	AT+CSCA="0170111000",129 OK
Read	AT+CSCA?	+CSCA: <sca>,<tosca> OK	+CSCA: "",129 OK
Test	AT+CSCA=?	OK	

9.16.3 Defined values

Parameter	Type	Description
<sca>	String	Service center address
<tosca>	String	Type of address of <sca> (for more details refer to 3GPP TS 24.008 [12]); the default is 145 when string includes '+', otherwise the default is 129

9.17 Read concatenated message +UCMGR

+UCMGR						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	<10 s	+CMS Error

9.17.1 Description

Returns the message with location value <index> from message storage <mem1> to the DTE and shows additional information when the message is a segment of a concatenated one:

- SMS-DELIVER: the parameters <tooa>, <fo>, <pid>, <dcs>, <sca>, <tosca>, <length> shall be displayed only if +CSDH=1 is set.
- SMS-SUBMIT: the parameters <toda>, <fo>, <pid>, <dcs>, <vp>, <sca>, <tosca>, <length> shall be displayed only if +CSDH=1 is set.
- SMS-COMMAND: <pid>, <mn>, <da>, <toda>, <length>, <cdata> shall be displayed only if +CSDH=1 is set.

The syntax AT+UCMGR=0 allows to display an SMS class 0 if it is signalized to MT, because no MMI is available in the MT (see also the +CNMI AT command notes).

If the received message status is "received unread", the status in the storage changes to "received read".

The command is supported only for text mode (+CMGF=1).

If the <index> value is out of range (it depends on the preferred message storage, +CPMS command, settings) or it refers to an empty position, then the "+CMS ERROR: invalid memory index" error result code is returned.

9.17.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCMGR=<index>	**SMS-DELIVER** +UCMGR: <stat>,<oa>,[<alpha>], <scts>[,<tooa>, <fo>,<pid>,<dcs>, <sca>,<tosca>,<length>][,<seq>, <max>,<iei>,<ref>] <data> OK **SMS-SUBMIT** +UCMGR: <stat>,<da>,[<alpha>] [<toda>,<fo>,<pid>,<dcs>,[<vp>], <sca>,<tosca>,<length>][,<seq>, <max>,<iei>,<ref>] <data>	AT+UCMGR=1 +UCMGR: "REC READ", "+393488535999",,"07/04/05,18:02:28+08",145,4,0,0,"+393492000466",145,153,1,2,0,127 u-blox reserves all rights to this document and the information contained herein. Reproduction, use or disclosure to third parties without express permis OK

Type	Syntax	Response	Example
		OK **SMS-STATUS-report** +UCMGR:<stat>,<fo>,<mr>,[<ra>],[<tora>]<scts><dt>,<st> OK **SMS-COMMAND** +UCMGR: <stat>,<fo>,<ct>[,<pid>,[<mn>],[<da>],[<toda>],<length> [<cdata>]] OK **CBM storage** +UCMGR: <stat>,<sn>,<mid>,<dcs>,<page>,<pages> <data> OK	
Test	AT+UCMGR=?	OK	

9.17.3 Defined values

Parameter	Type	Description
<index>	Number	Storage position
<stat>	String	Indicates the status of message in memory: • "REC UNREAD": received unread SMS • "REC READ": received read SMS • "STO UNSENT": stored unsent SMS • "STO SENT": stored sent SMS
<oa>	String	Originator address
<alpha>	String	Alphanumeric representation of <da> or <oa> corresponding to the entry found in the phonebook 3GPP TS 24.008 [12]. The parameter is not managed.
<scts>	String	Service center time stamp in time-string format, refer to <dt>
<tooa>	Number	Type of address of <oa> - octet
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [8])
<pid>	Number	TP-Protocol-Identifier (default 0); see 3GPP TS 23.040 [8]
<dcs>	Number	Data Coding Scheme
<sca>	String	Service center address field
<tosca>	Number	Type of address of <sca> - octet in Number format (for more details see 3GPP TS 24.008 [12]); default 145 when string includes '+', otherwise default 129
<length>	Number	Number of characters
<seq>	Number	Sequence number of the current short message (1-255)
<max>	Number	Maximum number of short messages in the concatenated short message (1-255)
<iei>	Number	Information Element Identifier, the possible values are the following: • 0: Concatenated short messages, 8-bit reference number • 8: Concatenated short messages, 16-bit reference number
<ref>	Number	Concatenated short message reference number: • 0-255: concatenated short messages, 8-bit reference number case • 0-65535: concatenated short messages, 16-bit reference number case
<data>	String	In the case of SMS: 3GPP TS 23.040 [8] TP-User-Data in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used and <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is not set: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of 3GPP TS 27.005 [16] Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used, or <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is set: ME/TA converts

Parameter	Type	Description
		each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [9] CBM Content of Message in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of 3GPP TS 27.005 [16] Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<vp>	Number	Format depending of the <fo> setting: • Relative format: validity period starting from when the SMS is received by the SMSC, in range 0-255 (default value 167); for more details see 3GPP TS 23.040 [8] • Absolute format: absolute time of the validity period termination in string format ("yy/MM/dd,hh:mm:ss+zz") (refer to 3GPP TS 23.040 [8]); the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<mr>	Number	Message reference
<ra>	String	Recipient address field
<tora>	Number	Type of address of <ra> - octet
<scts>	String	Service center time stamp in time-string format, refer to <dt>
<dt>	String	Discharge time in format "yy/MM/dd,hh:mm:ss+zz"; the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<st>	Number	Status of an SMS STATUS-REPORT
<ct>	Number	TP-Command-Type (default 0)
<mn>	Number	3GPP TS 23.040 [8] TP-Message-Number in integer format
<mid>	Number	CBM message identifier
<cdata>	String	TP-Command-Data in text mode responses
<sn>	Number	CBM serial number
<page>	Number	3GPP TS 23.041 [9] CBM page parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [9] CBM page parameter bits 0-3 in integer format

<vp> nested table:

<vp>	Validity period value
0 to 143	(TP-VP + 1) x 5 minutes (i.e. 5 minutes intervals up to 12 hours)
144 to 167	12 hours + ((TP-VP -143) x 30 minutes)
168 to 196	(TP-VP - 166) x 1 day
197 to 255	(TP-VP - 192) x 1 week

9.18 List concatenated message +UCMGL

+UCMGL						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	Up to 3 min (<1 s for prompt ">" when present)	+CMS Error

9.18.1 Description

Returns SMS messages with status value <stat> from message storage <mem1> to the DTE and shows additional information when the message is a segment of a concatenated one:

- SMS-DELIVER: the parameters <tooa>, <length> shall be displayed only if +CSDH=1 is set.
- SMS-SUBMIT: the parameters <toda>, <length> shall be displayed only if +CSDH=1 is set.

☞ If status of the received message is "received unread", status in the storage changes to "received read".

☞ The command is supported only for text mode (+CMGF=1).

9.18.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCMGL[=<stat>]	**SMS-DELIVERs:** +UCMGL: <index>,<stat>,<oa>,[<alpha>],[<scts>][,<tooa>,<length>][,<seq>,<max>,<iei>,<ref>] <data> [+UCMGL: <index>,<stat>,<oa>,[<alpha>],[<scts>][,<tooa>,<length>][,<seq>,<max>,<iei>,<ref>]<data>[...]] OK	AT+UCMGL +UCMGL: 304,"REC READ","+39340 1234999",,"08/08/06,10:01:38+08",145,152,1,2,8,32767 u-blox reserves all rights to this document and the information contained herein. Reproduction, use or disclosure to third parties without express permi +UCMGL: 305,"REC READ","+39340 1234999",,"08/08/06,10:01:40+08",145,29,2,2,8,32767 ssion is strictly prohibited. OK
		SMS-SUBMITs: +UCMGL: <index>,<stat>,<da>,[<alpha>],[<toda>, <length>][,<seq>,<max>,<iei>,<ref>] <data> [+UCMGL: <index>,<stat>,<da>,[<alpha>],[<toda>,<length>][,<seq>,<max>,<iei>,<ref>]<data>[...]] OK	
		SMS-STATUS-REPORTs: +UCMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> [+UCMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> [...]] OK	
		SMS-COMMANDs: +UCMGL: <index>,<stat>,<fo>,<ct> [+UCMGL: <index>,<stat>,<fo>,<ct>[...]] OK	
		CBM storage: +UCMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages><data> [+UCMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages>,<data>[...]] OK	
Test	AT+UCMGL=?	+UCMGL: (list of supported <stat>s) OK	+UCMGL: ("REC UNREAD","REC READ","STO UNSENT","STO SENT","ALL ") OK

9.18.3 Defined values

Parameter	Type	Description
<stat>	String	Indicates the status of message in memory:

Parameter	Type	Description
		• "REC UNREAD": received unread SMS messages • "REC READ": received read SMS messages • "STO UNSENT": stored unsent SMS messages • "STO SENT": stored sent SMS messages • "ALL": all SMS messages (default value)
<index>	Number	Storage position
<oa>	String	Originator address
<alpha>	String	Alphanumeric representation of <da> or <oa> corresponding to the entry found in the phonebook 3GPP TS 24.008 [12]. The parameter is not managed.
<scts>	String	Service center time stamp in time-string format; refer to <dt>
<tooa>	Number	Type of address of <oa> - octet
<length>	Number	Number of characters
<seq>	Number	Sequence number of the current short message (1-255)
<max>	Number	Maximum number of short messages in the concatenated short message (1-255)
<iei>	Number	Information Element Identifier, the possible values are the following: • 0: concatenated short messages, 8-bit reference number • 8: concatenated short messages, 16-bit reference number
<ref>	Number	Concatenated short message reference number: • 0-255: concatenated short messages, 8-bit reference number case • 0-65535: concatenated short messages, 16-bit reference number case
<data>	String	In the case of SMS: 3GPP TS 23.040 [8] TP-User-Data in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used and <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is not set: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of 3GPP TS 27.005 Annex A [16] o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used, or <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is set: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [9] CBM Content of Message in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of 3GPP TS 27.005 [16] Annex A • if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [8])
<mr>	Number	Message reference
<ra>	String	Recipient address field
<tora>	Number	Type of address of <ra> - octet
<dt>	String	Discharge time in format "yy/MM/dd,hh:mm:ss+zz"; the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<st>	Number	Status of an SMS STATUS-REPORT
<ct>	Number	TP-Command-Type (default 0)
<sn>	Number	CBM serial number
<mid>	Number	CBM message identifier
<page>	Number	3GPP TS 23.041 [9] CBM Page Parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [9] CBM Page Parameter bits 0-3 in integer format

Parameter	Type	Description
<dcs>	Number	Data Coding Scheme

9.19 Send concatenated message +UCMGS

+UCMGS						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	Up to 3 min (<1 s for prompt ">" when present)	+CMS Error

9.19.1 Description

Sends one segment of a concatenated message from a DTE to the network (SMS-SUBMIT). The message reference value <mr> is returned to the DTE for a successful message delivery. <Ctrl-Z> indicates that the SMS shall be sent, while <ESC> indicates aborting of the edited SMS.

☞ The command is supported only for text mode (+CMGF=1).

☞ The entered text is preceded by a ">" (Greater-Than sign) character, and this indicates that the interface is in "text enter" mode. The DCD signal shall be in ON state while the text is entered.

9.19.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCMGS=<da>,[<toda>],<seq>,<max>,<iei>,<ref><CR> text is entered<Ctrl-Z/ESC>	+UCMGS: <mr> OK	AT+UCMGS="0171112233",,1,2,0,127<CR> > u-blox reserves all rights to this document and the information contained herein. Reproduction, use or disclosure to third parties without express permis<Ctrl-Z> +UCMGS:2 OK AT+UCMGS="0171112233",,2,2,0,127<CR> > sion is strictly prohibited.<Ctrl-Z> +UCMGS:3 OK
Test	AT+UCMGS=?	OK	

9.19.3 Defined values

Parameter	Type	Description
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<seq>	Number	Sequence number of the current short message (1-255)
<max>	Number	Maximum number of short messages in the concatenated short message (1-255)
<iei>	Number	Information Element Identifier, the possible values are the following: • 0: Concatenated short messages, 8-bit reference number • 8: Concatenated short messages, 16-bit reference number
<ref>	Number	Concatenated short message reference number: • 0-255: Concatenated short messages, 8-bit reference number case • 0-65535: Concatenated short messages, 16-bit reference number case
<text>	String	SMS String
<mr>	Number	Message reference

9.20 Write concatenated message to memory +UCMGW

+UCMGW						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	< 10 s	+CMS Error

9.20.1 Description

Stores one segment of a concatenated message (SMS-DELIVER or SMS-SUBMIT) to memory storage <mem2> and returns the memory location <index> of the stored message. <Ctrl-Z> indicates that the SMS shall be stored, while <ESC> indicates aborting of the edited SMS.

☞ The command is supported only for text mode (+CMGF=1)

☞ The entered text is preceded by a ">" (Greater-Than sign) character, and this indicates that the interface is in "text enter" mode. The DCD signal shall be in ON state while the text is entered.

9.20.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCMGW=[<oa/da>],[<tooa/toda>],[<stat>],<seq>,<max>,<iei>,<ref><CR> text is entered<Ctrl-Z/ESC>	+UCMGW: <index> OK	AT+UCMGW="091137880",,,1,2,8,32767<CR> > u-blox reserves all rights to this document and the information contained herein. Reproduction, use or disclosure to third parties without express permi<Ctrl-Z> +UCMGW:302 OK AT+UCMGW="091137880",,,2,2,8,32767<CR> > ssion is strictly prohibited.<Ctrl-Z> +UCMGW:303 OK
Test	AT+UCMGW=?	OK	

9.20.3 Defined values

Parameter	Type	Description
<da>	String	3GPP TS 23.040 [8] TP-Destination-Address Address-Value field in string format; BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters of the currently selected TE character set (refer command +CSCS in 3GPP TS 27.007 [2]); type of address given by <toda>
<oa>	String	3GPP TS 23.040 [8] TP-Originating-Address Address-Value field in string format; BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters of the currently selected TE character set (refer command +CSCS chapter Chapter 4.10); type of address given by <tooa>
<tooa>	Number	3GPP TS 24.011 [13] TP-Originating-Address Type-of-Address octet in integer format (default refer <toda>)
<toda>	Number	3GPP TS 24.011 [13] TP-Destination-Address Type-of-Address octet in integer format (when first character of <da> is + (IRA 43) default is 145, otherwise default is 129)
<stat>	String	Indicates the status of message in memory: • "REC UNREAD": received unread SMS messages • "REC READ": received read SMS messages • "STO UNSENT": stored unsent SMS messages • "STO SENT": stored sent SMS messages (default value)
<seq>	Number	Sequence number of the current short message (1-255)

Parameter	Type	Description
<max>	Number	Maximum number of short messages in the concatenated short message (1-255)
<iei>	Number	Information Element Identifier, the possible values are the following: • 0: Concatenated short messages, 8-bit reference number • 8: Concatenated short messages, 16-bit reference number
<ref>	Number	Concatenated short message reference number: • 0-255: Concatenated short messages, 8-bit reference number case • 0-65535: Concatenated short messages, 16-bit reference number case
<text>	String	SMS String
<index>	Number	Storage position

9.21 More messages to send +CMMS

+CMMS						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CMS Error

9.21.1 Description

Controls the continuity of SMS relay protocol link. When enabled, multiple SMS messages can be sent much faster as link is kept open.

9.21.2 Syntax

Type	Syntax	Response	Example
Set	AT+CMMS=[<mode>]	OK	AT+CMMS=2 OK
Read	AT+CMMS?	+CMMS: <mode> OK	+CMMS: 2 OK
Test	AT+CMMS=?	+CMMS: (list of supported <mode>s) OK	+CMMS: (0-2) OK

9.21.3 Defined values

Parameter	Type	Description
<mode>	Number	• 0 (default value): disabled • 1: keep enabled until the time between the response of the latest message send command (such as +CMGS) and the next send command exceeds 5 s, then close the link and switch <mode> automatically back to 0 • 2: keep permanently enabled. The link is closed after each send sequence, but <mode> is not switched back to 0

9.22 Sending of originating data via the control plane +CSODCP

+CSODCP						
Modules	SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

9.22.1 Description

Transmits data over control plane from a DTE to the network. Data is identified by the local context identification parameter <cid>. This command causes transmission of an ESM DATA TRANSPORT message (see the 3GPP TS 24.301 [88] subclause 9.9.4.25).

It optionally indicates that the exchange of data will be completed with:

- Current uplink data transfer
- The next received downlink data

9.22.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSODCP=<cid>,<cpdata_length>,<cpdata>[,<RAI>[,<type_of_user_data>]]	OK	AT+CSODCP=1,3,"AA11BB" OK
Test	AT+CSODCP=?	+CSODCP: (range of supported <cid>s),(maximum number of bytes of the <cpdata_length>),(list of supported <RAI>s),(list of supported <type_of_user_data>s) OK	+CSODCP: (0-10),(512),(0,1,2),(0,1) OK

9.22.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<cpdata_length>	Number	Size of the received data. The maximum length is 512 bytes
<cpdata>	String	User data container content (see the 3GPP TS 24.301 [88] subclause 9.9.4.24)
<RAI>	Number	Indicates the value of the release assistance indication (see the 3GPP TS 24.301 [88] subclause 9.9.4.25) • 0 (default value): no information available • 1: data exchange completed with the transmission of the ESM DATA TRANSPORT message. • 2: data exchange completed with the receipt of the ESM DATA TRANSPORT message.
<type_of_user_data>	Number	Indicates the type of user data: • 0 (default value): regular data • 1: exception data

9.22.4 Notes

SARA-R412M

- The <RAI> parameter (release assistance) is not supported.

9.23 Terminating data reporting via control plane +CRTDCP

+CRTDCP						
Modules	SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

9.23.1 Description

Configures the terminating data reporting from network to the DTE via the control plane. Data is identified by the local context identification parameter <cid>. When enabled, the URC is sent from the MT upon reception of data from network.

9.23.2 Syntax

Type	Syntax	Response	Example
Set	AT+CRTDCP=<reporting>	OK	AT+CRTDCP=1 OK
Read	AT+CRTDCP?	+CRTDCP: <reporting> OK	+CRTDCP: 1 OK
Test	AT+CRTDCP=?	+CRTDCP: (list of supported <reporting>s),(range of supported <cid>s),(maximum number of octets of user data indicated by <cpdata_length>) OK	+CRTDCP: (0-1),(0-10),(512) OK
URC		+CRTDCP: <cid>,<cpdata_length>,<cpdata>	+CRTDCP: 0,2,"ab"

9.23.3 Defined values

Parameter	Type	Description
<reporting>	Number	• 0 (default value): reporting disabled • 1: reporting enabled by means of the URC +CRTDCP
<cid>	Number	See <cid>
<cpdata_length>	Number	Size of the received data. The maximum length 512 bytes
<cpdata>	String	User data container content (see the 3GPP TS 24.301 [88] subclause 9.9.4.24)

10 V24 control and V25ter

10.1 Introduction

These commands, unless specifically stated, do not implement set syntax using "=", read ("?"), or test ("=?"). If such commands are used, the "+CME ERROR: unknown" or "+CME ERROR: 100" error result code is provided (depending on the +CMEE AT command setting).

10.2 Circuit 109 behavior &C

&C						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

10.2.1 Description

Controls how the state of RS232 circuit 109 - Data Carrier Detect (DCD) - relates to the detection of received line signal from the remote end.

10.2.2 Syntax

Type	Syntax	Response	Example
Action	AT&C[<value>]	OK	

10.2.3 Defined values

Parameter	Type	Description
<value>	Number	Indicates the behavior of circuit 109 • 0: DCE always presents ON condition on circuit 109 • 1 (default value and factory-programmed value): circuit 109 changes in accordance with the Carrier detect status; ON if the Carrier is detected, OFF otherwise

10.2.4 Notes

- See the corresponding module system integration manual for the DCD behavior during the initialization phase of the module.

10.3 Circuit 108/2 behavior &D

&D						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

10.3.1 Description

Controls how the state of RS232 circuit 108/2 - Data Terminal Ready (DTR) - relates to changes from ON to OFF condition during on-line data state.

10.3.2 Syntax

Type	Syntax	Response	Example
Action	AT&D[<value>]	OK	

10.3.3 Defined values

Parameter	Type	Description
<value>	Number	• 0: the DCE ignores circuit 108/2 • 1 (default value and factory-programmed value): upon an ON-to-OFF transition of circuit 108/2, the DCE enters online command state and issues an OK result code • 2: upon an ON-to-OFF transition of circuit 108/2, the DCE performs an orderly cleardown of the call. The automatic answer is disabled while circuit 108/2 remains OFF

10.3.4 ~+++ behavior in PSD &D

SARA-R4 / SARA-N4
The ~+++ behavior in PSD &D is not supported.

- A special meaning of the &D value is provided for the ~+++ sequence during a PSD data transfer with PPP L2 protocol (this is outside the V25-ter specification scope). The ~+++ causes context deactivation during a PSD data transfer session for the AT&D0 and AT&D2 value (the +++ return to on-line command mode is provided for each &D value during a CSD data call)
- A different implementation for the ~+++ is done with the &D1 value: the PSD data transfer is escaped and system returns in the on-line command state. The ATO command is used to resume the PSD data transfer session
- During the on-line command mode different AT commands can be sent but data calls in PSD on-line command mode cannot be granted (activate the AT+CRC=1 mode to identify the kind of call and reject data incoming calls if PSD is in the on-line command mode)

For more details see the ITU-T Recommendation V250 [20], ITU-T V.25ter Recommendation [21] and ITU-T V.32 Recommendation [22].

See the corresponding module system integration manual for the DTR behavior during the initialization phase of the module.

10.3.5 Circuit 108/2, +++ behavior for the different &D: summarizing tables

	CSD data mode	
Event	**DTE sends escape sequence (e.g. +++)**	**DTR On to Off transition**
&D0	DCE enters command mode	No action
&D1	DCE enters command mode	Switch to command mode
&D2	DCE enters command mode	Cleardown call

Table 6: CSD data mode

	PSD data mode (PPP L2 protocol case)	
Event	**DTE sends ~+++**	**DTR On to Off transition**
&D0	Context deactivation	No action
&D1	DCE enters command mode	DCE enters command mode
&D2	Context deactivation	Context deactivation

Table 7: PSD data mode

10.3.6 Notes

- The ON/OFF DTR transition in direct link forces the DCE into command mode. In case of AT&D0 the DTR transition is ignored, also in direct link.
- The escape sequence for the PSD data mode with a L2 protocol different from the PPP is not ~+++, and it could be not supported. See the #unique_398/unique_398_Connect_42_t1 for more information.

10.4 DSR override &S

&S						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

10.4.1 Description

Selects how the module will control RS232 circuit 107 - Data Set Ready (DSR).

10.4.2 Syntax

Type	Syntax	Response	Example
Action	AT&S[<value>]	OK	

10.4.3 Defined values

Parameter	Type	Description
<value>	Number	• 0: sets the DSR line to ON • 1 (default value and factory-programmed value): sets the DSR line to ON in data mode and to OFF in command mode

10.4.4 Notes

- See the corresponding module system integration manual for the DSR behavior during the initialization phase of the module.

10.5 Flow control &K

&K						
Modules	SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

10.5.1 Description

Controls the flow control mechanism. The following settings are allowed:

- No flow control
- HW flow control also referred with RTS / CTS flow control
- SW flow control also referred with XON / XOFF flow control

10.5.2 Syntax

Type	Syntax	Response	Example
Action	AT&K[<value>]	OK	

10.5.3 Defined values

Parameter	Type	Description
<value>	Number	• 0: disable DTE flow control • 3 (default and factory-programmed value): enable the RTS/CTS DTE flow control • 4: enable the XON/XOFF DTE flow control • 5: enable the XON/XOFF DTE flow control • 6: enable the XON/XOFF DTE flow control

10.5.4 Notes

- The command handling is the same for <value> parameter 4, 5 or 6.

- Set the <value> parameter of AT&K command to 0 (flow control disabled) or 4, 5 or 6 (software flow control) when the RTS and CTS lines are not physically connected.
- The software flow control (XON/XOFF) setting is not allowed on the USB interfaces, on the SPI interface and on a multiplexer channel. See the Multiple AT command interfaces for all the behavior differences in respect to the supported interfaces.
- The SW flow control (XON/XOFF) activation is only allowed in case of the text transmission: the binary data cannot be transmitted because it may contain the special flow control characters (XON/XOFF).
- When the software flow control (XON/XOFF) is used, the DC1 (XON, 0x11) and DC3 (XOFF, 0x13) characters are reserved and therefore filtered (e.g. in SMS text mode these two characters can not be input).
  Since the DTE-DCE communication relies on the correct reception of DC1/DC3 characters, the UART power saving should be disabled on the module when the SW flow control is used. If the UART power saving is active, the DC1/DC3 characters could be used to wake up the module's UART, and therefore lost. In case a DC3 character (XOFF) is correctly received by module's UART and some data is waiting to be transmitted, the module is forced to stay awake until a subsequent DC1 character (XON) is received.

SARA-R4 / SARA-N4

- The SW flow control is not supported (<value>=4, 5 and 6 are not allowed).

10.5.5 SW flow control enhancement for PSD data transfer with PPP L2 protocol

☞ The software flow control enhancement is only supported on the UART interface.

☞ SARA-R4 / SARA-N4
The SW flow control enhancement is not supported.

The standard implementation of the UART XON/XOFF flow control is limited to DTE-DCE communications where the ASCII non-printable control characters are not transferred. This is an important limitation, since it is not possible to use it in case of the generic binary data transfer. An extension to a PPP L2 protocol data transfer has been done by exploiting the PPP octet stuffing procedure.

PPP Octet-stuffed framing and transparency

The PPP protocol implements an escape mechanism specified to allow control data such as XON/XOFF to be transparently transmitted over the link, and to remove spurious control data which may be injected into the link by intervening hardware and software.

The control escape octet is defined as binary 01111101 (hexadecimal 0x7d), most significant bit first. As a minimum, sending implementations must escape the flag sequence and control escape octets.

After Frame Check Sequence (FCS) computation, the transmitter examines the entire frame between the two flag sequences. Each flag sequence, control escape octet, and any octet which is flagged in the sending Async-Control - Character-Map (ACCM), is replaced by a two octet sequence consisting of the control escape octet followed by the original octet exclusive-or'd with hexadecimal 0x20.

The receiving implementations must correctly process all the control escape sequences. On the reception, prior to FCS computation, each octet with value less than hexadecimal 0x20 is checked. If it is flagged in the receiving ACCM, it is simply removed (it may have been inserted by intervening data communications equipment). Each control escape octet is also removed, and the following octet is exclusive-or'd with hexadecimal 0x20, unless it is the flag sequence (which aborts a frame).

ACCM negotiation for XON/XOFF chars during PPP LCP negotiation

The ACCM is negotiated in a LCP (Link Control Protocol, part of PPP protocol) configuration request. In particular the LCP Option 02 is used.

This option is described in the RFC 1662 and has the following format.

| 02 | 06 | Async Control Character Map |

This configuration option provides a method to negotiate the use of control character transparency on asynchronous links.

The module by default would start in any case requesting an ACCM sets to 0x00000000, which is incompatible with XON/XOFF flow control.

To overcome this situation, the ACCM negotiation handler should combine the value received in a Configure-Nak via a logical bitwise OR operation with the last configure-request value it sent. This result should then be sent in the next Configure-Request message. If a configure-request is received whose bit mask includes cleared bits for characters that the local implementation knows to be problematic (perhaps by way of an administrative option or some kind of hardware information), then it should send a Configure-Nak with the prior value modified to have these bits set.

Application to XON/XOFF flow control implementation in the module

The flow control characters DC1 and DC3 appears at arbitrary locations in the data stream received by the module. The module with software flow control active during a PPP session, discards these characters after modifying the flow control state (stopping or starting its own transmit process) and does not include them in any part of the received data or CRC calculation; in the transmitted data the module escapes the XON/XOFF characters if they appear in the transmitted PPP frame. They are transmitted on the link as follows:

0x11 is encoded as 0x7d, 0x31. (XON)

0x13 is encoded as 0x7d, 0x33. (XOFF)

PPP ACCM negotiation in the module firmware is implemented in the following way:

- If the XON/XOFF flow control is active on the UART when the PPP is invoked, the requested ACCM is 0x000A0000
- If the XON/XOFF flow control is not active on the UART when the PPP is invoked, the requested ACCM is 0x00000000

As soon as the LCP configuration phase is completed, the IPCP protocol (the network control protocol for establishing and configuring Internet Protocol over a Point-to-Point Protocol link) can start; from this point forward the negotiated ACCM are applied.

If SW flow control is enabled on the module, but the DTE requests a wrong ACCM setting (ACCM differs than 0x0A0000) the SW flow control is anyway effective during the data mode, that is the 0x11 and 0x13 is detected during data mode even if the ACCM is not properly set by the DTE during LCP configuration.

10.6 DTE-DCE character framing +ICF

+ICF						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

10.6.1 Description

Sets the local serial port start-stop (asynchronous) character framing which is used in information interchange between DCE and DTE. Value 0 corresponds to the auto-detect case (if autobauding is supported).

☞ The following restrictions must be reminded:

- If a data frame format refers to a frame without parity (ex. Format 3), the command is accepted, but the parity value is ignored; it is returned by the AT+ICF read command (and displayed by AT&V) but it has no meaning
- The command setting is ignored when the AT command interface runs on the USB or on the SPI interface

10.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+ICF=[<format>[,<parity>]]	OK	AT+ICF=3,1 OK
Read	AT+ICF?	+ICF: <format>,<parity> OK	+ICF: 3,1 OK
Test	AT+ICF=?	+ICF: (list of supported <format>s), (list of supported <parity>s) OK	+ICF: (0-3,5),(0-1) OK

10.6.3 Defined values

Parameter	Type	Description
<format>	Number	• 0: auto detect • 1: 8 data 2 stop • 2: 8 data 1 parity 1 stop • 3: 8 data 1 stop • 4: 7 data 2 stops • 5: 7 bit, 1 parity, 1 stop • 6: 7 bit, 1 stop
<parity>	Number	• 0: odd • 1: even

10.6.4 Notes

SARA-R4

- Automatic frame recognition is not supported (<format> cannot be set to 0).
- The only supported values are <format> = 3 and <parity> = 1.

10.7 DTE-DCE local flow control +IFC

+IFC						
Modules	SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

10.7.1 Description

Controls the operation of the local flow control between DTE and DCE used when the data are sent or received.

The SW flow control (XON/XOFF) activation is only allowed in case of the text transmission: the binary data cannot be transmitted because it may contain the special flow control characters (XON/XOFF). For the SW flow control enhancement, allowing its usage during a PSD call with PPP L2 protocol, see SW flow control enhancement for PSD data transfer with PPP L2 protocol in the AT&K command description.

When the software flow control (XON/XOFF) is used, the DC1 (XON, 0x11) and DC3 (XOFF, 0x13) characters are reserved and therefore filtered (e.g. in SMS text mode these two characters can not be input).

Since the DTE-DCE communication relies on the correct reception of DC1/DC3 characters, the UART power saving should be disabled on the module when SW flow control is used. If the UART power saving is active, the DC1/DC3 characters could be used to wake up the module's UART, and therefore lost. In case a DC3 character (XOFF) is correctly received by module's UART and some data is waiting to be transmitted, the module is forced to stay awake until a subsequent DC1 character (XON) is received.

☞ The software flow control (XON/XOFF) setting is not allowed on the USB interfaces, on the SPI interface and on a multiplexer channel. See the Multiple AT command interfaces for all the behavior differences in respect to the supported interfaces.

10.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+IFC=[<DCE_by_DTE>[,<DTE_by_DCE>]]	OK	AT+IFC=2,2 OK
Read	AT+IFC?	+IFC: <DCE_by_DTE>,<DTE_by_DCE> OK	+IFC: 2,2 OK
Test	AT+IFC=?	+IFC: (list of supported <DCE_by_DTE>),(list of supported <DTE_by_DCE>s) OK	+IFC: (0-2),(0-2) OK

10.7.3 Defined values

Parameter	Type	Description
<DCE_by_DTE>	Number	• 0: none • 1: DC1/DC3 on circuit 103 (XON/XOFF) • 2 (default and the factory-programmed value): circuit 105 (RTS)
<DTE_by_DCE>	Number	• 0: none • 1: DC1/DC3 on circuit 104 (XON/XOFF) • 2 (default and the factory-programmed value): circuit 106 (CTS)

10.7.4 Notes

- <DCE_by_DTE> and <DTE_by_DCE> parameters must be provided with the same value in pairs (only (0, 0), (1,1) and (2,2) are allowed. The other combinations are not allowed and the "+CME ERROR: operation not allowed" error result code is returned).

SARA-R4 / SARA-N4

- The SW flow control is not supported (<DCE_by_DTE> and <DTE_by_DCE> cannot be set to 1).

10.8 Set flow control \Q

\Q						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

10.8.1 Description

Controls the operation of the local flow control between DTE and DCE. It is used when the data are sent or received.

The SW flow control (XON/XOFF) activation is only allowed in case of the text transmission: the binary data cannot be transmitted because it may contain the special flow control characters (XON/XOFF). For the SW flow control enhancement, allowing its usage during a PSD call with PPP L2 protocol, see the SW flow control enhancement for PSD data transfer with PPP L2 protocol in the AT&K command description.

When the software flow control (XON/XOFF) is used, the DC1 (XON, 0x11) and DC3 (XOFF, 0x13) characters are reserved and therefore filtered (e.g. in SMS text mode these two characters can not be input).

Since the DTE-DCE communication relies on the correct reception of DC1/DC3 characters, the UART power saving should be disabled on the module when SW flow control is used. If the UART power saving is active, the DC1/DC3 characters could be used to wake up the module's UART, and therefore lost. In case a DC3 character (XOFF) is correctly received by module's UART and some data is waiting to be transmitted, the module is forced to stay awake until a subsequent DC1 character (XON) is received.

The software flow control (XON/XOFF) setting is not allowed on the USB interfaces, on the SPI interface and on a multiplexer channel. See the Multiple AT command interfaces for all the behavior differences in respect to the supported interfaces.

10.8.2 Syntax

Type	Syntax	Response	Example
Set	AT\Q[<value>]	OK	AT\Q3 OK

10.8.3 Defined values

Parameter	Type	Description
<value>	Number	• 0: no flow control • 1: DC1/DC3 on circuit 103 and 104 (XON/XOFF) • 3 (default value): DCE_by_DTE on circuit 105 (RTS) and DTE_by_DCE on circuit 106 (CTS)

10.9 UART data rate configuration +IPR

+IPR						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

10.9.1 Description

Specifies the data rate at which the DCE accepts commands on the UART interface. The full range of data rates depends on HW or other criteria.

When supported, the autobauding feature allows baud rate recognition by the DCE when it operates in command mode.

☞ The command settings are ignored when the AT command interface runs either on the USB or on the SPI interface. The DCE sends the "OK" final result code but the command will have no effect.

10.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+IPR=[<rate>]	OK	AT+IPR=9600 OK
Read	AT+IPR?	+IPR: <rate> OK	+IPR: 9600 OK
Test	AT+IPR=?	+IPR: (list of supported autodetectable <rate> values)[,(list of fixed only <rate> values)] OK	+IPR: (0,2400,4800,9600,19200, 38400,57600,115200),() OK

10.9.3 Defined values

Parameter	Type	Description
<rate>	Number	Baud rate • 0 (factory-programmed value): autobauding • 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 (default value), 230400, 460 800, 921600, 3000000, 3250000, 6000000, 6500000

10.9.4 Notes

- On the UART AT interface, after the reception of the "OK" result code for the +IPR command, the DTE shall wait for at least 100 ms before issuing a new AT command; this is to guarantee a proper baud rate reconfiguration.

SARA-R4 / SARA-N4

- Automatic baud rate detection is not implemented (<rate>=0 is not supported).
- The factory-programmed value for <rate> is 115200.
- This command is not supported in the multiplexer mode. See the +CMUX AT command for more details.
- Baud rate changes using +IPR may occur asynchronously to the final result code.

SARA-R404M / SARA-R410M-01B / SARA-R410M-02B

- Valid baud rates <rate>= 9600, 19200, 38400, 57600, 115200.

SARA-R410M-52B / SARA-N4

- Valid baud rates <rate>= 9600, 19200, 38400, 57600, 115200, 230400, 460800.

10.10 Return to on-line data state O

O						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

10.10.1 Description

Causes the DCE to return to online data state and issue a CONNECT or CONNECT <text> (based on ATX command) intermediate result code on DTE. It is the complementary command to the escape sequence, or to the other actions (DTR ON to OFF transition, see table in Chapter 10.3.5) that cause the DCE to switch from online data state to online command state.

ATO command is used to resume both circuit-switched and packet-switched data call. The resume is only possible if the PPP L2 protocol is used.

10.10.2 Syntax

Type	Syntax	Response	Example
Action	ATO	<response>	ATO CONNECT

10.10.3 Defined values

Parameter	Type	Description
<response>	String	• CONNECT • NO CARRIER: the online data state cannot be resumed

10.10.4 Notes

- The command provides an error result code ("+CME ERROR: operation not allowed" if +CMEE is set to 2) in the following cases:
  - The DCE is not in online command state
  - It is issued on a DCE different from the one in online command state
- In case of PSD call, any data from the network (downlink data) received by the DCE during the on-line command state is discarded. This means that after the O command and on-line data state resume, any possible data loss has to be recovered by upper layer protocols (e.g. TCP).

10.11 Escape character S2

S2						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

10.11.1 Description

Controls the decimal value of the ASCII character used as the escape character. A value greater than 127 disables the escape process, i.e. no escape character will be recognized. The escape sequence contains three escape characters e.g. "+++".

10.11.2 Syntax

Type	Syntax	Response	Example
Set	ATS2=<value>	OK	ATS2=43 OK
Read	ATS2?	<value>	043

Type	Syntax	Response	Example
		OK	OK

10.11.3 Defined values

Parameter	Type	Description
<value>	Number	Range 1 to 255. The answer to the read command is in "xxx" format. The default and the factory-programmed value is 43 (ASCII '+').

10.11.4 Notes

SARA-R4 / SARA-N4

- The following table shows how the ATS2 command works for different data call scenarios.

Data call command	L2 protocol	Description	ATS2 behavior
ATD*99***1#	PPP	PSD call: dial-up	Escape sequence detection is only done for ~+++. ATS2 is not effective. There is not a timing constraint (see the S12 AT command) for ~+++ (++ + is incapsulated in a PPP frame)
ATD1234		CSD call	The command is effective if issued in both command and online command mode
AT+USODL=0		PSD call: Direct Link mode	The command is effective
AT+USOWR=0,32		PSD call:AT socket (not transparent)	Break detection is not supported

Table 8: ATS2 handling for different data call scenarios

SARA-R4 / SARA-N4

- The command has no effect.

10.12 Command line termination character S3

S3						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

10.12.1 Description

Sets a value representing the decimal IRA5 value of the character recognized by the DCE from the DTE, to terminate the incoming command line. It is also generated by the DCE as part of the header, trailer and terminator for result codes and information text, along with the S4 setting.

10.12.2 Syntax

Type	Syntax	Response	Example
Set	ATS3=<value>	OK	ATS3=13 OK
Read	ATS3?	<value> OK	013 OK

10.12.3 Defined values

Parameter	Type	Description
<value>	Number	Range 0 to 127. The answer to the read command is in "xxx" format. The default and the factory-programmed value is 13 (ASCII carriage return (CR, IRA5 0/13)).

10.13 Response formatting character S4

S4						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

10.13.1 Description

Sets a value representing the decimal IRA5 value of the character generated by the DCE as part of the header, trailer and terminator for result codes and information text, along with the S3 setting.

10.13.2 Syntax

Type	Syntax	Response	Example
Set	ATS4=<value>	OK	ATS4=10
			OK
Read	ATS4?	<value>	010
		OK	OK

10.13.3 Defined values

Parameter	Type	Description
<value>	Number	Range 0 to 127. The answer to the read command is in "xxx" format. The default and the factory-programmed value is 10 (line feed (LF, IRA5 0/10)).

10.14 Command line editing character S5

S5						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

10.14.1 Description

Sets a value representing the decimal IRA5 character recognized by the DCE as a request to delete from the command line the immediately preceding character.

10.14.2 Syntax

Type	Syntax	Response	Example
Set	ATS5=<value>	OK	ATS5=8
			OK
Read	ATS5?	<value>	008
		OK	OK

10.14.3 Defined values

Parameter	Type	Description
<value>	Number	Range 0 to 127. The answer to the read command is in "xxx" format. The default and the factory-programmed value is 8 (ASCII backspace (BS, IRA5 0/8)).

10.15 Pause before blind dialling S6

S6						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

10.15.1 Description

Specifies the time in seconds that the DCE waits between connecting to the line and dialling, when the dial tone is not implemented or enabled. The command is not applicable for signal based mobile phone software.

10.15.2 Syntax

Type	Syntax	Response	Example
Set	ATS6=<value>	OK	ATS6=2
			OK
Read	ATS6?	<value>	002
		OK	OK

10.15.3 Defined values

Parameter	Type	Description
<value>	Number	Range 2 - 10. The answer to the read command is in "xxx" format. The default value is 2 s.

10.16 Connection completion timeout S7

S7						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

10.16.1 Description

Specifies the time in seconds, that the DCE shall allow between either answering a call or completion of dialling and establishment of a connection with a remote site.

10.16.2 Syntax

Type	Syntax	Response	Example
Set	ATS7=<value>	OK	ATS7=30
			OK
Read	ATS7?	<value>	060
		OK	OK

10.16.3 Defined values

Parameter	Type	Description
<value>	Number	Range 1 - 255. The answer to the read command is in "xxx" format. The default and the factory-programmed value is 60 s.

10.17 Command dial modifier time S8

S8						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

10.17.1 Description

Specifies the amount of time, in seconds, that the DCE shall pause during dialling, when a ',' (comma) dial modifier is encountered in a dial string.

☞ The command has no effect.

10.17.2 Syntax

Type	Syntax	Response	Example
Set	ATS8=<value>	OK	ATS8=4
			OK
Read	ATS8?	<value>	002
		OK	OK

10.17.3 Defined values

Parameter	Type	Description
<value>	Number	Range 0 - 255. The answer to the read command is in "xxx" format. The default value is 2.

10.18 Automatic disconnect delay S10

S10						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

10.18.1 Description

Specifies the time in tenth of a second, that the DCE will remain connected to the line after the DCE has indicated the absence of received line signal. Not supported for GSM but the OK response is returned.

10.18.2 Syntax

Type	Syntax	Response	Example
Set	ATS10=<value>	OK	ATS10=30
			OK
Read	ATS10?	<value>	030
		OK	OK

10.18.3 Defined values

Parameter	Type	Description
<value>	Number	Range 1 - 254. Default: 1

10.18.4 Notes

SARA-R4 / SARA-N4

- The command has no effect.

10.19 Escape prompt delay (EPD) S12

S12						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

10.19.1 Description

Defines the maximum period, in fiftieths of a second, allowed between the reception of the last character of the sequence of three escape characters from the DTE and the sending of the OK result code to the DTE. If any characters are detected during this time, the OK will not be sent.

Furthermore, the timeout is:

- The minimum period, before the first character reception of the three escape character sequence, during which no other character must be detected to accept it as a valid first character
- The maximum period allowed between receipt of first, or second, character of the three escape character sequence and receipt of the next
- The minimum period, after the last character reception of the three escape character sequence, during which no other character must be detected to accept the escape sequence as a valid one

10.19.2 Syntax

Type	Syntax	Response	Example
Set	ATS12=<value>	OK	ATS12=80 OK
Read	ATS12?	<value> OK	050 OK

10.19.3 Defined values

Parameter	Type	Description
<value>	Number	Range 0 - 255. The answer to the read command is in "xxx" format. The default value is 50 (1 s)

10.20 Command echo E

E						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

10.20.1 Description

Controls whether or not the MT echoes characters received from the DTE during command state.

10.20.2 Syntax

Type	Syntax	Response	Example
Set	ATE[<value>]	OK	ATE1 OK

10.20.3 Defined values

Parameter	Type	Description
<value>	Number	• 0: echo off • 1 (default and the factory-programmed value): echo on

10.21 Result code suppression Q

Q						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

10.21.1 Description

Determines if DCE transmits result codes to the DTE or not. When result codes are being suppressed, no portion of any intermediate, final or URC is transmitted. Information text transmitted in response to commands is not affected by this setting.

10.21.2 Syntax

Type	Syntax	Response	Example
Set	ATQ[<value>]	OK	ATQ1 OK

10.21.3 Defined values

Parameter	Type	Description
<value>	Number	• 0 (default and the factory-programmed value): DCE transmits result codes • 1: Result codes are suppressed and not transmitted

10.22 DCE response format V

V						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

10.22.1 Description

Control the contents of the header and trailer transmitted with result codes and information text responses. It also determines whether the result code is transmitted in a numeric form or an alphabetic (or verbose) form. The information text response is not affected by this setting. See Information text responses and result codes for description of the result code formats.

10.22.2 Syntax

Type	Syntax	Response	Example
Set	ATV[<value>]	OK	ATV1 OK

10.22.3 Defined values

Parameter	Type	Description
<value>	Number	• 0: DCE transmits limited headers, trailers and numeric text • 1 (default and the factory-programmed value): DCE transmits full headers, trailers and verbose response text

10.23 Result code selection and call progress monitoring control X

X						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

10.23.1 Description

In a CS data call, determines how the DCE transmits to the DTE the CONNECT result code.

10.23.2 Syntax

Type	Syntax	Response	Example
Set	ATX[<value>]	OK	ATX1 OK

10.23.3 Defined values

Parameter	Type	Description
<value>	Number	• 0: CONNECT result code is given upon entering online data state; • 1-4: CONNECT <speed> result code is given upon entering online data state; (4 is the default and the factory-programmed value)
<speed>	Number	Transfer speed for CSD calls configured via the CBST command

10.24 Reset to default configuration Z

Z						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

10.24.1 Description

Resets the DCE configuration into a known state; the reset includes the loading of the settings stored in the profile identified by the <value> parameter, into the current profile, and the application of the settings.

When the command is issued, any CSD call in progress is released. In case of success, the result code is issued using the format configuration (Q, V, S3, S4 commands) loaded from the requested profile. The other DCE settings are applied after the result code has been sent.

For more details on the settings stored in the profiles, see the Appendix B.1.

10.24.2 Syntax

Type	Syntax	Response	Example
Action	ATZ[<value>]	OK	

10.24.3 Defined values

Parameter	Type	Description
<value>	Number	Profile index, possible values 0-1; optional parameter, the default value is 0

10.25 Set to factory defined configuration &F

&F						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

10.25.1 Description

Resets the current profile to factory-programmed setting. Other NVM settings, not included in the profiles, are not affected.

In case of success, the response is issued using the configuration of the result codes format (Q, V, S3, S4 AT commands) loaded from the factory default profile. The other DCE settings are applied after the response has been sent.

For more details on the settings stored in the profiles, refer to Parameters stored in profiles.

10.25.2 Syntax

Type	Syntax	Response	Example
Action	AT&F[<value>]	OK	

10.25.3 Defined values

Parameter	Type	Description
<value>	Number	Only 0 allowed

10.26 Display current configuration &V

&V						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

10.26.1 Description

Reports a summary of the current configuration and of the stored user profiles.

Since not all configuration items are listed with this command, see the example below for the list of the displayed configuration items. Appendix B.1 provides the complete list of the configuration items stored in the profiles.

The command does not display audio parameters. Audio parameters can be displayed by the corresponding read command (i.e. AT+UMGC?).

10.26.2 Syntax

Type	Syntax	Response	Example
Action	AT&V	ACTIVE PROFILE: List of commands stored in the active profile with the related values STORED PROFILE 0: List of commands stored in the profile 0 with the related values STORED PROFILE 1: List of commands stored in the profile 1 with the related values OK	ACTIVE PROFILE: &C1, &D1, &S1, &K3, E1, Q0, V1, X4, S00:000, S02:043, S03:013, S04:010, S05:008, S07:060, +CBST:007, 000, 001, +CRLP:061, 061, 048, 006, +CR:000, +CRC:000, +IPR:0, +COPS:0,0, FFFFF, +ICF:3,1, +UPSV: 0, +CMGF:0, +CNMI:1,0,0,0,0, +USTS: 0 STORED PROFILE 0: &C1, &D1, &S1, &K3, E1, Q0, V1, X4, S00:000, S02:043, S03:013, S04:010, S05:008, S07:060, +CBST:007, 000, 001, +CRLP:061, 061, 048, 006, +CR:0

Type	Syntax	Response	Example
			00, +CRC:000, +IPR:0, +COPS:0,0, FFFFF, +ICF:3,1, +UPSV: 0, +CMGF:0 , +CNMI:1,0,0,0,0, +USTS: 0 STORED PROFILE 1: &C1, &D1, &S1, &K3, E1, Q0, V1, X4, S00:000, S0 2:043, S03:013, S04:010, S05:00 8, S07:060, +CBST:007, 000, 001, +CRLP:061, 061, 048, 006, +CR:0 00, +CRC:000, +IPR:0, +COPS:0,0, FFFFF, +ICF:3,1, +UPSV: 0, +CMGF:0 , +CNMI:1,0,0,0,0, +USTS: 0 OK

10.26.3 Notes

SARA-R4 / SARA-N4

- Only the ACTIVE PROFILE is displayed. The AT command does not show STORED PROFILE 0 or STORED PROFILE 1.
- Besides current active profile settings, all relevant settings, i.e. of volatile AT commands (e.g. +CEREG) as well as NVM stored settings (e.g. +CGDCONT) are displayed.

11 SIM management

11.1 Generic SIM access +CSIM

+CSIM						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

11.1.1 Description

Allows direct control of the SIM by a distant application on the TE. This command transparently transmits the <command> to the SIM via the MT. The <response> is returned in the same manner to the TE.

The command needs the SIM module to work correctly.

It is recommended to wait some seconds after boot (or reset) before using the command.

11.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSIM=<length>,<command>	+CSIM: <length>,<response> OK	AT+CSIM=14,"A0A40000027F20" +CSIM: 4,"6E00" OK
Test	AT+CSIM=?	OK	OK

11.1.3 Defined values

Parameter	Type	Description
<length>	Number	Length of the characters sent to the TE in <command> or <response> parameters
<command>	String	Command passed on by MT to SIM in hex format; see the 3GPP TS 51.011 [18] and ETSI TS 102 221 [93]
<response>	String	Response to the command passed on by the SIM to the MT (3GPP TS 51.011 [18] and ETSI TS 102 221 [93])

11.2 Restricted SIM access +CRSM

+CRSM						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	< 10 s	+CME Error

11.2.1 Description

Allows easy access to the SIM database. The set command transmits the SIM command and its required parameters to the MT. The MT handles internally all SIM-MT interface locking and file selection routines. As response to the command, the MT sends the actual SIM information parameters and response data. An error result code may be returned when the command cannot be passed to the SIM, but the failure in the execution of the command in the SIM is reported in <sw1> and <sw2> parameters.

The expected response time shall be increased when using a remote SIM card via SAP and in case of simultaneous access to the SIM by another AT interface or by internal clients (e.g. BIP, IMS).

The command needs the SIM module to work correctly.

11.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+CRSM=<command>[,<fileid>[,<P1>,<P2>,<P3>[,<data> [,<pathid>]]]]	+CRSM: <sw1>,<sw2>[,<response>] OK	AT+CRSM=176,28471,0,0,3 +CRSM: 144,0,"989301770020594178F2" OK
Test	AT+CRSM=?	OK	OK

11.2.3 Defined values

Parameter	Type	Description
<command>	Number	• 176: read binary • 178: read record • 192: get response • 214: update binary • 220: update record • 242: status
<fileid>	Number	Identifies elementary datafile on SIM. Mandatory for each command except STATUS (e.g. 28423: meaning IMSI file (6F07))
<P1>, <P2>, <P3>	Number	Defines the request. These parameters are mandatory for each command, except GET RESPONSE and STATUS. The values are described in 3GPP TS 51.011 [18] and ETSI TS 102 221 [93].
<data>	String	Information which shall be written to the SIM (hexadecimal character format; see the +CSCS - string containing hexadecimal characters)
<pathid>	String	Contains the path of an elementary file on the SIM/UICC in hexadecimal format as defined in ETSI TS 102 221 [93] (e.g. "7F205F70" in SIM and UICC case). The <pathid> shall only be used in the mode "select by path from MF" as defined in ETSI TS 102 221 [93]
<sw1>, <sw2>	Number	Contains SIM information about the execution of the actual command and can be (more details in 3GPP TS 51.011 [18] and ETSI TS 102 221 [93]): • 0x90 0x00: normal ending of the command • 0x9F 0xXX: length XX of the response data • 0x92 0x0X: command successful but after using an internal retry routine X times • 0x92 0x40: memory problem • 0x94 0x00: no EF selected • 0x94 0x02: out of range (invalid address) • 0x94 0x04: file ID not found; pattern not found • 0x94 0x08: file is inconsistent with the command • 0x98 0x02: no CHV initialized • 0x98 0x04: access condition not fullfiled / unsucc. CHV verify / authent.failed • 0x98 0x08: in contradiction with CHV status • 0x98 0x10: in contradiction with invalidation status • 0x98 0x40: unsucc. CHV-verif. or UNBLOCK CHV-verif. / CHV blocked / UNBL.blocked • 0x98 0x50: increase cannot be performed. Max. value reached • 0x67 0xXX: incorrect parameter P3 • 0x6A 0x81: function not supported • 0x6A 0x82: file not found • 0x6B 0xXX: incorrect parameter P1 or P2 • 0x6D 0xXX: unknown instruction code given in the command • 0x6E 0xXX: wrong instruction class given in the command • 0x6F 0xXX: technical problem with no diagnostic given
<response>	String	The response of successful completion of the command previously issued (hexadecimal character format; see the +CSCS). STATUS and GET RESPONSE return data, which gives information about the current elementary datafield. This information includes the type of file and its size (see the 3GPP TS 51.011 [18] and the ETSI TS 102 221 [93]). After READ BINARY or READ RECORD command the requested data will be returned. <response> is not returned after a successful UPDATE BINARY or UPDATE RECORD command.

11.3 Read the SIM language +CLAN

+CLAN						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

11.3.1 Description

Reads the language from the SIM.

The read syntax will display the most preferred language from the preferred language list in EF_{ELP} (2F05) file. If the EF_{ELP} file does not exist, the preferred language is read from EF_{LP} (6F05) file. This file content is decoded according to the CB (cell broadcast) data coding scheme (dcs), and the according language is displayed in the response string. If this byte does not result in a valid language according to the CB dcs, then it is printed in the response string in hexadecimal representation.

11.3.2 Syntax

Type	Syntax	Response	Example
Read	AT+CLAN?	+CLAN: <code>	+CLAN: "en"
		OK	OK
Test	AT+CLAN=?	OK	

11.3.3 Defined values

Parameter	Type	Description
<code>	String	It is a two-letter abbreviation of the language. The language codes, as defined in ISO 639, consists of two characters, e.g. "en", "it" etc

11.4 SIM states reporting +USIMSTAT

+USIMSTAT						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

11.4.1 Description

Configures the +UUSIMSTAT URC presentation. Based on the configuration, the URC is able to report the SIM card initialization status, the phonebook initialization status and the REFRESH proactive command execution result.

If <state> 9 and 10 are reported, update all SIM card related parameters cached in the DTE's application (e.g. the IMSI retrieved with +CIMI command).

11.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+USIMSTAT=<mode>	OK	AT+USIMSTAT=3
			OK
Read	AT+USIMSTAT?	+USIMSTAT: <mode>	+USIMSTAT: 3
		OK	OK
Test	AT+USIMSTAT=?	+USIMSTAT: (list of supported <mode>s)	+USIMSTAT: (0-7)
		OK	OK
URC		+UUSIMSTAT: <state>	+UUSIMSTAT: 8

11.4.3 Defined values

Parameter	Type	Description
<mode>	Number	Bitmask representing which indications the +UUSIMSTAT URC is allowed to report. See Table 9 for the meaning of each bit. The factory-programmed value is 0.
<state>	Number	• 0: SIM card not present • 1: PIN needed • 2: PIN blocked • 3: PUK blocked • 4: (U)SIM not operational • 5: (U)SIM in restricted use (FDN or BDN active) • 6: (U)SIM operational (registration may be initiated) • 7: SIM phonebook ready to be used (when the SIM application is active) • 8: USIM phonebook ready to be used (when the USIM application is active) • 9: (U)SIM toolkit REFRESH proactive command successfully concluded • 10: (U)SIM toolkit REFRESH proactive command unsuccessfully concluded • 11: PPP connection active, (U)SIM toolkit REFRESH proactive command delayed till PPP deactivation • 12: voice call active, (U)SIM toolkit REFRESH proactive command delayed till call release • 13: CSD call active, (U)SIM toolkit REFRESH proactive command delayed till call release

11.4.4 Notes

- <state>=9 and 10 will not be reported when dedicated (+CFUN=6) or raw (+CFUN=9) mode is active.
- Table 9 provides the meaning of each bit with the corresponding state:

Bit	States reported
0	Reports the (U)SIM initialization status (<state>'s from 0 to 6 may be reported)
1	Reports the (U)SIM phonebook initialization status (<state>'s from 7 to 8 may be reported)
2	Reports the (U)SIM toolkit REFRESH proactive command execution result (<state>'s from 9 to 13 may be reported)

Table 9: <mode> bitmask meaning

SARA-R4 / SARA-N4

- Only <mode>=4 is supported and is its factory programmed value. See the +UCUSATA AT command to disable +USIMSTAT URCs.
- <state>=11, 12 and 13 are not reported.

12 SIM toolkit

12.1 Introduction

SIM Application Toolkit (STK) is the 3GPP standard feature that allows the Subscriber Identity Module (SIM) to handle the DCE, also by giving commands such as displaying menus and/or asking for user input, and control its access to the network.

Once the SIM toolkit interface has been enabled via AT+CFUN command, the DTE is notified SIM toolkit commands and events and can interact with the SIM through appropriate STK AT commands.

SIM toolkit processing supports two modes: dedicated and raw. In dedicated mode, the DTE is notified of STK commands and events after decoding; in raw mode the DTE receives the raw data as received from the SIM. Only one mode can be enabled and function at a time.

For more details on the command description and parameters, see 3GPP TS 51.014 [44].

☞ The setup menu fetched from the SIM card may vary with the terminal profile supported by the MT, which is affected by the capabilities of the module itself (e.g. speech): this implies that different u-blox modules may display different setup menus with the same SIM card.

☞ The commands in this section properly work only if the SIM toolkit interface has been activated by the DTE. Otherwise the SIM toolkit processing will be blocked.

☞ If an AT command related to the dedicated mode is used when the raw mode is enabled (and vice versa), an error result code ("+CME ERROR: operation not allowed" if +CMEE is set to 2) is returned.

The STK commands related to the Bearer Independent Protocol, i.e. Open Channel, Close Channel, Receive Data, Send Data, Get Channel Status and the events Data Available and Channel Status, are autonomously managed by the device without the intervention from the TE, unless the dedicated mode is active and the Open Channel command requires the user intervention (see ETSI TS 102 223 [51]).

12.2 Bearer Independent Protocol status indication +UBIP

+UBIP						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

12.2.1 Description

Configures the Bearer Independent Protocol status indication, i.e. the +UUBIP URC presentation.

12.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UBIP=<mode>	OK	AT+UBIP=1 OK
Read	AT+UBIP?	+UBIP: <mode> OK	+UBIP: 0 OK
Test	AT+UBIP=?	+UBIP: (list of supported <mode>'s) OK	+UBIP: (0,1) OK
URC		+UUBIP: <ev_cmd>,<val>	+UUBIP: 10,261

12.2.3 Defined values

Parameter	Type	Description
<mode>	Number	Indicates whether the +UUBIP URC is enabled or not: • 0 (factory-programmed value): BIP status indication disabled • 1: BIP status indication enabled

Parameter	Type	Description
		• 2: OPEN CHANNEL, CLOSE CHANNEL and CHANNEL STATUS EVENT status indications enabled
<ev_cmd>	Number	Indicates the event download's tag or proactive command's tag. Allowed values: • 10: Channel status event • 64: Open channel proactive command • 65: Close channel proactive command • 66: Receive data proactive command • 67: Send data proactive command
<val>	Number	Indicates the channel status (in case of the event download channel status) or result in case of a proactive command (see ETSI TS 102 223 [51])

12.3 Read the USAT profile +CUSATR

+CUSATR						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

12.3.1 Description

Reads the USAT terminal profile for the given profile storage. If the <profile_storage> parameter is omitted in the set command, the information text response will return the profile for all the supported profile storage values.

12.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+CUSATR[=<profile_storage>]	+CUSATR: <profile_storage>, <profile> OK	AT+CUSATR=1 +CUSATR: 1,"F31FE84A119C00878C00001FE060000043C0000000004000400000000008" OK
Test	AT+CUSATR=?	+CUSATR: (list of supported <profile_storage>s) OK	+CUSATR: (0-5) OK

12.3.3 Defined values

Parameter	Type	Description
<profile_storage>	Number	Allowed values: • 0: the TE profile that can be set with the +CUSATW AT command • 1: the MT profile that can be set with the +CUSATW AT command • 2: MT default profile that reflects the inherent, default supported facilities of the MT • 3: UICC profile that reflects the currently active UICC profile that was sent to the UICC in the last TERMINAL PROFILE command • 4: UICC EF_{UST}. It represents the elementary file that indicates services available in the USIM • 5: list of MT only facilities (facilities that are not allowed to be assigned to the TE, see 3GPP TS 31.111 [119])
<profile>	String	The profile in hexadecimal character format describing the supported facilities of the referenced <profile_storage> as specified for the Terminal Profile in 3GPP TS 31.111 [119] or for the related EF in 3GPP TS 31.102 [19].

12.4 Write the USAT profile +CUSATW

+CUSATW						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

12.4.1 Description

Writes a USAT terminal profile to the profile storage location. If the profile storage parameter is omitted in the set command, it resets the profiles for all the supported profile storage values to factory-programmed setting. If only the profile parameter is omitted, it will reset the given profile storage to factory-programmed setting. Upon an attempt to store or reset a profile that conflicts with an already stored profile or the list of MT only facilities, the operation fails and the profile referred to by the command parameter <profile_storage> remains unchanged. The MT will provide an error result code.

12.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+CUSATW[=<profile_storage>[,<profile>]]	OK	AT+CUSATW=1,"F31FE84A119C00878C00001FE060000043C0000000004000400000000008" OK
Test	AT+CUSATW=?	+CUSATW: (list of supported <profile_storage>s) OK	+CUSATW: (0,1) OK

12.4.3 Defined values

Parameter	Type	Description
<profile_storage>	Number	Allowed values: • 0: TE. It refers to the profile storage for the facilities supported by the TE. The default value is a blank profile with all bits set to zero. This value is applicable both in the execution command and in the information text response. • 1: MT. It refers to the profile storage for the facilities to be supported by the MT, which can be a subset of the default MT facilities. The TE can choose to register a subset of the MT default profile, typically omitting facilities also supported by the TE profile. The default value is the MT default profile. This value is applicable both in the execution command and in the information text response.
<profile>	String	The profile in hexadecimal character format describing the supported facilities of the referenced <profile_storage> as specified for the Terminal Profile in 3GPP TS 31.111 [119] or for the related EF in 3GPP TS 31.102 [19].

12.5 Enable USAT terminal URCs +UCUSATA

+UCUSATA						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

12.5.1 Description

Enables the USAT terminal URCs to the TE for USAT proactive commands sent from the UICC to the MT.

12.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCUSATA=<active_URC>	OK	AT+UCUSATA=0 OK

Type	Syntax	Response	Example
Read	AT+UCUSATA?	+UCUSATA: <active_URC> OK	+UCUSATA: 0 OK
Test	AT+UCUSATA=?	+UCUSATA: (list of supported <active_URC>s) OK	+UCUSATA: (0-7) OK
URC		+CUSATP: <proactive_command>	
URC		+CUSATEND	

12.5.3 Defined values

Parameter	Type	Description
<active_URC>	Number	Bitmask representing which URCs are activated. See Table 10 for the meaning of each bit. The factory-programmed value is 0.
<proactive_command>	String	Command in hexadecimal character format. Proactive command as defined in 3GPP TS 31.111 [119], consisting of the full BER-TLV data object.

12.5.4 Notes

- The MT issues the +CUSATP URC to forward to the TE proactive commands issued by the UICC.
- The MT issues the +CUSATEND URC when the UICC indicates that the proactive command session is terminated.
- Table 10 provides the meaning of each bit with the corresponding state:

Bit	States reported
0	Enable the +CUSATEND URC
1	Enable the +CUSATP URC
2	Enable the +UUSIMSTAT URC

Table 10: <mode> bitmask meaning

13 Packet switched data services

13.1 PDP contexts and parameter definition

13.1.1 Primary and secondary PDP contexts

A PDP context can be either **primary** or **secondary**. In LTE, PS data connections are referred to as EPS bearers: EPS bearers are conceptually equivalent to the legacy PDP contexts, which are often referred to for sake of simplicity. Similarly to a PDP context, the EPS bearer can be a default (primary) or dedicated (secondary) one. The initial EPS bearer established during LTE attach procedure is actually a default EPS bearer. A secondary PDP context uses the same IP address of a primary PDP context (the usual PDP context activated e.g. via dial-up). The Traffic Flow Filters for such secondary contexts shall be specified according to 3GPP TS 23.060 [10].

The typical usage of the secondary PDP contexts is in VoIP calls, where RTP (speech) packets are conveyed on one PDP context (e.g. the primary one) with a given QoS (e.g. low reliability) whereas SIP signalling is routed on a different PDP context (e.g. the secondary one, with the same IP address but different port numbers) with a more reliable QoS.

A Traffic Flow Template (i.e. a filter based on port number, specifying relative flow precedence) shall be configured for the secondary context to instruct the GGSN to route down-link packets onto different QoS flows towards the TE.

PDP context type	Activation procedure
Primary	Used to establish a logical connection through the network from the UE to the GGSN with a specifically negotiated Quality of Service (QoS). The UE initiates the PDP context activation: it changes the session management state to active, creates the PDP context, obtains the IP address and reserves radio resources. After the activation, the UE is able to send IP packets over the air interface.
Secondary	Used to establish a second PDP context with the same IP address and the same APN as the primary PDP context. The two contexts may have different QoS profiles, which makes the feature useful for applications that have different QoS requirements (e.g. IP multimedia); QoS is applied based on port number addressing.

SARA-R4 / SARA-N4
The secondary PDP contexts are not supported.

13.1.2 Multiple PDP contexts

Two PDP context types are defined:

- "external" PDP context: IP packets are built by the DTE, the MT's IP instance runs the IP relay function only;
- "internal" PDP context: the PDP context (relying on the MT's embedded TCP/IP stack) is configured, established and handled via the data connection management AT commands.

Multiple PDP contexts are supported. The DTE can access these PDP contexts either alternatively through the physical serial interface, or simultaneously through the virtual serial ports of the multiplexer (multiplexing mode MUX), with the following constraints:

- Using the MT's embedded TCP/IP stack, only a internal PDP context is supported. This IP instance supports up to 7 sockets;
- Using only external PDP contexts, it is possible to have at most 3 IP instances (with 3 different IP addresses) simultaneously active. If in addition the internal PDP context is used, at most 2 external PDP contexts can be activated.

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Multiple PDP contexts and internal PDP contexts are not supported.

13.1.3 Parameter definition

13.1.3.1 <APN>

The Access Point Name (APN) is a string parameter, which is a logical name, valid in the current PLMN's domain, used to select the GGSN (Gateway GPRS Support Node) or the external packet data network to be connected to. The APN can be omitted: this is the so-called "blank APN" setting that may be suggested by network operators (e.g. to roaming devices); in this case the APN string is not included in the message sent to the network.

The maximum length of the parameter is 99 characters (the maximum length of coded APN is 100 octets, see 3GPP TS 23.003 [117], subclause 9.1).

SARA-R4 / SARA-N4

An optional special code placed at the beginning of <APN> indicates the type of authentication handling between the module and the network and may be:

- CHAP: challenge handshake authentication protocol
- PAP: personal authentication protocol
- NOAUTH: authentication protocol not used
- code omitted: authentication protocol not used

An example for the usage of <APN> is:

```
AT+CGDCONT=1,"IP","CHAP:internet.t-d1.de"
```

The information text response to the +CGDCONT read command does not include the PAP: and CHAP: prefixes in the APN string.

13.1.3.2 <cid>

PDP context identifier. A numeric parameter specifying a particular PDP context definition. This parameter is valid only locally on the interface DTE-MT.

The maximum number of definable and active PDP contexts depend(s) on the product version:[1]

Product	Max number of definable PDP contexts	Max number of active PDP contexts
SARA-R4 / SARA-N4	8	8

13.1.3.3 <PDP_addr>

String parameter identifying the MT in the IP-address space applicable to the PDP service. If the value is null or omitted (dynamic IP addressing), then a value may be provided by the DTE during the PDP startup procedure or, failing that, a dynamic address will be requested via DHCP. It can be read with the command AT+CGPADDR or AT+CGDCONT read command.

To request a static IP address, a fixed IP address shall be specified for the <PDP_addr> paramater of the +CGDCONT set command and the user shall not rely on PPP negotiation via IPCP CONFREQ option.

Depending on the IP-version, the <PDP_addr> consists of 4 octets (IPv4) or 16 octets (IPv6):

- IPv4: "ddd.ddd.ddd.ddd"
- IPv4v6: "ddd.ddd.ddd.ddd ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd"
- IPv6: "ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd.ddd"

13.1.3.4 <PDP_type>

The Packet Data Protocol (PDP) type is a string parameter which specifies the type of packet data protocol:

- "IP" (default value): Internet Protocol (IETF STD 5)
- "NONIP": Non IP
- "IPV4V6": virtual <PDP_type> introduced to handle dual IP stack UE capability (see the 3GPP TS 24.301 [88])

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"IPV4V6" is the default PDP type for the default profile.

- "IPV6": Internet Protocol, version 6 (see RFC 2460)

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[1] The maximum number of active PDP contexts may be limited by the MNO

<PDP_type>="NONIP" is not supported.

13.2 PPP LCP handshake behaviour

When a data call is initiated by means of D* AT command, the module switches to PPP mode just after the CONNECT intermediate result code. The first step of the PPP procedure is the LCP handshake, in this phase the behaviour of 2G products differs from 3G products and 4G products.

Entering OnLine Command Mode (OLCM) during LCP handshake phase is strongly discouraged because the handshake procedure could be broken and should be restarted from the beginning.

13.3 Printing IP address format +CGPIAF

+CGPIAF						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

13.3.1 Description

Defines the printing format of IPv6 address parameters of the other AT commands. See RFC 4291 [94] for details of the IPv6 address format.

SARA-R4 / SARA-N4
The affected parameters are:

- In +CGDCONT the <PDP_addr> parameter
- In +CGPADDR the <PDP_addr_1> and <PDP_addr_2> parameters
- In +CGCONTRDP, the <local_address_and_subnet_mask>, <dns_prim_addr>, <dns_sec_addr>, <P_CSCF_prim_addr> and <P_CSCF_sec_addr> parameters

13.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGPIAF=[<IPv6_AddressFormat>[,<IPv6_SubnetNotation>[,<IPv6_LeadingZeros>[,<IPv6_CompressZeros>]]]]	OK	AT+CGPIAF=1,1,1,1 OK
Read	AT+CGPIAF?	+CGPIAF: <IPv6_AddressFormat>,<IPv6_SubnetNotation>,<IPv6_LeadingZeros>,<IPv6_CompressZeros> OK	+CGPIAF: 0,0,0,0 OK
Test	AT+CGPIAF=?	+CGPIAF: (list of supported <IPv6_AddressFormat>s),(list of supported <IPv6_SubnetNotation>s),(list of supported <IPv6_LeadingZeros>s),(list of supported <IPv6_CompressZeros>s) OK	+CGPIAF: (0-1),(0-1),(0-1),(0-1) OK

13.3.3 Defined values

Parameter	Type	Description
<IPv6_AddressFormat>	Number	Defines the IPv6 address format: • 0 (default value): IPv4-like dot-notation used. IP address and subnetwork mask if applicable, are dot-separated • 1: IPv6-like colon-notation used. IP address and subnetwork mask if applicable and when given explicitly, are separated by a space

Parameter	Type	Description
<IPv6_SubnetNotation>	Number	Defines the subnet-notation for <remote_address_and_subnet_mask>. The setting does not apply if <IPv6_AddressFormat>=0: • 0 (default value): both IP address and subnet mask are explicitly stated, separated by a space • 1: the printout format is applying / (forward slash) subnet-prefix Classless Inter-Domain Routing (CIDR)
<IPv6_LeadingZeros>	Number	Defines whether leading zeros are omitted or not. The setting does not apply if <IPv6_AddressFormat>=0: • 0 (default value): leading zeros omitted • 1: leading zeros included
<IPv6_CompressZeros>	Number	Defines whether 1-n instances of 16-bit-zero-values are replaced by only "::". This applies only once. The setting does not apply if <IPv6_AddressFormat>=0: • 0 (default value): no zero compression • 1: use zero compression

13.4 PDP context definition +CGDCONT

+CGDCONT						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	NVM	No	-	+CME Error

13.4.1 Description

Defines the connection parameters for a PDP context, identified by the local context identification parameter <cid>. If the command is used only with parameter <cid>, the corresponding PDP context becomes undefined.

Each context is permanently stored so that its definition is persistent over power cycles.

The command is used to set up the PDP context parameters for an external context, i.e. a data connection using the external IP stack (e.g. Windows dial-up) and PPP link over the serial interface.

Usage of static i.e. user defined IP address is possible in UTRAN and GERAN but not in EUTRAN; to prevent inconsistent addressing methods across various RATs, static IP addressing is not recommended for LTE modules: 3GPP TS 23.060 [10] Rel.8 and later releases specify that a UE with EUTRAN/UTRAN/GERAN capabilities shall not include a static PDP address in PDP context activation requests.

13.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGDCONT=[<cid>[,<PDP_type>[,<APN>[,<PDP_addr>[,<d_comp>[,<h_comp>[,<IPv4AddrAlloc>[,<emergency_indication>[,<P-CSCF_discovery>[,<IM_CN_Signalling_Flag_Ind>[,<NSLPI>]]]]]]]]]]	OK	**IPv4 example** AT+CGDCONT=1,"IP","APN_name","1.2.3.4",0,0 OK **IPv4v6 example** AT+CGDCONT=1,"IPV4V6","APN","0.0.0.0 0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0",0,0 OK **IPv6 example** AT+CGDCONT=1,"IPV6","APN","0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0",0,0 OK
Read	AT+CGDCONT?	+CGDCONT: <cid>,<PDP_type>,<APN>,<PDP_addr>,<d_comp>,<h_comp>[,<IPv4AddrAlloc>,<emergency_indication>,<P-CSCF_discovery>,<IM_CN_Signalling_Flag_Ind>[,<NSLPI>]]	+CGDCONT: 1,"IP","web.omnitel.it","91.80.140.199",0,0 OK

Type	Syntax	Response	Example
		OK	
Test	AT+CGDCONT=?	+CGDCONT: (list of supported <cid>s),<PDP_type>,,,(list of supported <d_comp>s),(list of supported <h_comp>s)[,(list of supported <IPv4AllocAddr>s),(list of supported <emergency_indication>s),(list of supported <P-CSCF_discovery>s),(list of supported <IM_CN_Signalling_Flag_Ind>s)[,(list of supported <NSLPI>s)]] OK	+CGDCONT: (1-3),"IP",,,(0-2),(0-4) OK

13.4.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<PDP_type>	String	See <PDP_type>
<APN>	String	See <APN>
<PDP_addr>	Number	See <PDP_addr>
<d_comp>	Number	PDP data compression; it can have the values: • 0 (default value): off • 1: on (predefined compression type i.e. V.42bis data compression) • 2: V.42bis data compression
<h_comp>	Number	PDP header compression; it can have the values: • 0 (default value): off • 1: on (predefined compression type, i.e. RFC1144) • 2: RFC1144 • 3: RFC2507 • 4: RFC3095 ☞ <h_comp>: the available head-compressions are dependent on configuration of the stack (configured via features in the stack)
<IPv4AddrAlloc>	Number	Controls how the MT/TA requests to get the IPv4 address information: • 0 (default value): IPv4 Address Allocation through NAS Signalling • 1: IPv4 Address Allocated through DHCP
<emergency_indication>	Number	Indicates whether the PDP context is for emergency bearer services or not: • 0 (default value): PDP context is not for emergency bearer services • 1: PDP context is for emergency bearer services
<P-CSCF_discovery>	Number	Influences how the MT/TA requests to get the P-CSCF address, see 3GPP TS 24.229 [103] annex B and annex L: • 0 (default value): preference of P-CSCF address discovery not influenced by +CGDCONT • 1: preference of P-CSCF address discovery through NAS Signalling • 2: preference of P-CSCF address discovery through DHCP
<IM_CN_Signalling_Flag_Ind>	Number	Shows whether the PDP context is for IM CN subsystem-related signalling only or not: • 0: PDP context is not for IM CN subsystem-related signalling only • 1: PDP context is for IM CN subsystem-related signalling only
<NSLPI>	Number	Indicates the NAS signalling priority requested for the corresponding PDP context: • 0 (default value): indicates that the PDP context has to be activated with the value for the low priority indicator configured in the MT. • 1: indicates that the PDP context has to be activated with the value for the low priority indicator set to "MS is not configured for NAS signalling low priority". The MT utilises the NSLPI information provided as specified in 3GPP TS 24.301 [88] and 3GPP TS 24.008 [12].

13.4.4 Notes

Additional examples:

Command	Response	Description
		Configure the error result code format by means of the +CMEE AT command
AT+CGDCONT=?	+CGDCONT: (1-3),"IP",,,(0),(0-1) OK	Test command
AT+CGDCONT=4,"IP","internet"	+CME ERROR: operation not allowed	Define out of range PDP contexts
AT+CGDCONT=2,"IP","internet"	OK	Define allowed PDP contexts
AT+CGDCONT=1,"IP","STATREAL"	OK	Define allowed PDP contexts
AT+CGDCONT=3,"IP","PAP: tim.ibox.it"	OK	Define allowed PDP contexts
AT+CGDCONT=253,"IP","internet"	+CME ERROR: operation not allowed	Define out of range PDP contexts
AT+CGDCONT?	+CGDCONT: 2,"IP","internet","0.0.0.0",0,0 +CGDCONT: 1,"IP","STATREAL","0.0.0.0",0,0 +CGDCONT: 3,"IP","tim.ibox.it","0.0.0.0",0,0 OK	Read command

SARA-R4 / SARA-N4

- When registering in LTE, the initial default EPS bearer is mapped to <cid>= 1.
- If not specified by the set command, the following values are assumed:
  - <cid>: 1
  - <PDP_addr>: "0.0.0.0"
- <d_comp>=1, 2 are not supported.
- The command setting are stored in the NVM at the module switch off.
- The module automatically accepts Mobile Terminated PDP contexts/EPS bearers.
- The <NSLPI> parameter is not supported.
- <P-CSCF_discovery>=2 is not supported.

SARA-R4 / SARA-N4

- <h_comp>= 1, 2, 3 and 4 are not supported.
- If <PDP_addr> is not assigned or set to all zeros and <PDP_type>="IPV4V6", the read command will only return the all zeros IPV6 address.

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- The settings of the initial default EPS bearer mapped to <cid>= 1 must have a blank APN.

13.5 Packet switched data configuration +UPSD

+UPSD						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

13.5.1 Description

Sets or reads all the parameters in a specific packet switched data (PSD) profile. The command is used to set up the PDP context parameters for an internal context, i.e. a data connection using the internal IP stack and related AT commands for sockets.

To set all the parameters of the PSD profile a set command for each parameter needs to be issued.

In the read command, if only the first parameter is issued, the module returns all the parameters of the given PSD profile, and lists them in separated lines.

13.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UPSD=<profile_id>,<param_tag>,<param_val>	OK	AT+UPSD=0,1,"apn.provider.com" OK
Read	AT+UPSD=<profile_id>,<param_tag>	+UPSD: <profile_id>,<param_tag>,<param_val> OK	AT+UPSD=0,1 +UPSD: 0,1,"apn.provider.com" OK
	AT+UPSD=<profile_id>	+UPSD: <profile_id>,0,<param_val0> +UPSD: <profile_id>,1,<param_val1>... +UPSD: <profile_id>,x,<param_valx> OK	AT+UPSD=0 +UPSD: 0,0,0 +UPSD: 0,1,"apn.provider.com" +UPSD: 0,2,"username" +UPSD: 0,4,"0.0.0.0" ... +UPSD: 0,19,0 OK

13.5.3 Defined values

Parameter	Type	Description
<profile_id>	Number	PSD profile identifier, in range 0-6
<param_tag>	Number	• 0: Protocol type; the allowed values of <param_val> parameter are o 0 (factory-programmed value): IPv4 o 1: IPv6 o 2: IPv4v6 with IPv4 preferred for internal sockets o 3: IPv4v6 with IPv6 preferred for internal sockets • 1: APN - <param_val> defines the APN text string, e.g. "apn.provider.com"; the maximum length is 99. The factory-programmed value is an empty string. • 2: username - <param_val> is the user name text string for the authentication phase. The factory-programmed value is an empty string. • 3: password - <param_val> is the password text string for the authentication phase. Note: the AT+UPSD read command with param_tag = 3 is not allowed and the read all command does not display it • 4: DNS1 - <param_val> is the text string of the primary DNS address. IPv4 DNS addresses are specified in dotted decimal notation form (i.e. four numbers in range 0-255 separated by periods, e.g. "xxx.yyy.zzz.www"). IPv6 DNS addresses are specified in standard IPv6 notation form (2001:DB8:: address compression is allowed). The factory-programmed value is "0.0.0.0". • 5: DNS2 - <param_val> is the text string of the secondary DNS address. IPv4 DNS addresses are specified in dotted decimal notation form (i.e. four numbers in range 0-255 separated by periods, e.g. "xxx.yyy.zzz.www"). IPv6 DNS addresses are specified in standard IPv6 notation form (2001:DB8:: address compression is allowed). The factory-programmed value is "0.0.0.0". • 6: authentication - the <param_val> parameter selects the authentication type: o 0 (factory-programmed value): none o 1: PAP o 2: CHAP o 3: automatic selection of authentication type (none/CHAP/PAP) • 7: IP address - <param_val> is the text string of the static IP address given by the ISP in dotted decimal notation form (i.e. four numbers in range 0-255 separated by periods, e.g. "xxx.yyy.zzz.www"). The factory-programmed value is "0.0.0.0". Note: IP address set as "0.0.0.0" means dynamic IP address assigned during PDP context activation • 8: data compression - the <param_val> parameter refers to the default parameter named d_comp and selects the data compression type: o 0 (factory-programmed value): off o 1: predefined, i.e. V.42bis o 2: V.42bis

Parameter	Type	Description
		• 9: header compression - the <param_val> parameter refers to the default parameter named h_comp and selects the header compression type: o 0 (factory-programmed value): off o 1: predefined, i.e. RFC1144 o 2: RFC1144 o 3: RFC2507 o 4: RFC3095 • 10: QoS precedence - the <param_val> parameter selects the precedence class: o 0 (factory-programmed value): subscribed o 1: high o 2: normal o 3: low • 11: QoS delay - the <param_val> parameter selects the delay class: o 0 (factory-programmed value): subscribed o 1: class 1 o 2: class 2 o 3: class 3 o 4: best effort • 12: QoS reliability - the <param_val> parameter selects the reliability class: o 0 (factory-programmed value): subscribed o 1: class 1 (Interpreted as class 2) o 2: class 2 (GTP Unack, LLC Ack and Protected, RLC Ack) o 3: class 3 (GTP Unack, LLC Unack and Protected, RLC Ack) o 4: class 4 (GTP Unack, LLC Unack and Protected, RLC Unack) o 5: class 5 (GTP Unack, LLC Unack and Unprotected, RLC Unack) o 6: class 6 (Interpreted as class 3) • 13: QoS peak rate - the <param_val> parameter selects the peak throughput in range 0-9. The factory-programmed value is 0. • 14: QoS mean rate - the <param_val> parameter selects the mean throughput in range 0-18, 31. The factory-programmed value is 0. • 15: minimum QoS precedence - the <param_val> parameter selects the acceptable value for the precedence class: o 0 (factory-programmed value): subscribed o 1: high o 2: normal o 3: low • 16: minimum QoS delay - the <param_val> parameter selects the acceptable value for the delay class: o 0 (factory-programmed value): subscribed o 1: class 1 o 2: class 2 o 3: class 3 o 4: best effort • 17: minimum QoS reliability - the <param_val> parameter selects the minimum acceptable value for the reliability class: o 0 (factory-programmed value): subscribed o 1: class 1 (Interpreted as class 2) o 2: class 2 (GTP Unack, LLC Ack and Protected, RLC Ack) o 3: class 3 (GTP Unack, LLC Unack and Protected, RLC Ack) o 4: class 4 (GTP Unack, LLC Unack and Protected, RLC Unack) o 5: class 5 (GTP Unack, LLC Unack and Unprotected, RLC Unack) o 6: class 6 (Interpreted as class 3) • 18: minimum QoS peak rate - the <param_val> parameter selects the acceptable value for the peak throughput in range 0-9. The factory-programmed value is 0. • 19: minimum QoS mean rate - the <param_val> parameter selects the acceptable value for the mean throughput in range 0-18, 31. The factory-programmed value is 0. • 20: 3G QoS delivery order - the <param_val> parameter selects the acceptable value for the delivery order: o 0 (factory-programmed value): subscribed

Parameter	Type	Description
		o 1: enable o 2: disable • 21: 3G QoS erroneous SDU delivery - the <param_val> parameter selects the acceptable value for the erroneous SDU delivery: o 0 (factory-programmed value): subscribed o 1: no detection o 2: enable o 3: disable • 22: 3G QoS extended guaranteed downlink bit rate - <param_val> is the value for the extended guaranteed downlink bit rate in kb/s. The factory-programmed value is 0. • 23: 3G QoS extended maximum downlink bit rate - <param_val> is the value for the extended maximum downlink bit rate in kb/s. The factory-programmed value is 0. • 24: 3G QoS guaranteed downlink bit rate - <param_val> is the value for the guaranteed downlink bit rate in kb/s. The factory-programmed value is 0. • 25: 3G QoS guaranteed uplink bit rate - <param_val> is the value for the guaranteed uplink bit rate in kb/s. The factory-programmed value is 0. • 26: 3G QoS maximum downlink bit rate - <param_val> is the value for the maximum downlink bit rate in kb/s. The factory-programmed value is 0. • 27: 3G QoS maximum uplink bit rate - <param_val> is the value for the maximum uplink bit rate in kb/s. The factory-programmed value is 0. • 28: 3G QoS maximum SDU size - <param_val> is the value for the maximum SDU size in octets. The factory-programmed value is 0. • 29: 3G QoS residual bit error rate - <param_val> selects the acceptable value for the residual bit error rate: o 0 (factory-programmed value): subscribed o 1: 5E2 o 2: 1E2 o 3: 5E3 o 4: 4E3 o 5: 1E3 o 6: 1E4 o 7: 1E5 o 8: 1E6 o 9: 6E8 • 30: 3G QoS SDU error ratio - <param_val> selects the acceptable value for the SDU error ratio: o 0 (factory-programmed value): subscribed o 1: 1E2 o 2: 7E3 o 3: 1E3 o 4: 1E4 o 5: 1E5 o 6: 1E6 o 7: 1E1 • 31: 3G QoS signalling indicator - <param_val> selects the acceptable value for the signalling indicator: o 0 (factory-programmed value): subscribed o 1: signalling indicator 1 • 32: 3G QoS source statistics descriptor - <param_val> selects the acceptable value for the source statistics descriptor: o 0 (factory-programmed value): subscribed o 1: source statistics descriptor 1 • 33: 3G QoS traffic class - <param_val> selects the acceptable value for the traffic class: o 0 (factory-programmed value): subscribed o 1: conversational o 2: streaming o 3: interactive o 4: background

Parameter	Type	Description
		• 34: 3G QoS traffic priority - <param_val> selects the acceptable value for the traffic priority: o 0 (factory-programmed value): subscribed o 1: priority 1 o 2: priority 2 o 3: priority 3 • 35: 3G QoS transfer delay - <param_val> is the value for the transfer delay in milliseconds. The factory-programmed value is 0. • 36: 3G minimum QoS delivery order - <param_val> selects the acceptable value for the delivery order: o 0 (factory-programmed value): subscribed o 1: enable o 2: disable • 37: 3G minimum QoS erroneous SDU delivery - <param_val> selects the acceptable value for the erroneous SDU delivery: o 0 (factory-programmed value): subscribed o 1: no detection o 2: enable o 3: disable • 38: 3G minimum QoS extended guaranteed downlink bit rate - <param_val> is the value for the extended guaranteed downlink bit rate in kb/s. The factory-programmed value is 0. • 39: 3G minimum QoS extended maximum downlink bit rate - <param_val> is the value for the extended maximum downlink bit rate in kb/s. The factory-programmed value is 0. • 40: 3G minimum QoS guaranteed downlink bit rate - <param_val> is the value for the guaranteed downlink bit rate in kb/s. The factory-programmed value is 0. • 41: 3G minimum QoS guaranteed uplink bit rate - <param_val> is the value for the guaranteed uplink bit rate in kb/s. The factory-programmed value is 0. • 42: 3G minimum QoS maximum downlink bit rate - <param_val> is the value for the maximum downlink bit rate in kb/s. The factory-programmed value is 0. • 43: 3G minimum QoS maximum uplink bit rate - <param_val> is the value for the maximum uplink bit rate in kb/s. The factory-programmed value is 0. • 44: 3G minimum QoS maximum SDU size - <param_val> is the value for the maximum SDU size in octets. The factory-programmed value is 0. • 45: 3G minimum QoS residual bit error rate - <param_val> selects the acceptable value for the residual bit error rate: o 0 (factory-programmed value): subscribed o 1: 5E2 o 2: 1E2 o 3: 5E3 o 4: 4E3 o 5: 1E3 o 6: 1E4 o 7: 1E5 o 8: 1E6 o 9: 6E8 • 46: 3G minimum QoS SDU error ratio - <param_val> selects the acceptable value for the SDU error ratio: o 0 (factory-programmed value): subscribed o 1: 1E2 o 2: 7E3 o 3: 1E3 o 4: 1E4 o 5: 1E5 o 6: 1E6 o 7: 1E1 • 47: 3G minimum QoS signalling indicator - <param_val> selects the acceptable value for the signalling indicator: o 0 (factory-programmed value): subscribed

Parameter	Type	Description
		o 1: signalling indicator 1 • 48: 3G minimum QoS source statistics descriptor - <param_val> selects the acceptable value for the source statistics descriptor: o 0 (factory-programmed value): subscribed o 1: source statistics descriptor 1 • 49: 3G minimum QoS traffic class - <param_val> selects the acceptable value for the traffic class: o 0 (factory-programmed value): subscribed o 1: conversational o 2: streaming o 3: interactive o 4: background • 50: 3G minimum QoS traffic priority - <param_val> selects the acceptable value for the traffic priority: o 0 (factory-programmed value): subscribed o 1: priority 1 o 2: priority 2 o 3: priority 3 • 51: 3G Minimum QoS transfer delay - <param_val> is the value for the transfer delay in milliseconds. The factory-programmed value is 0. • 100: map the +UPSD profile to the specified <cid> in the +CGDCONT table. o 1: map the current profile to <cid> 1 o 2: map the current profile to <cid> 2 o 3: map the current profile to <cid> 3 o 4: map the current profile to <cid> 4 o 5: map the current profile to <cid> 5 o 6: map the current profile to <cid> 6 o 7: map the current profile to <cid> 7 o 8 (factory-programmed value): map the current profile to <cid> 8

13.5.4 Notes

- For the description of the QoS parameters, see 3GPP TS 22.060 [50] and 3GPP TS 23.060 [10].
- The maximum length of <param_val> if <param_tag> is equal to 2 or 3 is 64.

SARA-R4 / SARA-N4

- The only supported <profile_id> is 0.
- The only supported <param_tag> is 0 (IP type).

13.6 GPRS attach or detach +CGATT

+CGATT						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 3 min	+CME Error

13.6.1 Description

Register (attach) the MT to, or deregister (detach) the MT from the GPRS service. After this command the MT remains in AT command mode. If the MT is already in the requested state (attached or detached), the command is ignored and OK result code is returned. If the requested state cannot be reached, an error result code is returned. The command can be aborted if a character is sent to the DCE during the command execution. Any active PDP context will be automatically deactivated when the GPRS registration state changes to detached.

The user should not enter colliding requests (e.g. AT+CGATT=1 and AT+CGATT=0) on different communication ports, because this might cause interoperability issues in case overlapping attach and detach requests are not handled by the network, and could result in an unpredictable registration state. Similarly, when notified of a mobile terminated GPRS detach event (e.g. via +CGEV URC), it is

recommended to wait a few seconds before entering AT+CGATT=0 in order to let the pending attach procedure (automatically triggered by the module in most cases) successfully end.

SARA-R412M
If MT is configured in class "B" (see the +CGCLASS AT command) and the GSM registration has not yet been performed, AT+CGATT=1 triggers both GSM and GPRS registration. If the command is aborted before the PS registration has ended, the CS registration is completed and the MT goes into class "CC".

The deregistration action is carried out even if the command is aborted.

13.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGATT=[<state>]	OK	AT+CGATT=1 OK
Read	AT+CGATT?	+CGATT: <state> OK	+CGATT: 1 OK
Test	AT+CGATT=?	+CGATT: (list of supported <state>s) OK	+CGATT: (0-1) OK

13.6.3 Defined values

Parameter	Type	Description
<state>	Number	Indicates the state of GPRS attachment: • 0: detached • 1 (default value): attached

13.7 PDP context activate or deactivate +CGACT

+CGACT						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 40-150 s (see below)	+CME Error

13.7.1 Description

Activates or deactivates the specified PDP context. After the command, the MT remains in AT command mode. If any context is already in the requested state, the state for the context remains unchanged. If the required action cannot succeed, an error result code is returned. If the MT is not GPRS attached when the activation of a PDP context is required, the MT first performs a GPRS attach and then attempts to activate the specified context.

The maximum expected response time is different whenever the activation or the deactivation of a PDP context is performed (150 s and 40 s respectively).

The command can be aborted if a character is sent to the DCE during the command execution: if a PDP context activation on a specific <cid> was requested, the PDP context deactivation is performed; if a multiple PDP context activation was requested, it is aborted after the pending PDP context activation has finished.

The deactivation action is carried out even if the command is aborted.

13.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGACT=[<status>[,<cid>[,...]]]	OK	AT+CGACT=1,1 OK
Read	AT+CGACT?	[+CGACT: <cid>,<status> [+CGACT: <cid>,<status> [...]]]	+CGACT: 1,1 OK

Type	Syntax	Response	Example
		OK	
Test	AT+CGACT=?	+CGACT: (list of supported <status>s) OK	+CGACT: (0-1) OK

13.7.3 Defined values

Parameter	Type	Description
<status>	Number	Indicates the state of PDP context activation: • 0: deactivated • 1: activated
<cid>	Number	See <cid>.

13.7.4 Notes

SARA-R4 / SARA-N4

- If <cid> is not defined, the command activates or deactivates all the defined PDP contexts.

13.7.5 Examples

Examples of usage of +CGDCONT, +CGACT, +CGPADDR command:

Command sent by the DTE	DCE response	Description
AT+CMEE=2	OK	Set the verbose error result codes
AT+COPS=0	OK	
AT+COPS?	+COPS: 0,0,"vodafone IT" OK	
AT+CGDCONT=1,"IP","web.omnitel.it"	OK	Define several PDP contexts
AT+CGDCONT=3,"IP","internet"	OK	
AT+CGDCONT=2,"IP", "mms.vodafone.it"	OK	
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0 +CGDCONT: 3,"IP","internet","0.0.0.0",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","0.0.0.0",0,0 OK	Read PDP contexts
AT+CGACT=1,1	OK	Activate the PDP context 1
AT+CGPADDR=1	+CGPADDR: 1, "91.80.104.82" OK	Show address of the PDP context 1
AT+CGPADDR=2	+CGPADDR: 2, "0.0.0.0" OK	Show the address of PDP context 2
AT+CGPADDR=3	+CGPADDR: 3, "0.0.0.0" OK	Show the address of PDP context 3
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","91.80.104.82",0,0 +CGDCONT: 3,"IP","internet","0.0.0.0",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","0.0.0.0",0,0 OK	
AT+CGACT=0,1	OK	Deactivate the PDP context 1
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0 +CGDCONT: 3,"IP","internet","0.0.0.0",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","0.0.0.0",0,0 OK	
AT+CGACT=1	OK	Activate all of defined PDP contexts

Command sent by the DTE	DCE response	Description
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","91.80.101.207",0,0 +CGDCONT: 3,"IP","internet","83.225.114.136",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","10.159.135.60",0,0 OK	
AT+CGPADDR=1	+CGPADDR: 1, "91.80.101.207" OK	Show the address of PDP context 1
AT+CGPADDR=2	+CGPADDR: 2, "10.159.135.60" OK	Show the address of PDP context 2
AT+CGACT=0	OK	Deactivate all of defined PDP contexts
AT+CGPADDR=2	+CGPADDR: 2, "0.0.0.0" OK	Show the address of PDP context 2
AT+CGPADDR=3	+CGPADDR: 3, "0.0.0.0" OK	Show the address of PDP context 3
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0 +CGDCONT: 3,"IP","internet","0.0.0.0",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","0.0.0.0",0,0 OK	
AT+CGACT=1,2	OK	Activate the PDP context 2
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0 +CGDCONT: 3,"IP","internet","0.0.0.0",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","10.153.123.229",0,0 OK	
AT+CGACT=1,3	OK	Activate PDP context 3
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0 +CGDCONT: 3,"IP","internet","83.225.171.77",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","10.153.123.229",0,0 OK	
AT+CGACT=1,1	OK	Activate the PDP context 1
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","91.80.175.163",0,0 +CGDCONT: 3,"IP","internet","83.225.171.77",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","10.153.123.229",0,0 OK	
AT+CGACT=0	OK	Deactivate all of defined PDP contexts
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0 +CGDCONT: 3,"IP","internet","0.0.0.0",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","0.0.0.0",0,0 OK	

13.8 Enter PPP state/GPRS dial-up D*

D*						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	Up to 3 min	+CME Error

13.8.1 Description

The V.24 dial command "D", similar to the command with the syntax AT+CGDATA="PPP",<cid>, causes the MT to perform the necessary actions to establish the communication between the DTE and the external PDP network through the PPP protocol. This can include performing a PS attach and, if the PPP server on the DTE side starts communication, PDP context activation on the specified PDP context identifier (if not already requested by means of +CGATT and +CGACT commands).

If the command is accepted and the preliminary PS procedures have succeeded, the "CONNECT" intermediate result code is returned, the MT enters the V.25ter online data state and the PPP L2 protocol between the MT and the DTE is started.

The data session is terminated by one of the following events:

- sending **~+++**.
- via a DTR transition from ON to OFF.
- sending an LCP Terminate Request.

If used with <cid>= 100, this command can enable the local dial-up, that establishes a PPP communication between the DTE and the module through a serial interface (UART, MUX, or CDC-ACM). In this case an active PDP context is not needed since the DTE is assigned a private IP address.

13.8.2 Local dial-up

The local dial-up feature is enabled by performing a dial-up on <cid>= 100. It establishes a PPP communication between the DTE and the module through a serial interface (UART, MUX, or CDC-ACM). An IP link is created by assigning private IP addresses to the endpoints. An active PDP context is not needed. The IP traffic is automatically routed by the module, thus allowing the DTE to communicate with:

- the internet through an active PDP context (at least one PDP context/EPS bearer is needed for the IP connectivity). By default, the first PDP context activated is used to convey the data;
- a device connected to the Virtual Ethernet over USB (RNDIS/CDC-ECM);
- devices (STA) connected to the Wi-Fi access point (AP) of the cellular module (see Wi-Fi section).

The feature has been studied to work in router mode.

In general no defined / no active context is required to use local dial-up. The local dial-up is in any case able to communicate with the interfaces connected to the module IP stack, as for example RNDIS and Wi-Fi interfaces.

The local dial-up feature does not support the OnLine Command Mode (OLCM). Furthermore the DTR ON to OFF transition and the ~+++ cannot be used to terminate the local dial-up (the procedure described in ~+++ behavior in PSD &D is not applicable).

The PIN insertion is not mandatory for the local dial-up feature.

The local dial-up feature supports only IPv4 connectivity.

13.8.3 Syntax

Type	Syntax	Response	Example
Set	ATD[<dialing_type_char>]*<dialing_number>[*[<address>][*[<L2P>][*[<cid>]]]]#	CONNECT (data transfer starts)	ATD*99***1# CONNECT

13.8.4 Defined values

Parameter	Type	Description
<dialing_type_char>	String	Optional (legacy) "T" or "P" character indicating the tone dialing or pulse dialing respectively

Parameter	Type	Description
<dialing_number>	Number	List all the supported values
<address>	-	Ignored
<L2P>	String	Layer 2 protocol to be used between the DTE and MT; allowed values: • "PPP" (default value) • "M-HEX" • "M-RAW_IP" • "M-OPT-PPP" ☞ The application on the remote side must support the selected protocol as well.
<cid>	Number	See <cid>

13.8.5 Notes

- Dial-up with PAP/CHAP authentication is not supported on an already active PDP context that was activated without authentication.
- The context identifier <cid> is mapped to 1 if not specified.
- The GPRS dial-up command maps to AT+CGDATA="PPP",<cid>.
- If FDN is enabled and FDN check for PS data call is supported by the module, to perform a GPRS dial-up one of the following entries must be stored in the FDN phonebook: *99#, *99*#, *99**# or *99***#.

SARA-R4 / SARA-N4

- The local dial-up feature is not supported.

13.9 Show PDP address +CGPADDR

+CGPADDR						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

13.9.1 Description

Returns a list of PDP addresses for the specified context identifiers. Only defined PDP contexts are displayed.

If the <cid> parameter is omitted, the addresses for all defined contexts are returned.

13.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGPADDR=[<cid>[,<cid> [,...]]]	+CGPADDR: <cid>,<PDP_addr>	AT+CGPADDR=1
		[+CGPADDR: <cid>,<PDP_addr>	+CGPADDR: 1,"1.2.3.4"
		[...]]	OK
		OK	
Test	AT+CGPADDR=?	+CGPADDR: [(list of defined <cid>s)]	+CGPADDR: 1,3
		OK	OK

13.9.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<PDP_addr>	Number	See <PDP_addr>

13.10 GPRS event reporting +CGEREP

+CGEREP						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	-	+CME Error

13.10.1 Description

Configures sending of URCs from MT to the DTE, in case of certain events occurring during GPRS signalling between the MT and the network.

13.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGEREP=[<mode>[,<bfr>]]	OK	AT+CGEREP=1,1 OK
Read	AT+CGEREP?	+CGEREP: <mode>,<bfr> OK	+CGEREP: 0,0 OK
Test	AT+CGEREP=?	+CGEREP: (list of supported <mode>s),(list of supported <bfr>s) OK	+CGEREP: (0-2),(0-1) OK
URC		+CGEV: ME PDN ACT <cid>[,<reason>[,<cid_other>]]	+CGEV: NW CLASS "CC"
		+CGEV: ME ACT <p_cid>,<cid>,<event_type>	
		+CGEV: ME PDN DEACT <cid>	
		+CGEV: ME DEACT <PDP_type>,<PDP_addr>,[<cid>]	
		+CGEV: ME DEACT,<p_cid>,<cid>,0	
		+CGEV: ME DEACT <p_cid>,<cid>,<event_type>	
		+CGEV: ME MODIFY <cid>,<change_reason>,<event_type>	
		+CGEV: ME DETACH	
		+CGEV: ME CLASS <class>	
		+CGEV: NW PDN ACT <cid>[,<reason>]	
		+CGEV: NW ACT <p_cid>,<cid>,<event_type>	
		+CGEV: NW PDN DEACT <cid>	
		+CGEV: NW DEACT <p_cid>,<cid>,0	
		+CGEV: NW DEACT <p_cid>,<cid>,<event_type>	
		+CGEV: NW DEACT <PDP_type>,<PDP_addr>,[<cid>]	
		+CGEV: NW MODIFY <cid>,<change_reason>,<event_type>	
		+CGEV: NW DETACH	
		+CGEV: NW CLASS <class>	
		+CGEV: VZW_SUBS_ACTION_NORMAL (0) - No restriction to data traffic	

13.10.3 Defined values

Parameter	Type	Description
<mode>	Number	Controls the processing of URCs specified within this command. Allowed values:

Parameter	Type	Description
		• 0 (default value): buffer URCs in the MT; if the buffer is full the oldest ones will be discarded • 1: discard URCs when V.24 link is reserved (online); otherwise forward them directly to the DTE • 2: buffer URCs in the MT when link reserved (online) and flush them to the DTE when the link becomes available; otherwise forward them directly to the DTE
<bfr>	Number	Controls the effect on buffered codes when <mode> 1 or 2 is entered. Allowed values: • 0 (default value): MT buffer of URCs defined within this command is cleared when <mode> 1 or 2 is entered • 1: MT buffer of URCs defined within this command is flushed to the DTE when <mode> 1 or 2 is entered (OK is given before flushing the codes)
<cid>	Number	See <cid>
<reason>	Number	Indicates whether the reason why the context activation request for PDP type IPv4v6 was not granted: • 0: IPv4 only allowed • 1: IPv6 only allowed • 2: single address bearers only allowed • 3: single address bearers only allowed and MT initiated context activation for a second address type bearer was not successful
<cid_other>	Number	Indicates whether the context identifier allocated by MT for an MT initiated context of a second address type
<p_cid>	Number	Numeric parameter that identifies the particular PDP context definition, specified using +CGDCONT, to which a secondary PDP context definition will be associated using +CGDSCONT. This parameter is only locally valid on the interface TE-MT.
<event_type>	Number	Indicates whether the event is informational or whether the TE has to acknowledge it: • 0: informational event • 1: information request: acknowledgement required
<change_reason>	Number	Indicates what kind of change occurred: • 1: TFT only changed • 2: QoS only changed • 3: both TFT and QoS changed
<PDP_type>	Number	See <PDP_type>
<PDP_addr>	Number	See <PDP_addr>
<class>	String	GPRS mobile class. Allowed values: • "A": class A mode of operation (A/Gb mode), or CS/PS mode of operation (Iu mode) (highest mode of operation) • "B": class B (circuit-switched and packet-switched data alternatively supported) • "CG": class C (one service only) in GPRS mode • "CC": class C (one service only) in circuit-switched (GSM) mode

13.10.4 Explanation of URCs

URC	Remarks
+CGEV: ME PDN ACT <cid>[,<reason>[,<cid_other>]]	The MT has activated a primary context.
+CGEV: ME ACT <p_cid>,<cid>,<event_type>	The network has responded to a MT initiated secondary context activation.
+CGEV: ME PDN DEACT <cid>	The MT has forced a primary context deactivation.
+CGEV: ME DEACT <PDP_type>,<PDP_addr>,[<cid>]	The MT has forced a context deactivation.
+CGEV: ME DEACT,<p_cid>,<cid>,0	The UE has forced a secondary context deactivation.
+CGEV: ME DEACT <p_cid>,<cid>,<event_type>	The MT has forced a secondary context deactivation.
+CGEV: ME MODIFY <cid>,<change_reason>,<event_type>	The MT has forced a context modification.
+CGEV: ME DETACH	The mobile station has forced a GPRS detach
+CGEV: ME CLASS <class>	The mobile station has forced a change of MT class; the highest available class is reported
+CGEV: NW PDN ACT <cid>[,<reason>]	The network has activated a primary context.
+CGEV: NW ACT <p_cid>,<cid>,<event_type>	The network has forced a secondary context activation.
+CGEV: NW PDN DEACT <cid>	The network has forced a primary context deactivation.

URC	Remarks
+CGEV: NW DEACT <p_cid>,<cid>,0	The network has forced a secondary context deactivation.
+CGEV: NW DEACT <p_cid>,<cid>,<event_type>	The network has forced a secondary context deactivation.
+CGEV: NW DEACT <PDP_type>,<PDP_addr>,[<cid>]	The network has forced a context deactivation.
+CGEV: NW MODIFY <cid>,<change_reason>,<event_type>	The network has forced a context modification.
+CGEV: NW DETACH	The network has forced a GPRS detach
+CGEV: NW CLASS <class>	The network has forced a change of MT class (e.g. due to service detach); the highest available class is reported
+CGEV: VZW_SUBS_ACTION_NORMAL (0) - No restriction to data traffic	No restriction to data traffic. The URC is provided only on Verizon network.

13.11 GPRS network registration status +CGREG

+CGREG						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

13.11.1 Description

Configures the GPRS network registration information. Depending on the <n> parameter value, a URC can be issued:

- +CGREG: <stat> if <n>=1 and there is a change in the GPRS network registration status in GERAN/UTRAN
- +CGREG: <stat>[,<lac>,<ci>[,<AcT>,<rac>]] if <n>=2 and there is a change of the network cell in GERAN/UTRAN

The parameters <lac>, <ci>, <AcT>, <rac> are provided only if available.

The read command provides the same information issued by the URC together with the current value of the <n> parameter. The location information elements <lac>, <ci> and <AcT>, if available, are returned only when <n>=2 and the MT is registered with the network.

When <n>=2, in UMTS RAT, unsolicited location information can be received if the network sends the UTRAN INFORMATION MOBILITY message during dedicated connections; in the latter cases the reported <ci> might be not correct because the UE in DCH state cannot read broadcast system information before the change of serving cell. In contrast, in GSM RAT no unsolicited location information is received during a CS connection.

If the GPRS MT also supports circuit mode services in GERAN/UTRAN and/or EPS services in E-UTRAN, the +CREG / +CEREG commands return the registration status and location information for those services.

13.11.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGREG=[<n>]	OK	AT+CGREG=1 OK
Read	AT+CGREG?	If <n>=0 or 1: +CGREG: <n>,<stat> OK	+CGREG: 0,4 OK
		If <n>=2: +CGREG: <n>,<stat>[,<lac>,<ci>[,<AcT>,<rac>]] OK	+CGREG: 2,1,"61EF","7D58A3",2,"14" OK
Test	AT+CGREG=?	+CGREG: (list of supported <n>s) OK	+CGREG: (0-2) OK
URC		If <n>=1:	+CGREG: 1

Type	Syntax	Response	Example
		+CGREG: <stat>	
		If <n>=2:	+CGREG: 1,"4E54","44A5"
		+CGREG: <stat>[,<lac>,<ci>[,<AcT>,<rac>]]	

13.11.3 Defined values

Parameter	Type	Description
<n>	Number	• 0 (default value and factory-programmed value): network registration URC disabled • 1: network registration URC enabled • 2: network registration and location information URC enabled
<stat>	Number	• 0: not registered, the MT is not currently searching an operator to register to • 1: registered, home network • 2: not registered, but MT is currently searching a new operator to register to • 3: registration denied • 4: unknown (e.g. out of GERAN/UTRAN coverage) • 5: registered, roaming • 8: attached for emergency bearer services only (see 3GPP TS 24.008 [12] and 3GPP TS 24.301 [88] that specify the condition when the MS is considered as attached for emergency bearer services) (applicable only when <AcT> indicates 2,4,5,6)
<lac>	String	Two bytes location area in hexadecimal format; it is optionally provided in the URC and in the response to the read command if <n>=2. The value FFFF means that the current <lac> value is invalid.
<ci>	String	From 2 to 4 bytes cell ID in hexadecimal format; it is optionally provided in the URC and in the response to the read command if <n>=2. The value FFFFFFFF means that the current <ci> value is invalid.
<AcT>	Number	Indicates the radio access technology: • 0: GSM • 1: GSM COMPACT • 2: UTRAN • 3: GSM with EDGE availability • 4: UTRAN with HSDPA availability • 5: UTRAN with HSUPA availability • 6: UTRAN with HSDPA and HSUPA availability • 255: the current <AcT> value is invalid
<rac>	String	One byte routing area in hexadecimal format

13.11.4 Notes

- The DTE application should set a reasonable timer (10 s) when receiving the +CGREG: 3 URC, since this might be due to the fact that the LTE registration was rejected (SIM not enabled for LTE RAT, wrong APN during the initial default bearer set-up in the EPS attach procedure and other temporary reject causes).

13.12 Manual deactivation of a PDP context H

H						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 20 s	-

13.12.1 Description

This command H (On-hook) deactivates a pending PDP context with PPP L2 protocol in online command mode. The MT responds with OK. See Chapter 6.3 for a detailed description.

☞ In GPRS online command mode, entered by typing the escape sequence "+++" or "~+++" (see Chapter 10.3.4), the ATH command is needed to terminate the connection. Alternatively, in data transfer mode, DTE originated DTR toggling or PPP disconnection may be used.

13.12.2 Syntax

Type	Syntax	Response	Example
Action	ATH	OK	

13.13 UE modes of operation for EPS +CEMODE

+CEMODE						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

13.13.1 Description

Sets the MT to operate according to the specified mode of operation for EPS, see 3GPP TS 24.301 [88]. If the requested operation mode is not supported, an error result code is returned.

u-blox cellular modules are certified according to all the capabilities and options stated in the Protocol Implementation Conformance Statement document (PICS) of the module. The PICS, according to 3GPP TS 51.010-2 [84], 3GPP TS 34.121-2 [85], 3GPP TS 36.521-2 [115] and 3GPP TS 36.523-2 [116], is a statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

13.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+CEMODE=[<mode>]	OK	AT+CEMODE=1 OK
Read	AT+CEMODE?	+CEMODE: <mode> OK	+CEMODE: 1 OK
Test	AT+CEMODE=?	+CEMODE: (list of supported <mode>'s) OK	+CEMODE: (0-3) OK

13.13.3 Defined values

Parameter	Type	Description
<mode>	Number	Mode configuration: • 0: PS mode 2 of operation. The UE registers only to EPS services, and the UE's usage setting is "data centric" • 1 (default and factory-programmed value for voice capable devices): CS/PS mode 1 of operation. The UE registers to both EPS and non-EPS services, and the UE's usage setting is "voice centric" • 2 (default and factory-programmed value for voice not-capable devices): CS/PS mode 2 of operation. The UE registers to both EPS and non-EPS services, and the UE's usage setting is "data centric" • 3: PS mode 1 of operation. The UE registers only to EPS services, and the UE's usage setting is "voice centric"

13.13.4 Notes

- A UE set to "Data centric" does not disable the E-UTRAN capability if voice services cannot be obtained. Upon receiving combined EPS/IMSI attach accept or combined TA/LA Update accept with "SMS-only" indication, a data centric UE stays in the current RAT and is not allowed to use CSFB. Upon receiving combined EPS/IMSI attach accept or combined TA/LA Update accept with "CSFB Not Preferred" indication, a data centric UE stays in the current RAT and is allowed to use CSFB.
- A UE set to "Voice centric" shall always try to ensure that Voice service is possible. A CSFB and an IMS/CS-voice capable UE set to "Voice centric" unable to obtain voice service in E-UTRAN (e.g. CSFB and IMS voice are not supported or the configured preferences on how to handle voice services prevent usage of

any available voice services), shall disable the E-UTRAN capability, which results in re-selecting GERAN or UTRAN. The E-UTRAN capability is re-enabled by the UE under the conditions described in 3GPP TS 24.301 [88].

- If +CEMODE is set to EPS-only (<mode>=0 or <mode>=3) the +CGCLASS command setting is automatically updated to class "CG".

SARA-R4 / SARA-N4

- The set command is not supported. The operation mode for EPS is network operator specific and handled via the +UMNOPROF command.

13.14 EPS network registration status +CEREG

+CEREG						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

13.14.1 Description

Configures the network registration URC related to EPS domain. The URC assumes a different syntax depending on the network and the <n> parameter:

- +CEREG: <stat> when <n>=1 and there is a change in the MT's EPS network registration status in E-UTRAN
- +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>]] when <n>=2 and there is a change of the network cell in EUTRAN
- +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,<cause_type>,<reject_cause>]] when <n>=3 and the value of <stat> changes
- +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,,[,[<Active_Time>],[<Periodic_TAU>]]]] when <n>=4 if there is a change of the network cell in E-UTRAN
- +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,[<cause_type>],[<reject_cause>][,[<Active_Time>],[<Periodic_TAU>]]]] when <n>=5 and the value of <stat> changes

The parameters <AcT>, <tac>, <ci>, <cause_type>, <reject_cause>, <Active_Time> and <Periodic_TAU> are provided only if available.

The read command returns the status of result code presentation and an integer <stat> which shows whether the network has currently indicated the registration of the MT. The location information elements <tac>, <ci> and <AcT>, if available, are returned only when <n>=2 and the MT is registered with the network. The parameters <cause_type>, <reject_cause>, if available, are returned when <n>=3.

SARA-R4 / SARA-N4
If the EPS MT in GERAN/UTRAN/E-UTRAN also supports circuit mode services and/or GPRS services, the +CREG / +CGREG set and read command result codes apply to the registration status and location information for those services.

13.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+CEREG=[<n>]	OK	AT+CEREG=1 OK
Read	AT+CEREG?	+CEREG: <n>,<stat>[,[<tac>],[<ci>],[<AcT>[,<cause_type>,<reject_cause>]]] OK	+CEREG: 2,1,"3a9b","0000c33d",7 OK
Test	AT+CEREG=?	+CEREG: (list of supported <n>s) OK	+CEREG: (0-3) OK
URC		+CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,<cause_type>,<reject_cause>[,[<Active_Time>],[<Periodic_TAU>]]]]	+CEREG: 1,"3a9b","0000c33d",7

13.14.3 Defined values

Parameter	Type	Description
<n>	Number	Mode configuration: • 0 (default value): network registration URC disabled • 1: network registration URC +CEREG: <stat> enabled • 2: network registration and location information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>]] enabled • 3: network registration, location information and EMM cause value information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,<cause_type>,<reject_cause>]] enabled • 4: PSM, network registration and location information information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,,[,[<Active_Time>],[<Periodic_TAU>]]]] enabled • 5: PSM, network registration, location information and EMM cause value information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,[<cause_type>],[<reject_cause>][,[<Active_Time>],[<Periodic_TAU>]]]] enabled
<stat>	Number	EPS registration status: • 0: not registered, the MT is not currently searching an operator to register to • 1: registered, home network • 2: not registered, but the MT is currently trying to attach or searching an operator to register to • 3: registration denied • 4: unknown (e.g. out of E-UTRAN coverage) • 5: registered, roaming • 8: attached for emergency bearer services only (see 3GPP TS 24.008 [12] and 3GPP TS 24.301 [88] that specify the condition when the MS is considered as attached for emergency bearer services)
<tac>	String	Two bytes tracking area code in hexadecimal format
<ci>	String	Four bytes E-UTRAN cell-id in hexadecimal format
<AcT>	Number	Access technology of the serving cell: • 7: E-UTRAN (see 3GPP TS 44.060 [89] that specifies the System Information messages which give the information about whether the serving cell supports EGPRS) • 8: E-UTRAN EC-GSM-IoT (A/Gb mode) • 9: E-UTRAN Cat NB1
<cause_type>	Number	<reject_cause> type: • 0: indicates that <reject_cause> contains an EMM cause value, see 3GPP TS 24.301 [88] Annex A • 1: indicates that <reject_cause> contains a manufacture-specific cause
<reject_cause>	Number	Cause of the failed registration. The value is of type as defined by <cause_type>
<Active_Time>	String	Indicates the Active Time value (T3324) to be allocated to the UE, one byte in an 8-bit format. For the coding and the value range, see the GPRS Timer 2 IE in 3GPP TS 24.008 [12]
<Periodic_TAU>	String	Indicates the extended periodic TAU value (T3412) to be allocated to the UE in EUTRAN, one byte in an 8-bit format. For the coding and the value range, see the GPRS Timer 3 IE in 3GPP TS 24.008 [12]

13.14.4 Notes

SARA-R4 / SARA-N4

- The parameter <stat> assumes value 6 after module boot or when the module exits the power saving mode.
- <tac>, <ci> and <AcT> should be ignored when the module is not registered.

SARA-R404M / SARA-R410M-01B / SARA-R410M-02B

- <n>= 4 and 5 are not supported.

SARA-R410M-01B / SARA-R410M-02B

- <AcT>=8 reports LTE Cat M1.

13.15 Delete non-active PDP contexts +CGDEL

+CGDEL						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

13.15.1 Description

Removes the indicated PDP context and removes all the associated data related to the indicated PDP contexts that are not activated. The AT command does not delete or remove the information for activated PDP contexts. The removed PDP context is listed by the +CGDEL: <cid> IRC.

If the <cid> parameter points to a primary PDP context, the PDP context will be deleted together with all the linked secondary PDP contexts if none of the PDP contexts are activated.

If the <cid> parameter points to a secondary PDP context, the PDP context will be deleted if it is not activated.

☞ If the parameter <cid> is omitted, all the primary PDP contexts that are not activated or that have any activated secondary PDP contexts will be removed and all secondary PDP contexts that are not activated will be removed. The associated data of all the deleted PDP contexts will be removed, and the removed PDP context are listed by the +CGDEL: <cid>[,<cid>,...]] IRC.

☞ The command removes the associated PDP context data that can be set by the AT commands +CGDCONT, +CGDSCONT, +CGTFT, +CGEQREQ, +CGEQMIN and +CGEQOS. For an attempt to delete PDP context(s) which would violate these rules, an error result code is returned.

13.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGDEL=[<cid>]	+CGDEL: <cid>[,<cid>[,...]]	AT+CGDEL=2
		OK	+CGDEL: 2
			OK
Test	AT+CGDEL=?	OK	OK

13.15.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>

13.16 Configure the authentication parameters of a PDP/EPS bearer +UAUTHREQ

+UAUTHREQ						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	NVM	No	-	+CME Error

13.16.1 Description

Configures the authentication parameters of a defined PDP/EPS bearer. The authentication parameters will be sent during the context activation phase as a protocol configuration options (PCO) information element.

When <auth_type>=3 is set, +CGACT=1,<cid> may trigger at most 3 PDP context activation requests for <cid> to the protocol stack. The first request for <cid> is done with no authentication. If the PDP context activation fails, a second attempt is triggered with PAP authentication. If the second PDP context activation fails, a third attempt is triggered with CHAP authentication. These 3 PDP context activation requests are not to be confused with the effective number of request PDP context activations sent to the network (see the 3GPP TS 24.008 [12]).

☞ The command returns an error result code if the input <cid> is already active or not yet defined.

13.16.2 Syntax

Type	Syntax	Response	Example
Set	AT+UAUTHREQ=<cid>,<auth_type>,<username>,<password>	OK	AT+UAUTHREQ=1,1,"user","pass" OK
Test	AT+UAUTHREQ=?	+UAUTHREQ: (list of supported <cid>s),(list of supported <auth_type>s)[,,] OK	+UAUTHREQ: (1-8),(0-2),, OK

13.16.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>.
<auth_type>	Number	Configure the authentication. Allowed values: • 0: no authentication • 1: PAP • 2: CHAP • 3: automatic selection of authentication type (none/CHAP/PAP)
<username>	String	Username. The default value is an empty string: • SARA-R4 / SARA-N4 - The maximum length is 64.
<password>	String	Password. The default value is an empty string: • SARA-R4 / SARA-N4 - The maximum length is 64.

13.16.4 Notes

- In a PPP dial-up scenario, the authentication parameters set by the +UAUTHREQ command are overwritten whenever the host provides a new setting via the PPP authentication protocol (PAP or CHAP).
- The <username> and <password> parameters must be set to an empty string if the authentication type is not set (<auth_type>=0).

SARA-R4 / SARA-N4

- <auth_type>=3 is not supported.
- If <auth_type>=2, then format is AT+UAUTHREQ=<cid>,<auth_type>,<password>,<username>

13.17 PDP Context Read Dynamic Parameters +CGCONTRDP

+CGCONTRDP						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

13.17.1 Description

Returns the relevant information <bearer_id>, <APN>, <local_addr_and_subnet_mask>, <gw_addr>, <DNS_prim_addr>, <DNS_sec_addr>, <P-CSCF_prim_addr>, <P-CSCF_sec_addr>, <IM_CN_Signalling_Flag> and <LIPA_indication> for an active non secondary PDP context with the context identifier <cid>.

If the MT has dual stack capabilities, for each <cid> will be printed two different rows: the first one will contain the IPv4 parameters, in the second one the IPv6 parameters.

A set command with an undefined <cid> provides an error result code.

13.17.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGCONTRDP[=<cid>]	+CGCONTRDP: <cid>,<bearer_id>,<APN>[,<local_addr_and_subnet_	AT+CGCONTRDP=1

Type	Syntax	Response	Example
		mask>[,<gw_addr>[,<DNS_prim_addr>[,<DNS_sec_addr>[,<P-CSCF_prim_addr>[,<P-CSCF_sec_addr>[,<IM_CN_Signalling_Flag_Ind>[,<LIPA_indication>]]]]]]] [+CGCONTRDP: <cid>,<bearer_id>,<APN>[,<local_addr_and_subnet_mask>[,<gw_addr>[,<DNS_prim_addr>[,<DNS_sec_addr>[,<P-CSCF_prim_addr>[,<P-CSCF_sec_addr>[,<IM_CN_Signalling_Flag_Ind>[,<LIPA_indication>]]]]]]]] OK	+CGCONTRDP: 1,0,"web.omnitel.it", "109.113.62.238.255.255.255.255", "109.113.62.201","83.224.70.77", "83.224.70.54",,,,0 OK
Test	AT+CGCONTRDP=?	+CGCONTRDP: (list of active non secondary PDP contexts) OK	+CGCONTRDP: 1 OK

13.17.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<APN>	String	See <APN>
<bearer_id>	Number	Identifies the bearer, i.e. the EPS bearer in EPS and the NSAPI in UMTS/GPRS. The range goes from 5 to 16
<local_addr_and_subnet_mask>	String	IP address and subnet mask of the MT. The string is given as dot-separated numeric (0-255) parameters on the form: • "a1.a2.a3.a4.m1.m2.m3.m4" for IPv4 • "a1.a2.a3.a4.a5.a6.a7.a8.a9.a10 .a11.a12.a13.a14.a15.a16.m1.m2.m3.m4.m5.m6.m7.m8.m9.m10 .m11.m12.m13.m14.m15.m16" for IPv6
<gw_addr>	String	Gateway Address of the MT. The string is given as dot-separated numeric (0-255) parameters.
<DNS_prim_addr>	String	IP address of the primary DNS server.
<DNS_sec_addr>	String	IP address of the secondary DNS server.
<P-CSCF_prim_addr>	String	IP address of the primary P-CSCF server.
<P-CSCF_sec_addr>	String	IP address of the secondary P-CSCF server.
<IM_CN_Signalling_Flag_Ind>	Number	Shows whether the PDP context is for IM CN subsystem-related signalling only or not: • 0: PDP context is not for IM CN subsystem-related signalling only • 1: PDP context is for IM CN subsystem-related signalling only
<LIPA_indication>	Number	Indicates that the PDP context provides connectivity using a LIPA PDN connection. This parameter cannot be set by the TE: • 0: indication not received that the PDP context provides connectivity using a LIPA PDN connection • 1: indication received that the PDP context provides connectivity using a LIPA PDN connection

13.18 PDP IP configuration when roaming +UDCONF=75

+UDCONF=75						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

13.18.1 Description

Configures the PDP IP when roaming. When set, the PDP IP can be limited to IPv4, IPv6, or IPv4v6 when roaming on a network.

The configuration will be effective at the next power on.

Only one PDP profile can be set using this command.

13.18.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=75,<cid>,<PDP_IP_conf>	OK	AT+UDCONF=75,1,0 OK
Read	AT+UDCONF=75	+UDCONF: 75,<cid>,<PDP_IP_conf> OK	AT+UDCONF=75 +UDCONF: 75,1,0 OK

13.18.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>.
<PDP_IP_conf>	Number	PDP IP configuration when roaming: • 0: IP • 1: IPv6 • 2: IPv4v6 See <PDP_type>.

13.18.4 Notes

SARA-R4 / SARA-N4

- Set the <PDP_IP_conf> parameter before to read it.

13.19 Disable data when roaming +UDCONF=76

+UDCONF=76						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

13.19.1 Description

Disables the PDP when roaming. When disabled, the PDP will not be able to send data when roaming on a network. The default is value is "off".

The configuration will be effective at the next power on.

Only one PDP profile can be set using this command.

13.19.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=76,<cid>,<Data_Flag>	OK	AT+UDCONF=76,1,0 OK
Read	AT+UDCONF=76	+UDCONF: 76,<cid>,<Data_Flag> OK	AT+UDCONF=76 +UDCONF: 76,1,0 OK

13.19.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>.
<Data_Flag>	Number	PDP data configuration when roaming:

Parameter	Type	Description
		• 0 (default value): OFF - PDP is enabled when roaming • 1: ON - PDP is disabled when roaming

13.19.4 Notes

SARA-R4 / SARA-N4

- Set the <Data_Flag> parameter before to read it.

14 System features

14.1 Firmware installation +UFWINSTALL

+UFWINSTALL						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	FW Install Error

14.1.1 Description

Triggers the FW installation procedure, starting from the file (update binary file) stored in the module file system. It could be used as a part of implementation of the FOTA procedure. The command causes a SW system reset with network deregistration.

During the update process, the device cannot be used to make calls, even emergency calls. The update process is fault tolerant, even if the battery is suddenly removed.

At the end of a successful installation, the main firmware software boots up, NVM and profiles data are set to the factory-programmed values of the new firmware version and the SIM is reset (the PIN will be required if enabled).

☞ SARA-R4 / SARA-N4
Refer to the specific firmware update release notes for information concerning NVM after installing the firmware.

☞ Once the command has been sent correctly, the FW resets and at the next boot-up, the FW install will start.

☞ In case of power loss during the install phase, at the next module wake-up a fault is detected and the module remains in Firmware Install Mode until the end of the procedure (install terminated).

The command syntax differs depending on the module: see the corresponding subsection for the correct command handling.

14.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UFWINSTALL	OK	AT+UFWINSTALL OK
Test	AT+UFWINSTALL=?	OK	OK

14.1.3 Notes

SARA-R4 / SARA-N4

- After the command is issued, the module reboots and starts the install process which can take up to 20 minutes long. No result codes are issued on the terminal during this phase and both UART and USB interfaces are unavailable for the communication. At the end of the update process the module reboots again with the new firmware installed.
- Store the update file on the device; the procedure for storing is up to the user (+UFTPC, +UFWUPD or +UDWNFILE).

14.2 Firmware update Over AT (FOAT) +UFWUPD

+UFWUPD						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	< 20 s	FOAT Error

14.2.1 Description

Triggers the firmware update using the Xmodem or Xmodem-1k protocol.

The command syntax differs depending on the module series: see the corresponding subsection for the correct command handling.

☞ The errors (data corruption, data loss, etc.) during the Update phase are internally handled by the Xmodem protocol itself; for more details about the error result codes, see FOAT error result codes.

☞ If no data comes to the module after having issued the AT+UFWUPD command, up to ten NACK are sent and then Firmware Update Mode is dropped out coming back to normal mode; the FW is unchanged and still useable (ERROR1).

14.2.2 Description

Making use of the file triggers the firmware download using the Xmodem or Xmodem-1k protocols.

☞ In case of power loss during the download, at the next module wake-up the module remains in Firmware Download Mode expecting that the download restarts from the beginning.

14.2.3 Syntax

Type	Syntax	Response	Example
Set	AT+UFWUPD=<filetype>	+UFWUPD: ONGOING CCC<NACK><NACK><NACK> <NACK><NACK><NACK><NACK> <NACK><NACK><NACK> OK	AT+UFWUPD=3 +UFWUPD: ONGOING CCC<NACK><NACK><NACK> <NACK><NACK><NACK><NACK> <NACK><NACK><NACK> OK
Test	AT+UFWUPD=?	+UFWUPD: (list of supported <filetype>s) OK	+UFWUPD: (3) OK

14.2.4 Defined values

Parameter	Type	Description
<filetype>	Number	Download type: • 3: firmware image update

14.2.5 Notes

SARA-R404M

- Status updates on the file transfer via CCC or <NACK><NACK><NACK> are not sent to the terminal.

14.3 Antenna detection +UANTR

+UANTR						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

14.3.1 Description

Measures the DC component of load of the cellular antenna (the GPS antenna is RFU). The antenna load is expressed in kOhm.

14.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UANTR=[<antenna_id>]	+UANTR: <antenna_id>,<antenna_load> OK	AT+UANTR=0 +UANTR: 0,10 OK
Test	AT+UANTR=?	+UANTR: (list of supported <antenna_id>s) OK	+UANTR: (0) OK

14.3.3 Defined values

Parameter	Type	Description
<antenna_id>	Number	Antenna identifier (optional parameter) • 0 (default value): cellular antenna • 1: GPS antenna (RFU)
<antenna_load>	Number	Measured value in kOhm of the antenna load with a resolution of 1 kOhm. The range goes from -1 to 53 (only integer values can be assumed), where: • -1: open circuit • 0: short circuit • 1: 1 kOhm (minimum limit of the measurement range) ... • 53: 53 kOhm (maximum limit of the measurement range)

14.3.4 Notes

- The load resistor values below the minimum limit of 1 kOhm are identified as short circuit (<antenna_load>=0), while values above the maximum limit of 53 kOhm are identified as open circuit (<antenna_load>=-1).
- The reported value could differ from the real resistance value of the diagnostic resistor mounted inside the antenna assembly due to antenna cable length, antenna cable capacity and the measurement method.

14.4 Power saving control (Power SaVing) +UPSV

+UPSV						
Modules	SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

14.4.1 Description

Sets the UART power saving configuration, but it has a global effect on the module power saving configuration:

- If the power saving is enabled (+UPSV: 4), the UART interface is disabled after 6 s of inactivity and the module enters the idle mode automatically whenever possible

- If the power saving is disabled (+UPSV: 0), the UART interface is always enabled and the module does not enter the idle mode

14.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UPSV=<mode>	OK	AT+UPSV=4 OK
Read	AT+UPSV?	+UPSV: <mode> OK	+UPSV: 0 OK
Test	AT+UPSV=?	+UPSV: (list of supported <mode>s) OK	+UPSV: (0,4) OK

14.4.3 Defined values

Parameter	Type	Description
<mode>	Number	Power saving configuration. Allowed values: • 0 (default and factory-programmed value): power saving disabled • 4: power saving is controlled by the UART **TX** line activity

14.4.4 Notes

- For a detailed explanation of modules' operating modes, modules and interfaces behavior in reference to the +UPSV command setting, see the corresponding system integration manual.

14.5 End user test +UTEST

+UTEST						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

14.5.1 Description

Enables the module testing on the RF parts and all the digital pins.

The usage of this command shall be restricted to controlled (shielded chamber/box) environments and for test purposes only.

u-blox assumes no responsibilities for the inappropriate use of this command.

14.5.2 RF test description

Sets the module in non-signalling (or test) mode, or returns to the signalling (or normal) mode.

In test/non-signalling mode, the module switches off the protocol stack for performing single tests which could not be performed during signalling mode.

Improper usage of this command on a real network could disturb other users and the network itself.

When entering the test mode, it is possible to sequentially trigger the following actions for testing purposes (also depending on the RATs supported by the module):

- 2G transmission of a GSM burst sequence on the desired channel and power level (only one time slot configuration is available)
- 2G transmission of an 8-PSK modulation burst sequence on the desired channel and power level (only one time slot configuration is available)
- 3G transmission of a WCDMA signal on the desired channel and power level
- 4G transmission of an LTE SC-FDMA OFDM signal (5 MHz bandwidth) in the desired channel in the FDD band and power level

- 4G transmission of LTE SC-FDMA OFDM signal (5 MHz bandwidth) in the desired channel in TDD band and power level
- Receiving signal detection and RF level measurement on the desired 2G, 3G or 4G (LTE) channel
- Receiving signal detection at diversity or secondary antenna input and RF level measurement on the desired 2G, 3G or 4G (LTE) channel

☞ The command only accepts the parameter set supported by the specific module version. When an unsupported parameter is issued, an error result code will be provided ("+CME ERROR: operation not supported" or "+CME ERROR: 4" depending on the +CMEE AT command setting).

The execution of these actions is performed in non-signalling mode. In non-signalling mode:

- The module only accepts +UTEST commands

☞ SARA-R4 / SARA-N4
The module also accepts some non-signaling related commands. Although it is recommended that only +UTEST commands are used.

In normal mode:

- The only allowed +UTEST command is the AT+UTEST=1 used to enable the testing interface
- All other +UTEST commands return an error result code ("+CME ERROR: operation not allowed" or "+CME ERROR: 3" depending on the +CMEE AT command setting)

☞ The module must not be registered with the network before entering the non-signalling mode, otherwise an error result code ("+CME ERROR: operation not allowed" or "+CME ERROR: 3" depending on the +CMEE AT command setting) is provided.

☞ The +CMEE command can only be set in normal mode.

To return to the normal mode, perform one of these actions:

- A module reset
- Power off the module
- Send AT+UTEST=0 (depending on the module series, a reboot could be automatically performed; for more details, see the End User Test Application Note [133])

When the module returns the normal mode, the network registration status stored in the profile will be restored.

☞ See the End User Test Application Note [133] for further test command examples.

14.5.3 Syntax

Type	Syntax	Response	Example
Set	AT+UTEST=<mode>,[<par1>],[<par2>],[<par3>],[<par4>],[<par5>]	If <mode>=0 or 1 OK	AT+UTEST=0 OK
		If <mode>=2 or 3 +UTEST: [<par1>,<par2>][,<par3>,<par4>,<par5>][,<min>,<avg>,<max>] OK	AT+UTEST=2,124,250 +UTEST: 124,250,-80,-80,-80 OK
Read	AT+UTEST?	+UTEST: <mode> OK	+UTEST: 1 OK
Test	AT+UTEST=?	+UTEST: (list of supported <mode>s) OK	+UTEST: (0-3) OK

14.5.4 Defined values

Parameter	Type	Description
<mode>	Number	Test mode setting: • 0: the module returns to the module normal mode • 1: the module enters non-signalling mode • 2: RX test mode (measuring the antenna level estimation of the received RF signal)

Parameter	Type	Description
		• 3: TX test mode (GSMK/8-PSK burst or transmission in 3G bands)
<par1>..<par5>	Number	Parameters needed for RX and TX test mode as reported in the table below.

14.5.5 Notes

- Check the corresponding module data sheet for the list of supported bands and Radio Access Technologies (RAT).
- **RX mode setting (<mode>=2)**

Parameter	Description	Range	Default	Notes
<par1>	Channel	0 ÷ 165535	32	RX channel 2G RAT: for 850, 900, 1800 bands the value corresponds to ARFCN while for 1900 band an offset of 32768 is added. o [0-124]: GSM 900 MHz o [128-251]: GSM 850 MHz o [512-885]: DCS 1800 MHz o [975-1023]: EGSM 900 MHz o [33280-33578]: PCS 1900 MHz (corresponding to ARFCN 512-810 range in band 1900) RX channel 3G RAT: the value corresponds to UARFCN except for band 19 where an offset of 20000 is added, additional channels available in some 3G bands are not supported. o [1537-1738]: band 4 (1700 MHz) o [2937-3088]: band 8 (900 MHz) o [4357-4458]: band 5 (850 MHz) o [4387-4413]: band 6 (800 MHz) o [20712-20763]: band 19 (800 MHz) o [9662-9938]: band 2 (1900 MHz) o [10562-10838]: band 1 (2100 MHz) o [10050-10125]: TD-SCDMA band 34 (2000 MHz) o [9400-9600]: TD-SCDMA band 39 (1900 MHz) RX channel 4G RAT: the value corresponds to EARFCN with an offset of 100000.

<par1> range	LTE band	EARFCN range
[100000-100599]	FDD 1	[0-599]
[100600-101199]	FDD 2	[600-1199]
[101200-101949]	FDD 3	[1200-1949]
[101950-102399]	FDD 4	[1950-2399]
[102400-102649]	FDD 5	[2400-2649]
[102650-102749]	FDD 6	[2650-2749]
[102750-103449]	FDD 7	[2750-3449]
[103450-103799]	FDD 8	[3450-3799]
[103800-104149]	FDD 9	[3800-4149]
[105010-105179]	FDD 12	[5010-5179]
[105180-105279]	FDD 13	[5180-5279]
[105730-105849]	FDD 17	[5730-5849]
[105850-105999]	FDD 18	[5850-5999]
[106000-106149]	FDD 19	[6000-6149]
[106150-106449]	FDD 20	[6150-6449]
[108040-108689]	FDD 25	[8040-8689]
[108690-109039]	FDD 26	[8690-9039]
[109210-109659]	FDD 28	[9210-9659]
[109660-109769]	FDD 29	[9660-9769]
[136200-136349]	TDD 34	[36200-36349]
[137750-138249]	TDD 38	[37750-38249]
[138250-138649]	TDD 39	[38250-38649]
[138650-139649]	TDD 40	[38650-39649]

Parameter	Description	Range	Default	Notes
				<par1> range / LTE band / EARFCN range [139650-141589] / TDD 41 / [39650-41589]
				Table 11: <par1> parameter range
				The "+CME ERROR: operation not supported" or "+CME ERROR: 4" error result code will be provided in these cases (depending on the +CMEE AT command setting): o A value not belonging to the above ranges is set o The RX channel parameter value belongs to a not supported RAT (2G or 3G or 4G RAT) or band
<par2>	Time	1 ÷ 600000	1000	Time interval for RX test expressed in ms
<par3>	Antenna diversity	0 ÷ 1	0	Receiver path: o 0: main / primary antenna o 1: diversity / secondary antenna The parameter is available only if supported, otherwise an error result code will be provided ("+CME ERROR: operation not supported" or "+CME ERROR: 4" depending on the +CMEE AT command setting)
<min>	Minimum antenna RF level estimation	-100 ÷ -20		Expressed in dBm, for 2G RAT SARA-R4 / SARA-N4 The range goes from -75 to -20.
<avg>	Average antenna RF level estimation	-100 ÷ -20		Expressed in dBm, for 2G RAT SARA-R4 / SARA-N4 The range goes from -75 to -20.
<max>	Maximum antenna RF level estimation	-100 ÷ -20		Expressed in dBm, for 2G RAT SARA-R4 / SARA-N4 The range goes from -75 to -20.

- **TX mode setting (<mode>=3)**

Parameter	Description	Range	Default	Notes
<par1>	Tx channel	0 ÷ 165535	32	TX channel 2G RAT: for 850, 900, 1800 bands the value corresponds to ARFCN while for 1900 band an offset of 32768 is added. o [0-124]: GSM 900 MHz o [128-251]: GSM 850 MHz o [512-885]: DCS 1800 MHz o [975-1023]: EGSM 900 MHz o [33280-33578]: PCS 1900 MHz (corresponding to ARFCN 512-810 range in band 1900) TX channel 3G RAT: the value corresponds to UARFCN except for the band 19 where an offset of 20000 is added, additional channels available in some 3G bands are not supported. o [1312-1513]: band 4 (1700 MHz) o [2712-2863]: band 8 (900 MHz) o [4132-4233]: band 5 (850 MHz) o [4162-4188]: band 6 (800 MHz) o [20312-20363]: band 19 (800 MHz) o [9262-9538]: band 2 (1900 MHz) o [9612-9888]: band 1 (2100 MHz) o [10050-10125]: TD-SCDMA band 34 (2000 MHz) o [9400-9600]: TD-SCDMA band 39 (1900 MHz) TX channel 4G RAT: the value corresponds to EARFCN with an offset of 100000.

Parameter	Description	Range	Default	Notes

<par1> range	LTE band	EARFCN range
[118000-118599]	FDD 1	[18000-18599]
[118600-119199]	FDD 2	[18600-19199]
[119200-119949]	FDD 3	[19200-19949]
[119950-120399]	FDD 4	[19950-20399]
[120400-120649]	FDD 5	[20400-20649]
[120650-120749]	FDD 6	[20650-20749]
[120750-121449]	FDD 7	[20750-21449]
[121450-121799]	FDD 8	[21450-21799]
[121800-122149]	FDD 9	[21800-22149]
[123010-123179]	FDD 12	[23010-23179]
[123180-123279]	FDD 13	[23180-23279]
[123730-123849]	FDD 17	[23730-23849]
[123850-123999]	FDD 18	[23850-23999]
[124000-124149]	FDD 19	[24000-4149]
[124150-124449]	FDD 20	[24150-24449]
[126040-126689]	FDD 25	[26040-26689]
[126690-127039]	FDD 26	[26690-27039]
[127210-127659]	FDD 28	[27210-27659]
[136200-136349]	TDD 34	[36200-36349]
[137750-138249]	TDD 38	[37750-38249]
[138250-138649]	TDD 39	[38250-38649]
[138650-139649]	TDD 40	[38650-39649]
[139650-141589]	TDD 41	[39650-41589]

Table 12: <par1> parameter range

The "+CME ERROR: operation not supported" or "+CME ERROR: 4" error result code will be provided in these cases (depending on the +CMEE AT command setting):

- A value not belonging to the above ranges is set
- The TX channel parameter value belongs to a not supported RAT (2G or 3G or 4G RAT) or band

Avoid channels that would put the TX waveform outside the band due to SC-FDMA modulation bandwidth.

<par2>	Power control level	-56 ÷ 24	5	For 2G RAT: PCL (power control level). The allowed values depend on the related <par1> value: lower numbers means higher power level. o [0-19]: GSM 850 and 900, if <par2> is less than 5 the handling is the same for <par2>=5 o [0-15]: DCS 1800 and PCS 1900 In case <par4> is set to 2 (8-PSK modulation) the range is as below. Other values are valid but behave as the indicated level: o [0-19]: GSM 850 and 900 if <par2> is less than 8 the handling is the same for <par2>=8 o [0-15]: DCS 1800 and PCS 1900; if <par2> is less than 2 the handling is the same for <par2>=2 For 3G RAT: absolute output power [dBm] o [-56 ÷ 24] for all the bands For 4G RAT: absolute output power [dBm] o [-40 ÷ 24] for all the bands

Parameter	Description	Range	Default	Notes
				Only the values indicated in the above ranges are valid, otherwise an error result code will be provided ("+CME ERROR: operation not supported" or "+CME ERROR: 4" depending on the +CMEE AT command setting).
<par3>	Training sequence	0 ÷ 7	5	Training sequence to be used (to be changed only in case of link with network simulator, else use default) In 3G / 4G RAT the values is unused.
<par4>	Modulation mode	1 ÷ 2	1	Modulation mode: o 1: GMSK normal modulation including the training sequence o 2: 8-PSK normal modulation including the training sequence In 3G / 4G RAT the parameter is ignored. LTE SC-FDMA OFDM modulation (5 MHz bandwidth), FDD, is automatically set using for <par1> an EARFCN value. The LTE Cat.M1 SC-FDMA OFDM modulation (1.4 MHz bandwidth), FDD, is automatically set using an EARFCN value for the <par1> parameter.
<par5>	Time	0 ÷ 600000	1000	Time interval for TX test expressed in ms o 0: burst sequence is continuously transmitted. In this case the command will immediately return the information text response. The command line will be immediately available for any +UTEST command. Provide AT+UTEST=1 command to stop the burst sequence transmission, any other +UTEST commands can be set and the current sequence transmission is stopped.

14.5.6 SARA-R4 Examples

In RX mode test command examples the module provides the information text response after the timeout issued in the set command.

Command	Response	Description
AT+UTEST=2	+UTEST: 32,1000,-89,-88,-87 OK	The module measures the antenna RX level at RX channel 32 band GSM 900 for 1 s interval. In the example -89,-88,-87 are the antenna RF level estimation: the numbers are just an example.
AT+UTEST=2,885,5000	+UTEST: 885,5000,-66,-65,-65 OK	The module measures the antenna RX level at RX channel 885 band DCS 1800 for 5 s interval.
AT+UTEST=2,10562,2000	+UTEST: 10562,2000,-60,-60,-59 OK	The module measures the antenna RX level at RX channel 10562 band B1 for 2 s interval on the main antenna path.
AT+UTEST=2,10562	+UTEST: 10562,1000,0,-85,-85,-85 OK	The module measures the antenna RX level at RX channel 10562 band B1 for 1 s interval on the main antenna path.
AT+UTEST=2,65,3000,0	+UTEST: 65,3000,0,-63,-62,-62 OK	The module measures the antenna RX level at RX channel 65 band GSM 900 for 3 s interval on the main antenna path.
AT+UTEST=2,4357,,1	+UTEST: 4357,1000,1,-51,-51,-51 OK	The module measures the antenna RX level at RX channel 4357 band B5 for 1 s interval on the diversity antenna path.
AT+UTEST=2,102174,500,0	+UTEST: 102174,500,0,-71,-70,-70 OK	The module measures the antenna RX level at RX channel 2174 band FDD 4 for 0.5 s interval on the primary antenna path.

Command	Response	Description
AT+UTEST=2,105230,,1	+UTEST: 105230,1000,1,-72,-71,-70 OK	The module measures the antenna RX level at RX channel 5230 band FDD 13 for 1 s interval on the secondary antenna path.
AT+UTEST=2,109690,,0	+UTEST: 109690,1000,0,-52,-51,-50 OK	The module measures the antenna RX level at RX channel 9690 band FDD 29 for 1 s interval on the primary antenna path.
AT+UTEST=2,109690,,1	+UTEST: 109690,1000,1,-52,-51,-50 OK	The module measures the antenna RX level at RX channel 9690 band FDD 29 for 1 s interval on the secondary antenna path.

Table 13: RX mode test command examples

Command	Response	Description
AT+UTEST=3,32,7,5	+UTEST: 32,7,5,1,1000 OK	The module will transmit for 1 s interval 1 slot burst sequence at TX channel 32 GSM 900 at PCL 5 using training sequence 5 and normal GMSK modulation.
AT+UTEST=3,65,8,,2,5000	+UTEST: 65,8,5,2,5000 OK	The module will transmit for 5 s interval 1 slot burst sequence at TX channel 65 GSM 900 at PCL 8 (gamma 6, 27 dBm) using training sequence 5 and normal 8-PSK modulation.
AT+UTEST=3,660,,,,0	+UTEST: 660,5,5,1,0 OK	The module will transmit continuously 1 slot burst sequence at TX channel 660 DCS 1800 at PCL 5 using training sequence 5 and normal GMSK modulation.
AT+UTEST=3,9612,22,,,2000	+UTEST: 9612,22,5,1,2000 OK	The module will transmit for 2 s interval at TX channel 9612 band B1 at 22 dBm power level using WCDMA modulation.
AT+UTEST=3,120399,15,,,3000	+UTEST: 120399,15,5,1,3000 OK	The module transmits for 3 s interval at TX channel 20399 band FDD 4 at 15 dBm power level using SC-FDMA OFDM modulation 5 MHz bandwidth.
AT+UTEST=3,123230,-10,,,0	+UTEST: 123230,-10,5,1,0 OK	The module continuously transmits at TX channel 23230 band FDD 13 at -10 dBm power level using SC-FDMA OFDM modulation 5 MHz bandwidth.

Table 14: TX mode test command examples

14.5.7 Digital pins testing description

Defines the commands to perform some verifications on all the digital pins of the u-blox cellular modules.

These pins can be considered as generic digital input / output pins; it is possible to configure one pin as a digital output with "high" logic level and then verify the voltage level present. Conversely, it is possible set a pin as a digital input, externally apply a "high" or "low" logic level and then check if the module is able to correctly measure the voltage level applied.

After the execution of the AT+UTEST=10,5 command, it is possible to externally apply a voltage level to the enabled input pins and / or measure the voltage level on the pins configured as digital input.

These commands are intended for production to check the correct digital pins behavior, detect possible soldering or functional problems and can be executed only in non-signalling mode (otherwise the "+CME ERROR: operation not allowed" or "+CME ERROR: 3" error result code - depending on the +CMEE AT command setting - is issued without performing any operations).

Do not exceed the values reported in the Generic Digital Interface section of the module data sheet when testing a pin as a digital input pin, since stressing the device above the listed ratings may cause a permanent damage of the module.

SARA-R4 / SARA-N4
See the End User Test Application Note [133] and the corresponding module data sheet for the list of pins available for testing and their levels characteristics and further test command examples.

14.5.8 Syntax

Type	Syntax	Response	Example
Digital pins testing generic syntax			
Set	AT+UTEST=10,<op_code>[,[<bit_padding>]<pin_seq>]	OK	AT+UTEST=10,3,"0000001000000300" OK
Original configuration restoring			
Set	AT+UTEST=10,0	OK	AT+UTEST=10,0 OK
Pins set definition			
Set	AT+UTEST=10,2,[<bit_padding>]<pin_seq>	OK	AT+UTEST=10,2,"0000000C300000003000" OK
Pins configuration			
Set	AT+UTEST=10,3,[<bit_padding>]<pin_seq>	OK	AT+UTEST=10,3,"0000000420000001000" OK
Output pins definition			
Set	AT+UTEST=10,4,[<bit_padding>]<pin_seq>	OK	AT+UTEST=10,4,"00000000100000002000" OK
Digital testing execution			
Set	AT+UTEST=10,5	OK	AT+UTEST=10,5 OK
Digital value measurement			
Set	AT+UTEST=10,6	<bit_padding>]<pin_seq> OK	AT+UTEST=10,6 00000004100000003000 OK
Read	AT+UTEST?	+UTEST: <mode> OK	+UTEST: 1 OK
Test	AT+UTEST=?	+UTEST: (list of supported <mode>s) OK	+UTEST: (0-3) OK

14.5.9 Defined values

Parameter	Type	Description
<op_code>	Number	Test mode setting: • 0: exits the test interface and restore the pins to the original configuration • 2: defines a set of pins that will be tested and initialize these pins to be ready for testing. The original pins configuration is kept for final restore. In the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: o 0: the pin will not be tested o 1: the pin will be tested (as digital input or output) • 3: configures the logical pins previously enabled for testing as output or input; the command has effect only if AT+UTEST=10,2 has been previously issued. In case a not enabled pin is set as digital input or output, the command does not return an error and the setting is not applied. In the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: o 0: the pin will be set as an output o 1: the pin will be set as an input • 4: configures the value of the output pins under testing; the command has effect only if AT+UTEST=10,3 has been previously issued; The command is not mandatory if there are not output pins to configure. In the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit:

Parameter	Type	Description
		o 0: the pin will output a "low" logic level o 1: the pin will output a "high" logic level • 5: apply the setting change defined with <op_code>= 2 / 3 / 4 and triggers the execution of the digital testing. Digital testing of the pins is possible only after the execution of the AT+UTEST=10,5 command. • 6: returns the logic value of pins under testing (both input and output); in the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: o 0: "low" logic digital level measured at the module pin o 1: "high" logic digital level measured at the module pin
[<bit_padding>]<pin_seq>	Number	Sequence of hexadecimal digits containing the pin information and the action to execute: • SARA-R4 / SARA-N4 - See the Notes and End User Test Application Note [133] for detailed number description

14.5.10 Notes

- Consider these steps to construct the [<bit_padding>]<pin_seq> sequence:
  - o Consider the total number of the module's pins available
    - SARA-R4 / SARA-N4 - 64 pins
  - o When a non-testable pin is selected, the command does not return an error result code but the value is not considered and not applied.
  - o The status of the n-th pin will be represented by the corresponding n-th bit; see the <op_code> description for the notation of each mode setting
  - o Convert each group of four binary digits into its hexadecimal representation

☞ SARA-R4 / SARA-N4
See the End User Test Application Note [133] for the list of pins available for testing.

- An example of the AT commands sequence to test the digital pins is reported in Table 15.

Command	Response	Description
		Configure the formatting of the error result code by means of +CMEE AT command
AT+COPS=2	OK	Deregister the module from the network
AT+UTEST=1	OK	The module enters the test mode
AT+UTEST=10,2,"000007F400C000D83F00"	OK	The command puts the module in Interface initialised state; the command saves the pins status to restore it at the end of the test. Pins enabled for testing: DSR, RI, DCD, DTR, RTS, CTS, GPIO1, GPIO2, GPIO3, GPIO4, I2S1_RXD/GPIO6, I2S1_TXD/GPIO7, GPIO5, I2S1_CLK/GPIO8, I2S1_WA/GPIO9, SPI_SCLK/GPIO10, SPI_MOSI/GPIO11, SPI_MISO/GPIO12, SPI_SRDY/GPIO13, SPI_MRDY/GPIO14
AT+UTEST=10,3,"0000049400040000C01800"	OK	Pins configuration: o DTR, RTS, GPIO3, GPIO4, I2S1_RXD/GPIO6, GPIO5, I2S1_CLK/GPIO8, SPI_MOSI/GPIO11, SPI_MRDY/GPIO14 as input o DSR, RI, DCD, CTS, GPIO1, GPIO2, I2S1_TXD/GPIO7, I2S1_WA/GPIO9, SPI_SCLK/GPIO10, SPI_MISO/GPIO12, SPI_SRDY/GPIO13 as output
AT+UTEST=10,4,"0000036000800018 2700"	OK	Digital logic value of the output pins: o DSR, RI, DCD, CTS, GPIO1, GPIO2, I2S1_TXD/GPIO7, I2S1_WA/GPIO9, SPI_SCLK/GPIO10, SPI_MISO/GPIO12, SPI_SRDY/GPIO13 set to "high".
AT+UTEST=10,5	OK	Configurations made by AT+UTEST=10,2; AT+UTEST=10,3 and AT+UTEST=10,4 are executed.
AT+UTEST=10,6	000007F400C000D83F00 OK	Logic digital value measured at modules pins: o DSR, RI, DCD, DTR, RTS, CTS, GPIO1, GPIO2, GPIO3, GPIO4, I2S1_RXD/GPIO6, I2S1_TXD/GPIO7, GPIO5, I2S1_CLK/GPIO8, I2S1_WA/GPIO9, SPI_SCLK/GPIO10, SPI_MOSI/GPIO11, SPI_MISO/GPIO12, SPI_SRDY/GPIO13, SPI_MRDY/GPIO14: "high" level detected

Command	Response	Description
AT+UTEST=0	OK	Module exits from the test mode and normal pins configurations is restored.

Table 15: Digital pins test command examples

The digital pins can be configured as many times as needed by the testing process; AT+UTEST=10,2 command is not needed any more as the DUT is already in Interface initialised state.

14.6 Internal temperature monitor +UTEMP

+UTEMP						
Modules	SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

14.6.1 Description

Returns the values of internal temperature sensors of the specified unit.

The command handling (sensors position and command syntax) depends on the module series:

- SARA-R4 / SARA-N4 - The AT command returns the value measured by the temperature sensor on the **Die**.

14.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+UTEMP=<unit>	OK	AT+UTEMP=0 OK
Read	AT+UTEMP?	+UTEMP: <die_temp> OK	+UTEMP: 310 OK
Test	AT+UTEMP=?	+UTEMP: (list of supported <unit>) OK	+UTEMP: (0-1) OK

14.6.3 Defined values

Parameter	Type	Description
<unit>	Number	Select the measurement unit for value representation: • 0: values in tenth of Celsius degrees returned • 1: values in tenth of Fahrenheit degrees returned
<die_temp>	Number	Fetched value of Die temperature of the selected measurement unit; the allowed range depends on the measurement unit: • Celsius degrees: [-40; 140] • Fahrenheit degrees: [-40; 284] • 655355: no valid temperature measure is available

14.7 Power Saving Mode Setting +CPSMS

+CPSMS						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	NVM	No	< 10 s	+CME Error

14.7.1 Description

Enable the UEs power saving mode (PSM) and configures the corresponding parameters. The command configures the PSM on the UE, as well as:

- the requested extended periodic RAU value in GERAN/UTRAN

- the requested GPRS READY timer value in GERAN/UTRAN
- the requested extended periodic TAU value in E-UTRAN
- the requested Active Time value

See the URCs provided by command +CEREG for the Active Time value and the extended periodic TAU value that are allocated to the UE by the network in E-UTRAN.

Use the read command to get the assigned values from the network:

- If the power saving mode is enabled (+CPSMS: 1), everything on the device will power down except the real-time clock (RTC) after the expiry of T3324 (Active Time). It will stay powered down until the expiry of T3412 (Extended TAU Timer) or if the Power On line is toggled.
- If the power saving mode is disabled (+CPSMS: 0), the device will not enter Power Save Mode (PSM)

☞ SARA-R4
The URCs provided by the +CEREG AT commands for the Active Time value and the extended periodic TAU value are not supported.

☞ SARA-R4
The read command will return the requested values. See the +UCPSMS AT command to get the values assigned from the network.

14.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPSMS=[<mode>[, <Requested_Periodic_RAU>[, <Requested_GPRS_READY_timer>[, <Requested_Periodic_TAU>[, <Requested_Active_Time>]]]]]	OK	AT+CPSMS=1,,,"01000011","01000011" OK
Read	AT+CPSMS?	+CPSMS: <mode>,[<Requested_Periodic_RAU>],[<Requested_GPRS_READY_timer>], [<Requested_Periodic_TAU>], [<Requested_Active_Time>] OK	+CPSMS: 1,,,"01000011","01000011" OK
Test	AT+CPSMS=?	+CPSMS: (list of supported <mode>s),(list of supported <Requested_Periodic_RAU>s),(list of supported <Requested_GPRS_READY_timer>s),(list of supported <Requested_Periodic_TAU>s),(list of supported <Requested_Active_Time>s) OK	+CPSMS: (0,1,2),,,("00000000"-"11111111"),("00000000"-"11111111") OK

14.7.3 Defined values

Parameter	Type	Description
<mode>	Number	Indication to disable or enable the use of PSM in the UE. Allowed values: • 0 (default and factory-programmed value): disable the use of PSM • 1: enable the use of PSM • 2: disable the use of PSM and reset all parameters for PSM to factory-programmed values.
<Requested_Periodic_RAU>	String	Requested extended periodic RAU (T3312) value to be allocated to the GERAN/UTRAN, one byte in an 8 bit format. For the coding and the value range, see the GPRS Timer 3 IE in 3GPP TS 24.008 [12]
<Requested_GPRS_READY_timer>	String	Requested GPRS READY timer (T3314) value to be allocated to the UE in GERAN/UTRAN, one byte in an 8 bit format. For the coding and the value range, see the GPRS Timer 3 IE in 3GPP TS 24.008 [12]
<Requested_Periodic_TAU>	String	One byte in an 8 bit format. Requested extended periodic TAU value (T3412) to be allocated to the device in E-UTRAN. The requested extended periodic TAU value is coded as one byte (octet 3) of the GPRS Timer 3 information element coded as bit format (e.g. "01000111" equals 70 hours). For the coding and the value range, see the

Parameter	Type	Description
		GPRS Timer 3 IE in 3GPP TS 24.008 Table 10.5.163a/3GPP TS 24.008 [12]. See also 3GPP TS 23.682 [153] and 3GPP TS 23.401 [154]. • SARA-R4 - The factory-programmed value is 150 s. The default value is "01100000".
<Requested_Active_Time>	String	One byte in an 8 bit format. Requested Active Time value (T3324) to be allocated to the UE. The requested Active Time value is coded as one byte (octet 3) of the GPRS Timer 2 information element coded as bit format (e.g. "00100100" equals 4 minutes). For the coding and the value range, see the GPRS Timer 2 IE in 3GPP TS 24.008 Table 10.5.163/3GPP TS 24.008 [12]. See also 3GPP TS 23.682 [153], 3GPP TS 23.060 [10] and 3GPP TS 23.401 [154]. • SARA-R4 - The factory-programmed value is 6 s. The default value is "00000000".

14.7.4 Notes

- The <Requested_Periodic_RAU> and <Requested_GPRS_READY_timer> parameters are not supported.

SARA-R4

- <mode>= 2 is not supported.
- Reboot the module after enabling the Power Save Mode in order to enter the PSM state.
- The PSM mode cannot be enabled with a PIN enabled UICC card.

14.8 Power Saving Mode Assigned Values +UCPSMS

+UCPSMS						
Modules	SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

14.8.1 Description

Reads the UEs power saving mode (PSM) parameters assigned by the network. The command returns the state of PSM on the UE, as well as:

- the requested extended periodic RAU value in GERAN/UTRAN
- the requested GPRS READY timer value in GERAN/UTRAN
- the requested extended periodic TAU value in E-UTRAN
- the requested Active Time value

To be noticed that

- Power saving mode enabled (+UCPSMS: 1): everything on the device is powered down except for the Real Time Clock (RTC) after the expiry of T3324 (Active Time). It will stay powered down until the expiry of T3412 (Extended TAU Timer) or if the Power On line is toggled.
- Power saving mode disabled (+UCPSMS: 0): the device will not enter the Power Save Mode (PSM).

14.8.2 Syntax

Type	Syntax	Response	Example
Read	AT+UCPSMS?	+UCPSMS: <mode>,[<Assigned_Periodic_RAU>],[<Assigned_GPRS_READY_timer>],[<Assigned_Periodic_TAU>],[<Assigned_Active_Time>] OK	+UCPSMS: 1,,,"01000011","01000011" OK

14.8.3 Defined values

Parameter	Type	Description
<mode>	Number	Indication to disable or enable the use of PSM in the UE. Allowed values: • 0: use of PSM disabled • 1: use of PSM enabled

Parameter	Type	Description
<Assigned_Periodic_RAU>	String	Assigned extended periodic RAU (T3312) value allocated to the GERAN/UTRAN, one byte in an 8 bit format. For the coding and the value range, see the GPRS Timer 3 IE in 3GPP TS 24.008 [12]
<Assigned_GPRS_READY_timer>	String	Assigned GPRS READY timer (T3314) value allocated to the UE in GERAN/UTRAN, one byte in an 8 bit format. For the coding and the value range, see the GPRS Timer 3 IE in 3GPP TS 24.008 [12]
<Assigned_Periodic_TAU>	String	One byte in an 8 bit format. Assigned extended periodic TAU value (T3412) allocated to the device in E-UTRAN. The Assigned extended periodic TAU value is coded as one byte (octet 3) of the GPRS Timer 3 information element coded as bit format (e.g. "0 1000111" equals 70 hours). For the coding and the value range, see the GPRS Timer 3 IE in 3GPP TS 24.008 Table 10.5.163a/3GPP TS 24.008 [12]. See also 3GPP TS 23.682 [153] and 3GPP TS 23.401 [154].
<Assigned_Active_Time>	String	One byte in an 8 bit format. Assigned Active Time value (T3324) allocated to the UE. The Assigned Active Time value is coded as one byte (octet 3) of the GPRS Timer 2 information element coded as bit format (e.g. "00100100" equals 4 minutes). For the coding and the value range, see the GPRS Timer 2 IE in 3GPP TS 24.008 Table 10 .5.163/3GPP TS 24.008 [12]. See also 3GPP TS 23.682 [153], 3GPP TS 23.060 [10] and 3GPP TS 23.401 [154].

14.8.4 Notes

SARA-R4 / SARA-N4

- <Assigned_Periodic_RAU> and <Assigned_GPRS_READY_timer> are not supported.

14.9 Set LWM2M FOTA URCs +ULWM2MSTAT

+ULWM2MSTAT						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	-

14.9.1 Description

Allows enabling or disabling of LWM2M FOTA status URCs.

14.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MSTAT=<n>	OK	AT+ULWM2MSTAT=1 OK
Read	AT+ULWM2MSTAT?	+ULWM2MSTAT: <n> OK	+ULWM2MSTAT: 1 OK
Test	AT+ULWM2MSTAT=?	+ULWM2MSTAT: (list of supported <n>s) OK	+ULWM2MSTAT: (0,1) OK
URC		+ULWM2MSTAT: <stat>,<percent>	+ULWM2MSTAT: 1,99

14.9.3 Defined values

Parameter	Type	Description
<n>	Number	Mode configuration: • 0: LWM2M FOTA status URC disabled • 1 (default value): LWM2M FOTA status +ULWM2MSTAT URC enabled
<stat>	Number	LWM2M FOTA status: • 0: FOTA download triggered • 1: FOTA download in progress • 2: FOTA download complete • 3: FOTA download error

Parameter	Type	Description
<percent>	Number	Percentage of FOTA download completed

14.10 Cancel LWM2M FOTA Download +ULWM2M=0

+ULWM2M=0						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	-

14.10.1 Description

When a LWM2M session is in progress and the firmware is being download to the device, the download can be canceled by issuing this command. To make use of this command, URCs for LWM2M FOTA sessions must be enabled. See +ULWM2MSTAT for details on enabling LWM2M URCs.

14.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2M=0	OK	AT+ULWM2M=0 OK

14.11 uFOTA configuration +UFOTACONF

+UFOTACONF						
Modules	SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

14.11.1 Description

Configures the uFOTA registration and timer for periodic connections to the uFOTA server.

14.11.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UFOTACONF=<mode>, <param>	OK	AT+UFOTACONF=2,604800 OK
uFOTA registration			
Set	AT+UFOTACONF=1,<registration>	OK	AT+UFOTACONF=1,1 OK
uFOTA periodic connection			
Set	AT+UFOTACONF=2,<timer>	OK	AT+UFOTACONF=2,604800 OK
Read	AT+UFOTACONF=<mode>	+UFOTACONF: <mode>,<param> OK	+UFOTACONF: 1,1 OK
Test	AT+UFOTACONF=?	+UFOTACONF: (list of supported <mode>s),(list of supported <param>s) OK	+UFOTACONF: (1-2),(-1,1-4294967295) OK

14.11.3 Defined values

Parameter	Type	Description
<mode>	Number	uFOTA parameter to be configured:

Parameter	Type	Description
		• 1: module registration to uFOTA server • 2: timer for periodic connection to the uFOTA server
<registration>	Number	uFOTA registration: • 0: module registration to uFOTA server disabled • 1 (factory-programmed and default value): module registration to uFOTA server enabled
<timer>	Number	Timer for periodic connection to the uFOTA server (in seconds); the factory-programmed and default value is 604800 (7 days): • -1: never periodically connected to the uFOTA server • 1-4294967295: range in seconds for periodic connections
<param>	Number / String	Type and supported content depend on the related <op_code> parameter; details are given above

14.11.4 Notes

SARA-R4 / SARA-N4

- Upon boot-up, the set and read commands will provide an error result code until the LWM2M application is ready which can take up to 45 s.

SARA-R410M-52B / SARA-R412M / SARA-N4

- <mode> = 1 is not supported. Disable the uFOTA registration by means of <mode> = 2 and <timer> = -1.

14.12 Last gasp configuration +ULGASP

+ULGASP						
Modules	SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	< 10 s	+CME Error

14.12.1 Description

The command enables/disables and configures the last gasp feature. The application is automatically triggered by a properly configured GPIO (see GPIO Introduction). The feature supports the sending of a predefined last notification in case of power outage, just before the power goes off. It is assumed that the cellular module is registered to the network when the alarm is triggered; however the command just configures the feature so it is possible to issue it also if PIN is not inserted. It is possible to enable/disable the +UULGASP URC in order to be notified about the operation result.

☞ This AT command must be issued after a proper configuration of the GPIO has been performed via the +UGPIOC command. Otherwise, if +UGPIOC is issued after +ULGASP, the Last Gasp will work only after a reboot.

☞ The parameters will be set to the values stored in the NVM in case they are omitted in the set command.

14.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULGASP=<GPIO_mode>,<text>,<msg_format>,,<profile_id>,<IP_protocol>,<IP_addr:PORT>[,[<method>],,[<urc_enable>],[<nv_upd_freq>],[<tx_count>]]	OK	AT+ULGASP=0,"Power_loss",0,,1,17,"192.168.100.20:8080" OK
Read	AT+ULGASP?	+ULGASP: <GPIO_mode>,<text>,<msg_format>,,<profile_ID>,<IP_protocol>,<IP_addr:PORT>,<method>,,<urc_enable>,<nv_upd_freq>,<tx_count> OK	+ULGASP: 0,"Power_loss",0,,1,17,"192.168.100.20:8080",1,,1,0,1 OK
Test	AT+ULGASP=?	+ULGASP: (list of supported <GPIO_mode>'s),,(list of supported <msg_	+ULGASP: (0-2),,(0-1),,(1),(17),,(1),,(0-1),(0-3600),(1-10)

Type	Syntax	Response	Example
		format>'s),,(list of supported <profile_id>'s),(list of supported <IP_protocol>'s),,(list of supported <method>'s),,(list of supported < urc_enable>'s),(list of supported <nv_upd_freq>'s),(list of supported <tx_count>'s) OK	OK
URC		+UULGASP: <result>,<bearer>	+UULGASP: 0,1

14.12.3 Defined values

Parameter	Type	Description
<GPIO_mode>	Number	Select the interrupt trigger. Allowed values: • 0 (factory-programmed value): trigger disabled; the following arguments will be ignored. • 1: falling edge • 2: rising edge
<text>	String	The string that will be sent upon GPIO movement. Text or binary format can be selected with the <msg_format> parameter. When text format is selected, a maximum of 256 ASCII chars is allowed. When the binary format is selected, a maximum of 512 chars (0-9,A-F) is allowed. Every 8-bit octet of the message must be written as two IRA character long hexadecimal numbers, e.g. an octet with integer value 42 (i.e. 0x2A) must be written as a string of two characters "2A" (IRA 50 and 65). Factory-programmed value: empty string.
<msg_format>	Number	Format of the <text> parameter. Allowed values: • 0 (factory-programmed value): text • 1: binary
<profile_id>	Number	PSD profile identifier. Only the value 1 is allowed.
<IP_protocol>	Number	IP protocol used for socket connection. Allowed values: • 17: UDP
<IP_addr:PORT>	String	IPv4 or IPv6 server address with the socket port. Factory-programmed value: empty string.
<method>	Number	Notification method, it is the way the application send out the <text message>. Allowed values: • 1: use IP (TCP or UDP) connection
<urc_enable>	Number	Flag determining if the URC is to be issued or not. Allowed values: • 0: disabled • 1 (factory-programmed value): enabled
<result>	Number	Operation result. Allowed values: • 0: success • 1: generic fail
<bearer>	Number	Notification used bearer. Allowed values: • 1: IP (TCP or UDP) connection
<nv_upd_freq>	Number	NVM update frequency in seconds. Valid range of 0-3600 seconds indicating how frequently to flush the settings to NVM. A zero value indicates that settings should never be saved to NVM, otherwise the following settings will be saved to NVM based on the timer: <GPIO_mode>, <text>, <IP_addr:PORT>, <urc_enable>, <tx_count>. Factory-programmed value: 60.
<tx_count>	Number	Indicates the number of times to transmit the last gasp message. Valid range is 1-10. Factory-programmed value: 1.

14.12.4 Notes

SARA-R410M-52B / SARA-N4

- The <urc_enable>,<nv_upd_freq>,<tx_count> parameters will return 0, 0 and 0 if read for the first time before setting the mandatory last gasp parameters. Once the mandatory last gasp parameters are set, these values take on the factory-programmed values.

14.13 LWM2M host device information +UHOSTDEV

+UHOSTDEV						
Modules	SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

14.13.1 Description

Sets the host identification, manufacturer model number and software version for the LWM2M device management.

14.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+UHOSTDEV=<Host_ID>,<Host_Manufacturer>,<Host_Model>,<Host_SW_Version>	OK	AT+UHOSTDEV="ubx123456-","u-blox","C030-R410","A1.01" OK
Read	AT+UHOSTDEV?	+UHOSTDEV: <Host_ID>,<Host_Manufacturer>,<Host_Model>,<Host_SW_Version> OK	+UHOSTDEV: "ubx123456-","u-blox","C030-R410","A1.01" OK
Test	AT+UHOSTDEV=?	+UHOSTDEV: (Host_ID),(Host_Manufacturer),(Host_Model) OK	+UHOSTDEV: (Host_ID),(Host_Manufacturer),(Host_Model),(Host_SW_Version) OK

14.13.3 Defined values

Parameter	Type	Description
<Host_ID>	String	Host identification. The factory-programmed value is HMAN0.
<Host_Manufacturer>	String	Host manufacturer name. The factory-programmed value is HMOD0.
<Host_Model>	String	Host model identification. The factory-programmed value is HSW0.
<Host_SW_Version>	String	Host software version. The factory-programmed value is HUID0.

14.14 RING line configuration +URINGCFG

+URINGCFG						
Modules	SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

14.14.1 Description

Configures the RING line of the UART interface for events such as the incoming SMS indication and incoming data. This command is independent of the URC setting for SMS.

The RING line will be asserted when one of the configured events occurs and it remains asserted for 1 s unless another configured event happens (in this case the 1 s timer will be started again).

14.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+URINGCFG=<mode>	OK	AT+URINGCFG=1 OK
Read	AT+URINGCFG?	+URINGCFG: <mode> OK	+URINGCFG: 1 OK

Type	Syntax	Response	Example
Test	AT+URINGCFG=?	+URINGCFG: (list of the supported <mode>s) OK	+URINGCFG: (0-3) OK

14.14.3 Defined values

Parameter	Type	Description
<mode>	Number	Configures the RING line handling: • 0 (factory-programmed value): feature disabled • 1: RING line asserted for incoming SMS • 2: RING line asserted for all the incoming data (PPP, sockets, FTP in Direct Link mode) • 3: RING line asserted for both incoming SMS and all incoming data (PPP, sockets, FTP in Direct Link mode)

14.14.4 Notes

- Configure the UART Ring Indicator (RI) line for the ring indication by means of the +UGPIOC AT command.

14.15 PSM indication +UPSMR

+UPSMR						
Modules	SARA-R412M					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

14.15.1 Description

Enables or disables the URC that indicates the device is about to enter Power Save Mode (PSM) or has exited Power Save Mode.

14.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+UPSMR=<mode>	OK	AT+UPSMR=1 OK
Read	AT+UPSMR?	+UPSMR: <mode> OK	+UPSMR: 1 OK
Test	AT+UPSMR=?	+UPSMR: (list of supported <mode>s) OK	+UPSMR: (0-1) OK
URC		+UUPSMR: <state>	+UUPSMR: 0

14.15.3 Defined values

Parameter	Type	Description
<mode>	Number	Indication to disable or enable the PSM URC: • 0 (factory-programmed value): PSM URC is disabled • 1: PSM URC is enabled
<state>	Number	Indication of the state of the module with respect to PSM: • 0: the module is out of PSM • 1: the module is entering PSM

15 GPIO

15.1 Introduction

The section describes the AT commands used to configure the GPIO pins provided by u-blox cellular modules.

15.1.1 GPIO functions

On u-blox cellular modules, GPIO pins can be opportunely configured as general purpose input or output. Moreover GPIO pins of u-blox cellular modules can be configured to provide custom functions via +UGPIOC AT command. The custom functions availability can vary depending on the u-blox cellular modules series and version: see Table 16 for an overview of the custom functions supported by u-blox cellular modules.

<gpio_mode>	Output	Input	Network status indication	GNSS supply enable	GNSS data ready	GNSS RTC sharing	Jamming detection	SIM card detection	Headset detection	GSM Tx burst indication	Module operating status indication	Module functionality status indication	I^2S digital audio interface	SPI serial interface	Master clock generation	UART (DSR, DTR, DCD and RI) interface	Wi-Fi enable	Ring indication	Last gasp enable	32.768 kHz output	Pad disabled
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	19	32	255
SARA-R404M / SARA-R410M-01B	*	*	*					*			*										*
SARA-R412M / SARA-R410M-02B	*	*	*	*	*			*			*										*
SARA-R410M-52B	*	*	*	*	*			*			*							*	*		*
SARA-N4	*	*	*	*	*			*			*								*		*

Table 16: GPIO custom functions overview

The configuration of the GPIO pins (i.e. the setting of the parameters of the +UGPIOC AT command) is saved in the NVM and used at the next power-on.

15.1.2 GPIO mapping

The number of available GPIO pins and their mapping can vary depending on the u-blox cellular modules series and version. The GPIOs mapping for different u-blox cellular modules is reported in the following tables.

☞ See the corresponding module system integration manual for the functions supported by each GPIO.

<gpio_id>	Pin name	Pin number	Factory-programmed function	Remarks
7	RI	7	UART RI	Only pin 7 can be configured for UART RI line functionality
16	GPIO1	16	Pin disabled	-
23	GPIO2	23	Pin disabled	-
24	GPIO3	24	Pin disabled	-
25	GPIO4	25	Pin disabled	-
42	GPIO5	42	Pin disabled	Only pin 42 can be configured for SIM card detection functionality
19	GPIO6	19	Pin disabled	-

Table 17: SARA-R4 / SARA-N4 series GPIO mapping

☞ SARA-R4 / SARA-N4

When the SIM card detection functionality is enabled, the +CIND AT command reports the status.
When the SIM card detection functionality is enabled, the status can be read with the +UGPIOR AT command.

See the corresponding module system integration manual for the complete overview of all allowed configurations.

15.1.3 Network status indication

When a GPIO pin is configured to provide network status indication, its progress depends on the CS network registration state (see +CREG) and on the module transmission state:

- No service: indicates no network coverage or not registered state
- Registered home network 2G: indicates registered state on home network in 2G RAT
- Registered home network 3G: indicates registered state on home network in 3G RAT
- Registered home network Cat NB1: indicates registered state on home network in Cat NB1
- Registered roaming 2G: indicates registered state with visitor 2G network (roaming in 2G RAT)
- Registered roaming 3G: indicates registered state with visitor 3G network (roaming in 3G RAT)
- Registered roaming Cat NB1: indicates registered state with visitor Cat NB1 network (roaming in Cat NB1)
- Data transmission: indicates voice or data call active either in 2G, 3G or 4G RAT
- Data transmission roaming: indicates voice or data call active either in 2G, 3G or 4G RAT with visitor network

The following figures report the allowed progresses for GPIO pin set as network indication: V_H and V_L values are provided in the corresponding module data sheet in the "Generic Digital Interfaces pins" section.

15.1.3.1 No service (no network coverage or not registered)

- Continuous Output / Low

Figure 1: GPIO pin progress for no service

15.1.3.2 Registered home network 2G

- Cyclic Output / High for 100 ms, Output / Low for 2 s

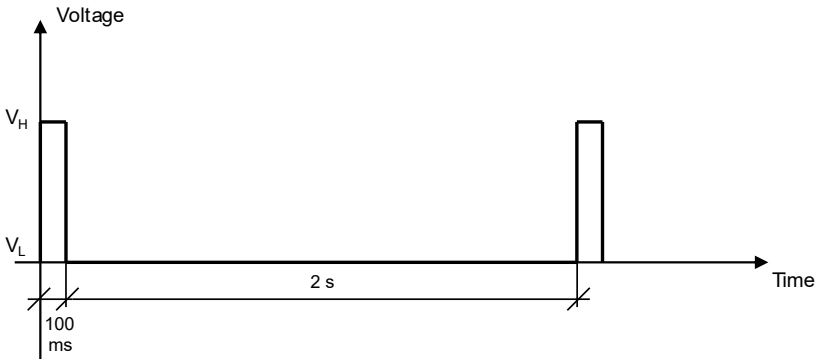

Figure 2: GPIO pin progress for registered home network 2G

15.1.3.3 Registered home network 3G

- Cyclic Output / High for 50 ms, Output / Low for 50 ms, Output / High for 50 ms, Output / Low for 2 s

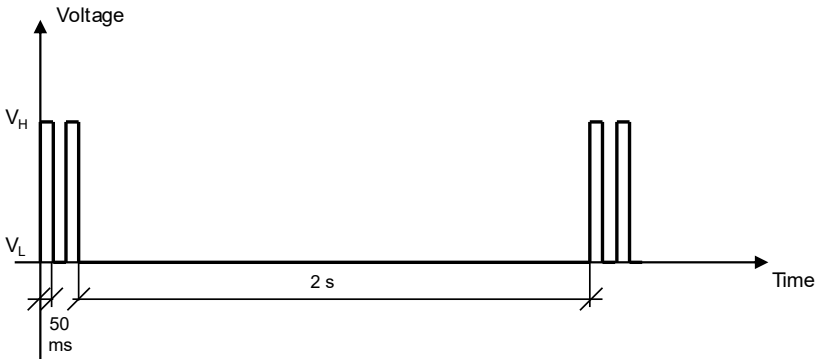

Figure 3: GPIO pin progress for registered home network 3G

15.1.3.4 Registered home network Cat NB1

- Cyclic Output / High for 100 ms, Output / Low for 30 s

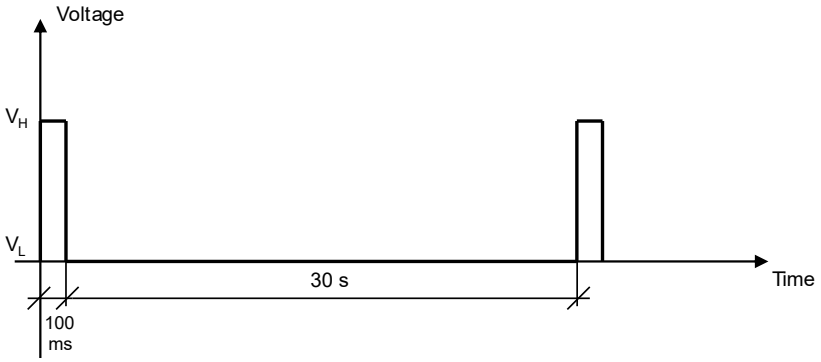

Figure 4: GPIO pin progress for registered home network Cat NB1

15.1.3.5 Registered roaming 2G

- Cyclic Output / High for 100 ms, Output / Low for 100 ms, Output / High for 100 ms, Output / Low for 2 s

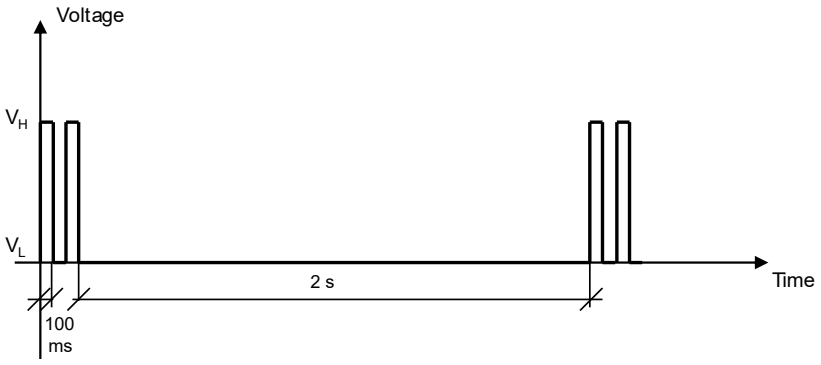

Figure 5: GPIO pin progress for registered roaming 2G

15.1.3.6 Registered roaming 3G

- Cyclic Output / High for 50 ms, Output / Low for 50 ms, Output / High for 50 ms, Output / Low for 100 ms

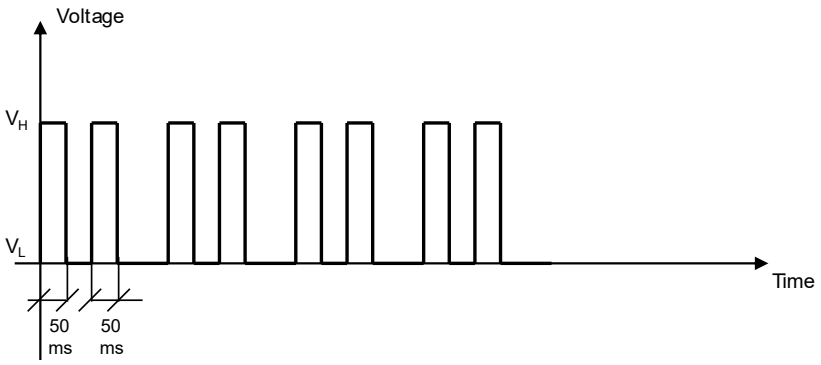

Figure 6: GPIO pin progress for registered roaming 3G

15.1.3.7 Registered roaming Cat NB1

- Cyclic Output / High for 100 ms, Output / Low for 100 ms, Output / High for 100 ms, Output / Low for 30 s

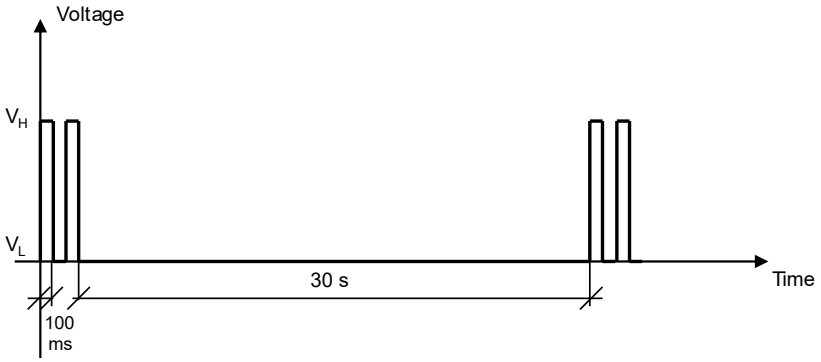

Figure 7: GPIO pin progress for registered roaming Cat NB1

15.1.3.8 Data transmission

- Continuous Output / High

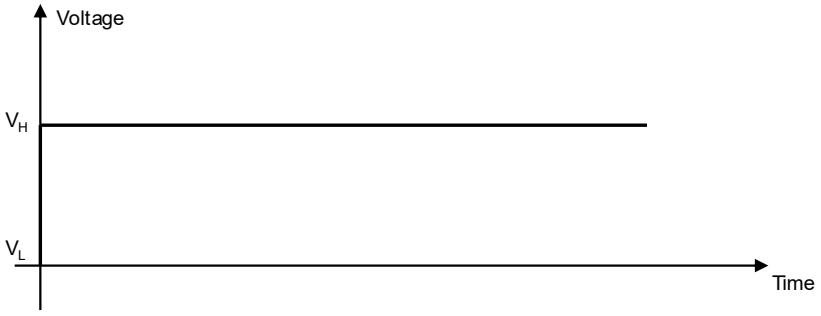

Figure 8: GPIO pin progress for data transmission

15.1.3.9 Data transmission roaming

- Cyclic Output / High for 800 ms, Output / Low for 200 ms

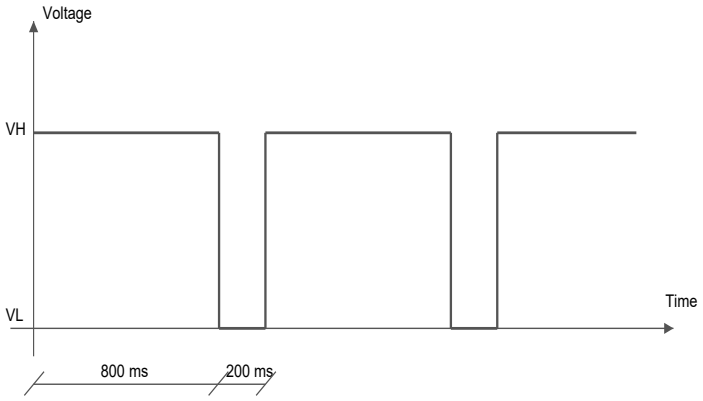

Figure 9: GPIO pin progress for data transmission roaming

SARA-R4 / SARA-N4
When registered on 4G (LTE) network, the GPIO pin progress is the same as for data transmission (Figure 8) because a PDP context/EPS bearer is available.

15.2 GPIO select configuration command +UGPIOC

+UGPIOC						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	< 10 s	+CME Error

15.2.1 Description

Configures the GPIOs pins as input, output or to handle a custom function. When the GPIOs pins are configured as output pin, it is possible to set the value.

The test command provides the list of the supported GPIOs, the supported functions and the status of all the GPIOs.

Not all the GPIO functions can be assigned to each GPIO pin. If the configuration is not allowed, an error result code will be returned (error result code 1502 - "+CME ERROR: Select GPIO mode error").
The following custom functions cannot be simultaneously configured on 2 GPIOs:

- Network status indication
- Ring indication
- GNSS supply enable
- GNSS data ready
- GNSS RTC sharing
- SIM card detection
- Headset detection
- GSM Tx burst indication
- Module operating status indication
- Module functionality status indication
- Last gasp trigger

For more details regarding the custom functions supported by the u-blox cellular modules and the factory-programmed settings, see GPIO functions and GPIO mapping.

15.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPIOC=<gpio_id>,<gpio_mode>[,<gpio_out_val>\<gpio_in_pull>]	OK	AT+UGPIOC=20,0,1 OK
Read	AT+UGPIOC?	+UGPIOC: <gpio_id>,<gpio_mode> [<gpio_id>,<gpio_mode> [....]] OK	+UGPIOC: 20,0 21,3 23,255 24,255 51,7 OK
Test	AT+UGPIOC=?	+UGPIOC: (list of supported <gpio_id>),(list of supported <gpio_mode>),(list of supported <gpio_out_val>\<gpio_in_pull>) [<gpio_id1>,<gpio_mode> ... <gpio_idN>,<gpio_mode>] OK	+UGPIOC: (20,21,23,24,51),(0-5,7,9,255),(0-2) OK

15.2.3 Defined values

Parameter	Type	Description
<gpio_id>	Number	GPIO pin identifier: pin number See the GPIO mapping for the available GPIO pins, their mapping and factory-programmed values on different u-blox cellular modules series and product version.
<gpio_mode>	Number	Mode identifier: configured function See the GPIO functions for custom functions supported by different u-blox cellular modules series and product version. Allowed values: • 0: output • 1: input • 2: network status indication • 3: GNSS supply enable • 4: GNSS data ready • 5: GNSS RTC sharing • 7: SIM card detection • 8: headset detection • 9: GSM Tx burst indication • 10: module operating status indication • 11: module functionality status indication • 12: I^2S digital audio interface • 13: SPI serial interface • 14: master clock generation • 15: UART (DSR, DTR, DCD e RI) interface • 16: Wi-Fi enable • 18: Ring indication • 19: Last gasp enable • 32: 32.768 kHz output • 255: pad disabled
<gpio_out_val>	Number	GPIO output value (for output function <gpio_mode>=0 only): • 0 (default value): low • 1: high
<gpio_in_pull>	Number	GPIO input value (for input function <gpio_mode>=1 only):

Parameter	Type	Description
		• 0 (default value): no resistor activated • 1: pull up resistor active • 2: pull down resistor active

15.3 GPIO read command +UGPIOR

+UGPIOR						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

15.3.1 Description

Reads the current value of the specified GPIO pin, no matter whether it is configured as input or output (see the +UGPIOC AT command to define the GPIO function). The parameters range is shown in the information text response to the test command.

15.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPIOR=<gpio_id>	+UGPIOR: <gpio_id>,<gpio_val> OK	AT+UGPIOR=20 +UGPIOR: 20,0 OK
Test	AT+UGPIOR=?	+UGPIOR: (list of supported <gpio_id>s) OK	+UGPIOR: (20, 21) OK

15.3.3 Defined values

Parameter	Type	Description
<gpio_id>	Number	GPIO pin identifier: pin number See the GPIO mapping for the available GPIO pins, their mapping and factory-programmed values on different u-blox cellular modules series and version.
<gpio_val>	Number	GPIO value. Allowed values are 0 and 1.

15.3.4 Notes

- The command works only if the parameter <gpio_mode> of the +UGPIOC AT command is set to 0 or 1.

15.4 GPIO set command +UGPIOW

+UGPIOW						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

15.4.1 Description

Sets ("writes") the output of the specified GPIO pin, but only if it is configured in output function (see the +UGPIOC AT command to set the pin as output).

15.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPIOW=<gpio_id>,<gpio_out_val>	OK	AT+UGPIOW=20,1 OK

Type	Syntax	Response	Example
Test	AT+UGPIOW=?	+UGPIOW: (list of supported <gpio_id>s),(list of supported <gpio_out_val>s) OK	+UGPIOW: (20, 21),(0-1) OK

15.4.3 Defined values

Parameter	Type	Description
<gpio_id>	Number	GPIO pin identifier: pin number See the GPIO mapping for the available GPIO pins, their mapping and factory-programmed values on different u-blox cellular modules series and version.
<gpio_out_val>	Number	GPIO value. Allowed values are 0 and 1.

15.4.4 Notes

- The command works only if the parameter <gpio_mode> of the +UGPIOC AT command is set to 0.

16 File System

16.1 File tags

16.1.1 Description

File system commands have the optional <tag> parameter that allows you to specify a file type when an AT command is issued, to inform the system what to do with it. Application specific files must be saved with the correct type tag, otherwise they are treated as common user files.

Table 18 defines the tags and their specific meanings while Table 19 defines their applicability to module series:

Tag	Name	Specification
"USER"	User file system	This is the default type if the <tag> parameter is omitted in file system AT commands. All generic files can be stored in this manner. Example: `AT+UDWNFILE="foobar",25,"USER"` is the same as `AT+UDWNFILE="foobar",25`
"FOAT"	FOAT file system	This tag is used to specify the file type as a firmware update package. It will place the firmware update package in the proper file cache to be used later by the +UFWINSTALL command.
"AUDIO"	Audio parameters	This tag is used to store audio calibration file "audio_gain_calibration<X>.xml" and "voice<X>.nvm" in the selected profile <X>=0,1. The profile is stored into NVM by using ATZ<X>. ☞ The "audio_gain_calibration<X>.xml" and "voice<X>.nvm" files can be over-written with AT&W<X> command.
"FOTA_EXT"	Firmware for FOTA procedure	This tag has to be used to store the firmware file for the FOTA procedure using a dedicated channel of the USB CDC-ACM interface.
"AUDIO_EXT"	Audio configuration	This tag is used to read or download audio configuration (see Audio parameters tuning section). The audio configuration file includes the NVM settings of the following AT commands (where applicable): • +CLVL AT command • +CRSL AT command • +UI2S AT command • +UMAFE AT command • +USAFE AT command • +UMSEL AT command • +UMGC AT command • +USGC AT command • +USPM AT command • +UTI AT command To download the audio configuration in the module, use the +UDWNFILE command. To read configuration from the module, use the +URDFILE command.
"ECALL_EXT"	eCall controller configuration and custom eCall prompts	This tag is used to read, download and delete the eCall controller configuration or download and delete custom eCall prompts (see eCall Prompts section). Reading and downloading commands use a dedicated channel of the USB CDC-ACM interface. To download the eCall controller configuration or custom eCall prompts in the module, use the +UDWNFILE command. To read the eCall controller configuration from the module, use the +URDFILE command. To delete eCall controller configuration or custom eCall prompts from the module, use the +UDELFILE command.
"PROFILE"	Profile files	This tag refers to the profile files that can be loaded on to the module to support Mobile Network Operators (MNOs) specific configurations. For more details on the profiles, see the +UMNOPROF command. The +URDFILE and +ULSTFILE AT commands are not allowed with this tag, the user can only download or delete these files.

Tag	Name	Specification
"GNSS"	GNSS files	This tag has to be used to store the firmware file for the internal GNSS receiver.
"CALLSRV_EXT"	Emergency Call Number List (ECNL) management	This tag is used to manage the Emergency Call Number List (ECNL) file stored in NVM.

Table 18: Tag meanings

Module	"USER"	"FOAT"	"AUDIO"	"ECALL_EXT"	"FOTA_EXT"	"AUDIO_EXT"	"PROFILE"	"GNSS"	"CALLSRV_EXT"
SARA-R4 / SARA-N4	*	*					*		

Table 19: Tag applicabilities to module series

SARA-R4 / SARA-N4
The files specified with the "FOAT" tag (used to specify the firmware update package file) can only be downloaded or deleted. The +URDFILE and +ULSTFILE AT commands are not allowed.

16.2 Download file +UDWNFILE

+UDWNFILE						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

16.2.1 Description

Stores (writes) a file into the file system:

- The stream of bytes can be entered after the '>' prompt has been provided to the user. The file transfer is terminated exactly when <size> bytes have been entered and either "OK" final result code or an error result code is returned. The feed process cannot be interrupted i.e. the command mode is re-entered once the user has provided the declared number of bytes.
- If the file already exists, the data will be appended to the file already stored in the file system.
- If the data transfer stops, after 20 s the command is stopped and the "+CME ERROR: FFS TIMEOUT" error result code (if +CMEE=2) is returned.
- If the module shuts down during the file storing, all bytes of the file will be deleted.
- If an error occurs during the file writing, the transfer is aborted and it is up to the user to delete the file.

SARA-R4 / SARA-N4
The available free memory space is checked before starting the file transfer. If the file size exceeds the available space, the "+CME ERROR: NOT ENOUGH FREE SPACE" error result code will be provided (if +CMEE=2).

SARA-R4 / SARA-N4
If the HW flow control is disabled (AT+IFC), a data loss could be experienced. So the HW flow control usage is strongly recommended. If HW flow control is not supported, the use of +UDWNBLOCK is recommended.

16.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDWNFILE=<filename>,<size>[,<tag>] > <text>	OK	AT+UDWNFILE="filename",36,"USER" > The 36 downloaded bytes of the file! OK

Type	Syntax	Response	Example
Download audio configuration			
Set	AT+UDWNFILE=<filename>,<size>,"AUDIO_EXT"	OK	AT+UDWNFILE="audioconfig",4873,"AUDIO_EXT" OK

16.2.3 Defined values

Parameter	Type	Description
<filename>	String	File name. For file system file name and data size limits see File system limits.
<size>	Number	File size expressed in bytes. For file system file name and data size limits see File system limits.
<tag>	String	Optional parameter that specifies the application file type. FILE TAGS table lists the allowed <tag> strings.
<text>	String	Stream of bytes.

16.2.4 Notes

- Issue the AT+ULSTFILE=1 command to retrieve the available user space in the file system.
- Two files with different types can have the same name, i.e. AT+UDWNFILE="testfile",20,"USER" and AT+UDWNFILE="testfile",43,"AUDIO".

16.3 List files information +ULSTFILE

+ULSTFILE						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

16.3.1 Description

Retrieves some information about the FS. Depending on the specified <op_code>, it can print:

- List of files stored into the FS
- Remaining free FS space expressed in bytes
- Size of the specified file expressed in bytes

☞ The available free space on FS in bytes reported by the command AT+ULSTFILE=1 is the theoretical free space including the space occupied by the hidden and temporary files which are not displayed by the AT+ULSTFILE=0.

16.3.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+ULSTFILE[=<op_code>[,<param1>[,<param2>]]]	+ULSTFILE: [<param3>,...[,<paramN>]] OK	AT+ULSTFILE=1 +ULSTFILE: 236800 OK
List of files stored into the FS			
Set	AT+ULSTFILE[=0[,<tag>]]	+ULSTFILE: [<filename1>[,<filename2>[,...[,<filenameN>]]]] OK	AT+ULSTFILE= +ULSTFILE: "filename" OK
Remaining free FS space expressed in bytes			
Set	AT+ULSTFILE=1[,<tag>]	+ULSTFILE: <free_fs_space> OK	AT+ULSTFILE=1 +ULSTFILE: 236800 OK
Size of the specified file			

Type	Syntax	Response	Example
Set	AT+ULSTFILE=2,<filename>[,<tag>]	+ULSTFILE: <file_size> OK	AT+ULSTFILE=2,"filename" +ULSTFILE: 784 OK

16.3.3 Defined values

Parameter	Type	Description
<op_code>	Number	Allowed values are: • 0 (default value): lists the files belonging to <tag> file type • 1: gets the free space for the specific <tag> file type • 2: gets the file size expressed in bytes, belonging to <tag> type (if specified)
<tag>	String	Specifies the application file type. FILE TAGS table lists the allowed <tag> strings.
<filename1>,..,<filenameN>	String	File name. For file system file name and data size limits see File system limits.
<free_fs_space>	Number	Available free space on FS in bytes.
<file_size>	Number	Size of the file specified with the <filename> parameter.
<param1>	Number / String	Type and supported content depend on related <op_code> (details are given above).
<param2>	Number / String	Type and supported content depend on related <op_code> (details are given above).

16.4 Read file +URDFILE

+URDFILE						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

16.4.1 Description

Retrieves a file from the file system.

SARA-R4 / SARA-N4
If the HW flow control is disabled (AT+IFC), a data loss could be experienced. So the HW flow control usage is strongly recommended. If HW flow control is not supported, the use of +URDBLOCK is recommended.

16.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+URDFILE=<filename>[,<tag>]	+URDFILE: <filename>,<size>,<data> OK	AT+URDFILE="filename" +URDFILE: "filename",36,"these bytes are the data of the file" OK

16.4.3 Defined values

Parameter	Type	Description
<filename>	String	File name. For file system file name and data size limits, see File system limits.
<tag>	String	The optional parameter <tag> specifies a different application file type. FILE TAGS table lists the allowed <tag> strings.
<size>	Number	File size, in bytes.
<data>	String	File content.

16.4.4 Notes

- The returned file data is displayed as an ASCII string of <size> characters in the range [0x00,0xFF]. At the end of the string, <CR><LF> are provided for user convenience and visualization purposes.

16.5 Partial read file +URDBLOCK

+URDBLOCK						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

16.5.1 Description

Retrieves a file from the file system.

Differently from +URDFILE command, this command allows the user to read only a portion of the file, indicating the offset and amount of bytes.

16.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+URDBLOCK=<filename>, <offset>,<size>[,<tag>]	+URDBLOCK: <filename>,<size>, <data> OK	AT+URDBLOCK="filename",0,20 +URDBLOCK: "filename",20,"these bytes are the " OK

16.5.3 Defined values

Parameter	Type	Description
<filename>	String	File name. For file system file name and data size limits see File system limits.
<offset>	Number	Offset in bytes from the beginning of the file.
<size>	Number	Number of bytes to be read starting from the <offset>.
<data>	String	Content of the file read.
<tag>	String	The optional parameter <tag> specifies a different application file type. FILE TAGS table lists the allowed <tag> strings.

16.5.4 Notes

- The returned file data is displayed as an ASCII string of <length> characters in the range [0x00,0xFF]. At the end of the string, <CR><LF> are provided for user convenience and visualization purposes.
- In case a size larger than the whole file size is required the command returns the file size only, indicating the amount of bytes read.
- In case an offset larger than the whole file size is required, the "+CME ERROR: FFS file range" error result code is triggered.

SARA-R4 / SARA-N4

- The <tag> parameter is not supported.

16.6 Delete file +UDELFILE

+UDELFILE						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

16.6.1 Description

Deletes a stored file from the file system.

If <filename> file is not stored in the file system the following error result code will be provided: "+CME ERROR: FILE NOT FOUND".

16.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDELFILE=<filename>[,<tag>]	OK	AT+UDELFILE="filename","USER" OK

16.6.3 Defined values

Parameter	Type	Description
<filename>	String	File name. For file system file name and data size limits see File system limits.
<tag>	String	The optional parameter <tag> specifies a different application file type. FILE TAGS table lists the allowed <tag> strings.

16.7 Partial download file +UDWNBLOCK

+UDWNBLOCK						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.7.1 Description

Stores (writes) a file to the file system.

- The stream of bytes can be entered after the '>' prompt has been provided to the user. The file transfer is terminated exactly when <size> bytes have been sent entered and either "OK" final result code or an error result code is returned. The feed process cannot be interrupted i.e. the command mode is re-entered once the user has provided the declared the number of bytes.
- If the file already exists, the data will be appended to the file already stored in the file system.
- If the data transfer stops, after 20 s the command is stopped and the "+CME ERROR: FFS TIMEOUT" error result code (if +CMEE=2) is returned.
- If the module shuts down during the file storing, all bytes of the file will be deleted.
- If an error occurs during the file writing, the transfer is aborted and it is up to the user to delete the file.

☞ Differently from +UDWNFILE command, this command allows the user to write only a portion of the file, indicating the offset and amount of bytes.

16.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDWNBLOCK=<filename>,<offset>,<size>,<filesize>[,<tag>] > <text>	OK	AT+UDWNBLOCK="filename",0,36,500,"USER" > The 36 downloaded bytes of the file! OK

16.7.3 Defined values

Parameter	Type	Description
<filename>	String	File name. For file system file name and data size limits see File system limits.
<offset>	Number	Offset in bytes from the beginning of the file.
<size>	Number	Number of bytes to be written starting from the <offset>.
<filesize>	Number	The size of the file to be written
<tag>	String	The optional parameter <tag> specifies a different application file type. FILE TAGS table lists the allowed <tag> strings.

16.7.4 Notes

- The <tag> parameter is supported only for "USER".

16.8 File system limits

16.8.1 Allowed characters in filenames

A filename cannot contain the following characters: / * : % | " < > ?

16.8.2 Limits

Here below are listed the maximum file name length, the maximum data size of the file system and the maximum number of files for the u-blox cellular modules.

Maximum file name length:

- SARA-R4 / SARA-N4 - 248 characters

Maximum file size:

- SARA-R4 / SARA-N4 - File size limited by the available file system space retrieved by +ULSTFILE=1 command

Maximum number of files:

- SARA-R4 / SARA-N4 - The theoretical maximum number of files that can be stored is 1100.

☞ The theoretical maximum file size and the maximum number of files also includes system, hidden and temporary files whose number is not statically predictable, so the actual numbers can be less than stated.

17 DNS

DNS service requires the user to define and activate a connection profile, either PSD or CSD.

When these command report an error which is not a +CME ERROR, the error class and code is provided through +USOER AT command.

17.1 Resolve name / IP number through DNS +UDNSRN

+UDNSRN						
Modules	SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 70 s	TCP/UDP/IP Error

17.1.1 Description

Translates a domain name to an IP address or an IP address to a domain name by using an available DNS. There are two available DNSs, primary and secondary. The network usually provides them after a GPRS activation or a CSD establishment. They are automatically used in the resolution process if available. The resolver will use first the primary DNS, otherwise if there is no answer, the second DNS will be involved.

☞ The DNS resolution timeout depends on the number of DNS servers available to the DNS resolution system. The response time for the DNS resolution is estimated in case 8 servers are used to perform this task.

☞ Pay attention to the DNS setting for the different profiles since the user DNS can be put into action if the corresponding profile is activated (if the user sets a DNS for a profile, and a different profile is activated, the user DNS has no action and the network DNS is used if available).

17.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDNSRN=<resolution_type>, <domain_ip_string>[,<async>]	+UDNSRN: <resolved_ip_address> OK or +UDNSRN: <resolved_domain_name> OK	AT+UDNSRN=0,"www.google.com" +UDNSRN: "216.239.59.147" OK
			AT+UDNSRN=0,"www.google.com",1 OK +UUDNSRN: "216.239.59.147"
			AT+UDNSRN=0,"www.google.com",0 +UDNSRN: "216.239.59.147" OK
URC		+UUDNSRN: <result_code>[,<resolved_ip_address>]	+UUDNSRN: 0,"216.239.59.147"
		+UUDNSRN: <result_code>[,<resolved_domain_name>]	+UUDNSRN: 0,"somedomain.com"
		+UUDNSRN: -1	+UUDNSRN: -1

17.1.3 Defined values

Parameter	Type	Description
<resolution_type>	Number	Type of resolution operation: • 0: domain name to IP address • 1: IP address to domain name (host by name)
<domain_ip_string>	String	Domain name (<resolution_type>=0) or the IP address in (<resolution_type>=1) to be resolved
<async>	Number	Asynchronous DNS resolution flag. Allowed values:

Parameter	Type	Description
		• 0 (default value): the final result code is returned only once the DNS response is available, locking the AT interface until the DNS activity is running • 1: a final result code (OK or an error result code) is returned immediately unlocking the AT interface and making it available for the execution of other AT commands. Once the result of DNS resolution becomes available, it is notified to the AT interface through the +UUDNSRN URC
<resolved_ip_address>	String	Resolved IP address corresponding to the specified domain name
<resolved_domain_name>	String	Resolved domain name corresponding to the provided IP address
<result_code>	Number	Result code of DNS resolution: • 0: no error • -1: DNS resolution failed. In this case the <resolved_ip_address> or the <resolved_domain_name> fields are not present

17.1.4 Notes

SARA-R4 / SARA-N4

- The <async> parameter and the +UUDNSRN URC are not available.

18 Internet protocol transport layer

18.1 Introduction

SARA-R4 / SARA-N4
Before using TCP/IP services, a connection profile must be defined and activated. The sockets can be managed independently and simultaneously over the same bearer (either PSD or CSD). AT commands for both reading and writing data on sockets are provided and the URC notifies the external application of incoming data and transmission result, no need for polling.

SARA-R4 / SARA-N4
When these commands report an error result code which is not a +CME ERROR, the error code can be queried using the +USOER or +USOCTL (specifying the socket ID and with <param_id>=1) AT commands.

The maximum number of sockets that can be managed are 7.

SARA-R4 / SARA-N4
The maximum number of secure sockets that can be managed is 4.

SARA-R4 / SARA-N4
No need to establish a PSD connection explicitly. This device automatically establishes a PSD connection as part of the network registration and attach procedure.

The UDP protocol has not any flow control mechanism and packets might be lost in the following scenarios:

- No network signal is available
- Unreliable radio interface (e.g. mobility in GPRS, where cell reselections can lead to data loss, that can be contrasted with the usage of LLC ack reliability QoS parameter

Some network operators close dynamic NATs after few minutes if there is no activity on the connection (no data transfer in the period). To solve this problem enable the TCP keep alive options with 1 minute delay (see the +USOSO AT command).

When both TCP and UDP socket are used at the same time at the maximum throughput (downlink and uplink at the maximum allowed baud rate) it is possible to lose some incoming UDP packets due to internal buffer limitation. A possible workaround is provided as follows:

- If it is possible, adopt an application layer UDP acknowledge system

18.2 IPv4/IPv6 addressing

18.2.1 Introduction

The section describes the IP addressing formats and IP address rules used by TCP/IP UDP/IP enabled applications.

18.2.2 IPv4

Format:

- 32 bits long in dot-decimal notation (without leading 0 notation).
- All the decimal numbers must be in range 0-255.
- The dot-octal notation is not supported.
- The dot-hexadecimal notation is not supported.

Examples:

IPv4 address	Remarks
254.254.254.254	Valid address
010.228.76.34	Invalid address; first decimal number prefixed with a leading zero
257.228.76.34	Invalid address; first decimal number greater than 255
0010.0344.0114.0042	Invalid address; dot-octal notation; decimals given as octal numbers

IPv4 address	Remarks
0x10.0xE4.0x4C.0x22	Invalid address; dot-hexadecimal notation; decimals given as hexadecimal numbers

Table 20: IPv4 address format examples

18.2.3 IPv6

Format:

- 128 bits long represented in 8 groups of 16 bits each.
- The 16 bits of a group are represented as 2 concatenated hexadecimal numbers.
- The groups are separated by a colon character (:).
- The leading 0 in a group is supported.
- A group containing 4 zeros can be abbreviated with one 0.
- Continuous groups (at least 2) with zeroes can be replaced with a double colon (::).
- The double colon can appear only once in an IPv6 address.

Examples:

IPv6 address	Remarks
2001:0104:0000:0000:0000:0104:0000:0000	Full version, with leading zeros
2001:104:0000:0000:0000:104:0000:0000	Abbreviated version, leading zero abbreviation
2001:104:0:0:0:104:0:0	Abbreviated version, zero group abbreviation
2001:104::104:0:0	Abbreviated version, one double colon abbreviation

Table 21: IPv6 address format examples

The following AT commands support the IPv6 address format:

- Dynamic DNS update: +UDYNDNS
- Connect Socket: +USOCO
- SendTo command: +USOST
- Receive From command: +USORF
- Set Listening Socket: +USOLI
- IP Change Notification: +UIPCHGN
- FTP service configuration: +UFTP
- HTTP control: +UHTTP

For packet swiched services AT commands (i.e. PDP_addr in +CGDCONT) the format is specified in the corresponding command section.

18.3 Create Socket +USOCR

+USOCR						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	TCP/UDP/IP Error +CME Error

18.3.1 Description

Creates a socket and associates it with the specified protocol (TCP or UDP), returns a number identifying the socket. Such command corresponds to the BSD socket routine. Up to 7 sockets can be created. It is possible to specify the local port to bind within the socket in order to send data from a specific port. The bind functionality is supported for both TCP and UDP sockets.

The socket creation operation can be performed only after the PDP context activation on one of the defined profiles.

18.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCR=<protocol>[,<local_port>]	+USOCR: <socket> OK	AT+USOCR=17 +USOCR: 2 OK
Test	AT+USOCR=?	+USOCR: (list of supported <protocol>s),(list of supported <local_port>s) OK	+USOCR: (6,17),(1-65535) OK

18.3.3 Defined values

Parameter	Type	Description
<protocol>	Number	• 6: TCP • 17: UDP
<local_port>	Number	Local port to be used while sending data. The range goes from 1 to 65535. If the parameter is omitted it will be set to 0; in this case a random port will be used while sending data.
<socket>	Number	Socket identifier to be used for any future operation on that socket. The range goes from 0 to 6.

18.4 SSL/TLS mode configuration on TCP socket +USOSEC

+USOSEC						
Modules	SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 1 s	+CME Error

18.4.1 Description

Enables or disables the use of SSL/TLS connection on a TCP socket. The configuration of the SSL/TLS properties is provided with an SSL/TLS profile managed by USECMNG.

The <usecmng_profile_id> parameter is listed in the information text response to the read command only if the SSL/TLS is enabled on the interested socket.

☞ This operation is only available for TCP sockets.

☞ The enable or disable operation can be performed only after the socket has been created with +USOCR AT command.

☞ The SSL/TLS is supported only with +USOCO command (socket connect command). The SSL/TLS is not supported with +USOLI command (socket set listen command is not supported and the +USOSEC settings will be ignored).

☞ SARA-R4 / SARA-N4
Issue the command before the +USOCO AT command (socket connect command).

18.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOSEC=<socket>,<ssl_tls_status>[,<usecmng_profile_id>]	OK	AT+USOSEC=0,1,1 OK
Read	AT+USOSEC=<socket>	+USOSEC=<socket>,<ssl_tls_status>[,<usecmng_profile_id>] OK	AT+USOSEC=0 +USOSEC=0,1,1 OK
Test	AT+USOSEC=?	+USOSEC: (list of supported <socket>s),(list of supported <ssl_tls_status>s),(list of supported <usecmng_profile_id>s)	+USOSEC: (0-6),(0,1),(0-4) OK

Type	Syntax	Response	Example
		OK	

18.4.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier defined by the AT+USOCR command. The range goes from 0 to 6.
<ssl_tls_status>	Number	• 0 (default value): disable the SSL/TLS on the socket. • 1: enable the SSL/TLS on the socket; a USECMNG profile can be specified with the <usecmng_profile_id> parameter.
<usecmng_profile_id>	Number	Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see USECMNG section).

18.5 Set socket option +USOSO

+USOSO						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	TCP/UDP/IP Error +CME Error

18.5.1 Description

Sets the specified standard option (type of service, local address re-use, linger time, time-to-live, etc.) for the specified socket, like the BSD setsockopt routine.

☞ Issue a set command to set each parameter.

18.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOSO=<socket>,<level>,<opt_name>,<opt_val>[,<opt_val2>]	OK	AT+USOSO=2,6,1,1 OK
Test	AT+USOSO=?	+USOSO: (list of supported <socket>s),(list of supported <level>s) OK	+USOSO: (0-6),(0,6,65535) OK

18.5.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6.
<level>	Number	• 0: IP protocol <opt_name> for IP protocol level may be: o 1: type of service (TOS) <opt_val>: 8 bitmask that represents the flags of IP TOS. The range is 0-255 (the default value is 0). For more information see the RFC 791 [27] o 2: time-to-live (TTL) <opt_val>: unsigned 8 bit value representing the TTL. The range is 0-255 (the default value is 255) • 6: TCP protocol <opt_name> for TCP protocol level may be: o 1: no delay option; do not delay send to coalesce packets; <opt_val>: numeric parameter, it enables/disables the "no delay" option: - 0 (default value): disabled - 1: enabled o 2: keepidle option: send keepidle probes when it is idle for <opt_val> milliseconds

Parameter	Type	Description
		<opt_val>: signed 32 bit numeric parameter representing the milliseconds for "keepidle" option. The range is 0-2147483647. The default value is 7200000 (2 hours) • 65535: socket <opt_name> for socket level options may be: o 4: local address re-use. <opt_val>: numeric parameter, it configures the "local address re-use" option. - 0 (default value): disabled - 1: enabled o 8: keep connections alive. <opt_val>: numeric parameter, it configures "keep connections alive" option. - 0 (default value): disabled - 1: enabled o 32: sending of broadcast messages. <opt_val>: numeric parameter, it configures "sending of broadcast messages". - 0 (default value): disabled - 1: enabled o 128: linger on close if data present. <opt_val>: numeric parameter, it configures the "linger" option. - 0 (default value): disabled - 1: enabled <opt_val2>: signed 16 bit numeric parameter, it sets the linger time, the range goes from 0 to 32767 in milliseconds. The default value is 0. o 512: local address and port re-use. <opt_val>: numeric parameter, it configures the "local address and port re-use". - 0 (default value): disabled - 1: enabled
<opt_name>	Number	Type and supported content depend on the related <level> parameter value (details are given above).
<opt_val>	Number	Type and supported content depend on the related <level> parameter value (details are given above).
<opt_val2>	Number	Type and supported content depend on the related <level> parameter value (details are given above).

18.5.4 Notes

SARA-R4 / SARA-N4

- <level>=6 (TCP protocol), <opt_name>=2 (keepidle option) is not supported.
- <level>=65535 (socket), <opt_name>=32 (sending of broadcast messages) is not supported.
- <level>=65535 (socket), <opt_name>=512 (local address and port re-use) is not supported.

18.6 Get Socket Option +USOGO

+USOGO						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	TCP/UDP/IP Error +CME Error

18.6.1 Description

Retrieves the specified standard option (type of service, local address re-use, linger time, time-to-live, etc) for the specified socket, like the BSD getsockopt routine.

18.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOGO=<socket>,<level>,<opt_name>	+USOGO: <opt_val>[,<opt_val2>] OK	AT+USOGO=0,0,2 +USOGO: 255 OK
Test	AT+USOGO=?	+USOGO: (list of supported <socket>s),(list of supported <level>s) OK	+USOGO: (0-6),(0,6,65535) OK

18.6.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6.
<level>	Number	• 0: IP Protocol <opt_name> for IP protocol level may be: o 1: type of service <opt_val>: 8 bit mask that represents the flags of IP TOS. For more information see the RFC 791 [27]. The range is 0-255. The default value is 0 o 2: time-to-live <opt_val>: unsigned 8 bit value representing the TTL. The range is 0-255. The default value is 0. • 6: TCP Protocol <opt_name> for TCP protocol level may be: o 1: no delay option: do not delay send to coalesce packets <opt_val>: numeric parameter, it enables/disables the "no delay" option - 0 (default value): disabled - 1: enabled o 2: keepidle option: send keepidle probes when idle for <opt_val> milliseconds <opt_val>: signed 32 bit number value representing the milliseconds for "keepidle" option. The range 0-2147483647. The default value is 7200000 (2 hours) • 65535: socket <opt_name> for the socket level options may be: o 4: local address re-use <opt_val>: numeric parameter, it configures the "local address re-use" option: - 0 (default value): disabled - 1: enabled o 8: keep connections alive <opt_val>: numeric parameter, it configures the "keep connections alive" option: - 0 (default value): disabled - 1: enabled o 32: sending of broadcast messages <opt_val>: numeric parameter, it configures the "sending of broadcast messages": - 1: enabled - 0 (default value): disabled o 128: linger on close if data present <opt_val>: numeric parameter, it sets on/off the "linger" option. - 0 (default value): disabled - 1: enabled <opt_val2>: signed 16 bit numeric value, linger time, the range goes from 0 to 32767 in milliseconds. The default value is 0. o 512: local address and port re-use <opt_val>: numeric parameter, it enables/disables "local address and port re-use": - 0 (default value): disabled - 1: enabled

18.6.4 Notes

SARA-R4 / SARA-N4

- The setting <level>= 6 (TCP protocol) and <opt_name>= 2 (keepidle option) is not supported.

18.7 Close Socket +USOCL

+USOCL						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	< 120 s (except URC)	+CME Error

18.7.1 Description

Closes the specified socket, like the BSD close routine. In case of remote socket closure the user is notified via the URC.

By default the command blocks the AT command interface until the the completion of the socket close operation. By enabling the <async_close> flag, the final result code is sent immediately. The following +UUSOCL URC will indicate the closure of the specified socket.

18.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCL=<socket>[,<async_close>]	OK	AT+USOCL=2 OK
Test	AT+USOCL=?	+USOCL: (list of supported <socket>s) OK	+USOCL: (0-6),(0-1) OK
URC		+UUSOCL: <socket>	+UUSOCL: 2

18.7.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6
<async_close>	Number	Asynchronous close flag. The flag has effect for TCP connections only. Allowed values: • 0 (default value): the operation result is returned only once the result of the TCP close becomes available, locking the AT interface until the connection closes. • 1: the final result code is returned immediately unlocking the AT interface and making it available for the execution of other AT commands. Once the result of TCP close becomes available, it is notified to the AT interface through the +UUSOCL URC.

18.7.4 Notes

SARA-R404M / SARA-R410M-01B

- The <async_connect> parameter is not supported.

18.8 Get Socket Error +USOER

+USOER						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	TCP/UDP/IP Error +CME Error

18.8.1 Description

Retrieves the last error occurred in the last socket operation, stored in the BSD standard variable error.

18.8.2 Syntax

Type	Syntax	Response	Example
Action	AT+USOER	+USOER: <socket_error>	+USOER: 104
		OK	OK

18.8.3 Defined values

Parameter	Type	Description
<socket_error>	Number	Code of the last error occurred in a socket operation. The allowed values are listed in Appendix A.5 • 0: no error

18.9 Connect Socket +USOCO

+USOCO						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	< 120 s	TCP/UDP/IP Error +CME Error

18.9.1 Description

Establishes a peer-to-peer connection of the socket to the specified remote host on the given remote port, like the BSD connect routine. If the socket is a TCP socket, the command will actually perform the TCP negotiation (3-way handshake) to open a connection. If the socket is a UDP socket, this function will just declare the remote host address and port for later use with other socket operations (e.g. +USOWR, +USORD). This is important to note because if <socket> refers to a UDP socket, errors will not be reported prior to an attempt to write or read data on the socket.

The estimated response time depends also by the DNS resolution. For further details about the estimated response time related to the DNS resolution, see the +UDNSRN AT command.

18.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCO=<socket>,<remote_addr>,<remote_port>[,<async_connect>]	OK	AT+USOCO=3,"151.63.16.9",1200 OK
			AT+USOCO=2,"151.63.16.9",8200,1 OK +UUSOCO: 2,0
			AT+USOCO=2,"151.63.16.9",8230,0 OK

Type	Syntax	Response	Example
Test	AT+USOCO=?	+USOCO: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <async_connect>s) OK	+USOCO: (0-6),"remote_host",(1-65535),(0-1) OK
URC		+UUSOCO: <socket>,<socket_error>	+UUSOCO: 2,0

18.9.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6
<remote_addr>	String	Remote host IP address or domain name of the remote host. For IP address format reference see the IP addressing.
<remote_port>	Number	Remote host port, in range 1-65535
<async_connect>	Number	Asynchronous connect flag. The flag has effect for TCP connections only. Allowed values: • 0 (default value): the operation result is returned only once the TCP connection is established, locking the AT interface until the connection activity is running • 1: the final result code is returned immediately unlocking the AT interface and making it available for the execution of other AT commands. Once the result of TCP connection becomes available, it is notified to the AT interface through the +UUSOCO URC.
<socket_error>	Number	Code of the last error occurred in a socket operation. The allowed values are listed in Appendix A.5: • 0: no error, connection successful

18.9.4 Notes

- In case of the socket connection with the asynchronous flag:
  - the socket will be closed if a further +USOCO AT command is issued before having received the +UUSOCO URC of the first AT command.
  - it is not possible to connect a second socket before the reception of the +UUSOCO URC related to the pending socket connection.

SARA-R404M / SARA-R410M-01B

- The <async_connect> parameter and the +UUSOCO URC are not available.

18.10 Write socket data +USOWR

+USOWR						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	< 120 s	TCP/UDP/IP Error +CME Error

18.10.1 Description

Writes the specified amount of data to the specified socket, like the BSD write routine, and returns the number of bytes of data actually written. The command applies to UDP sockets too, after a +USOCO command.

There are three kinds of syntax:

- Base syntax normal: writing simple strings to the socket, some characters are forbidden
- Base syntax HEX: writing hexadecimal strings to the socket, the string will be converted in binary data and sent to the socket; see the AT+UDCONF=1 command description to enable it
- Binary extended syntax: mandatory for writing any character in the ASCII range [0x00, 0xFF]

☞ Some notes about the **TCP socket**:

- If no network signal is available, the TCP packets are enqueued until the network will become available again. If the TCP queue is full the +USOWR command will return an error result code. To get the last socket error use the +USOCTL=1 command. If the error code returned is 11, it means that the queue is full.
- If the connection is closed by the remote host, the +UUSOCL URC is not sent until all received data is read using the AT+USORD command. If AT+USOWR command is used in this situation, an error result code is returned. See also the Notes section about the specific product behaviour
- If the connection is closed by the remote host and binary interface started with AT+USOWR command is still waiting for data, an error result code is returned indicating that the binary interface was closed. After the error result code a +UUSOCL URC is reported indicating that the socket was closed.

☞ Some notes about the **UDP socket**:

- Due to the UDP specific AT commands, it is preferred to use the +USOST command to send data via UDP socket. This command does not require the usage of +USOCO before sending data.
- If no network signal is available, out going UDP packet may be lost.

☞ The information text response indicates that data has been sent to lower level of protocol stack. This is not an indication of an acknowledgement received by the remote server the socket is connected to.

18.10.2 Syntax

Type	Syntax	Response	Example
Base syntax			
Set	AT+USOWR=<socket>,<length>,<data>	+USOWR: <socket>,<length> OK	AT+USOWR=3,12,"Hello world!" +USOWR: 3,12 OK
Binary syntax			
Set	AT+USOWR=<socket>,<length>	@<data> +USOWR: <socket>,<length> OK	AT+USOWR=3,16 @16 bytes of data +USOWR: 3,16 OK
Test	AT+USOWR=?	+USOWR: (list of supported <socket>s),(list of supported <length>s),"HEX data" +USOWR: (list of supported <socket>s),(list of supported <length>s),"data" +USOWR: (list of supported <socket>s),(list of supported <length>s) OK	+USOWR: (0-6),(0-512),"HEX data" +USOWR: (0-6),(0-1024),"data" +USOWR: (0-6),(0-1024) OK

18.10.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6.
<length>	Number	Number of data bytes to write: • Base syntax normal mode: range 1-1024 • Base syntax HEX mode: range 1-512 • Binary extended syntax: range 1-1024
<data>	String	Data bytes to be written. Not all of the ASCII charset can be used.

18.10.4 Notes

- For base syntax:
  - The value of <length> and the actual length of <data> must match
- For base syntax HEX mode:
  - Only the ASCII characters 0-9, A-F and a-f are allowed.

  - The length of the <data> parameter must be two times the <length> parameter.
- For binary syntax:
  - After the command is sent, the user waits for the @ prompt. When it appears the stream of bytes can be provided. After the specified amount of bytes has been sent, the system provides the final result code. The feed process cannot be interrupted i.e. the return in the command mode can be effective only when the number of bytes provided is the declared one.
  - After the @ prompt reception, wait for a minimum of 50 ms before sending data.
  - The binary extended syntax is the only way for the system to accept control characters as data; for the AT command specifications 3GPP TS 27.005 [16], characters like <CR>, <CTRL-Z>, quotation marks, etc. have a specific meaning and they cannot be used like data in the command itself. The command is so extended with a specific acceptance state identified by the @ prompt.
  - This feature can be successfully used when there is need to send a byte stream which belongs to a protocol that has any kind of characters in the ASCII range [0x00,0xFF].
  - In binary mode the module does not display the echo of data bytes.
  - Binary syntax is not affected by HEX mode option.
- For <data> parameter not all of the ASCII charset can be used.

SARA-R4 / SARA-N4

- In the information text response to the set command +USOWR: <socket>,<length>, the <length> parameter may not match with the value of the set command due to data segmentation. In this case, use the AT+USOCTL=1 command to get the number of bytes that were sent. If not all intended bytes are sent then send the remaining bytes using the +USOWR AT command.

18.11 SendTo command (UDP only) +USOST

+USOST						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	TCP/UDP/IP Error +CME Error

18.11.1 Description

Writes the specified amount of data to the remote address, like the BSD sendto routine, and returns the number of bytes of data actually written. It can be applied to UDP sockets only. This command allows the reuse of the same socket to send data to many different remote hosts.

There are three kinds of syntax:

- Base syntax normal: writing simple strings to the socket, there are characters which are forbidden
- Base syntax HEX: writing hexadecimal strings to the socket, the string will be converted in binary data and sent to the socket
- Binary extended syntax: mandatory for writing any character in the ASCII range [0x00, 0xFF]

☞ It is strongly recommended using this command to send data while using UDP sockets. It is also recommended avoiding +USOCO usage with UDP socket.

☞ (about UDP socket): if no network signal is available, outcoming UDP packet may be lost.

☞ To enable the base syntax HEX mode, see the AT+UDCONF=1 command description.

18.11.2 Syntax

Type	Syntax	Response	Example
Base syntax			
Set	AT+USOST=<socket>,<remote_addr>,<remote_port>,<length>,<data>	+USOST: <socket>,<length> OK	AT+USOST=3,"151.9.34.66",449,16,"16 bytes of data" +USOST: 3,16 OK

Type	Syntax	Response	Example
Binary syntax			
Set	AT+USOST=<socket>,<remote_addr>,<remote_port>,<length> After the"@" prompt <length> bytes of data are entered	@<data> +USOST: <socket>,<length> OK	AT+USOST=3,"151.9.34.66",449,16 @16 bytes of data +USOST: 3,16 OK
Test	AT+USOST=?	+USOST: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <length>s),"HEX data" +USOST: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <length>s),"data" +USOST: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <length>s) OK	+USOST: (0-6),"remote_host",(1-65535),(0-512),"HEX data" +USOST: (0-6),"remote_host",(1-65535),(0-1024),"data" +USOST: (0-6),"remote_host",(1-65535),(0-1024) OK

18.11.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6.
<remote_addr>	String	Remote host IP address or domain name of the remote host. For IP address format reference see the IP addressing.
<remote_port>	Number	Remote host port, in range 1-65535
<length>	Number	Number of data bytes to write • Base syntax normal mode: range 1-1024 • Base syntax HEX mode: range 1-512 • Binary syntax mode: range 1-1024
<data>	String	Data bytes to be written (not all of the ASCII charset can be used)

18.11.4 Notes

- For base syntax:
  - The value of <length> and the actual length of <data> must match
  - For base syntax HEX mode, only ASCII characters 0-9, A-F and a-f are allowed. The length of the <data> parameter must be two times the <length> parameter
- For binary syntax:
  - After the command is sent, the user waits for the @ prompt. When it appears the stream of bytes can be provided. After the specified amount of bytes has been sent, the system returns with final result code. The feed process cannot be interrupted i.e. the return in the command mode can be effective only when the number of bytes provided is the declared one
  - That binary extended syntax is the only way for the system to accept control characters as data; for the AT command specifications [16], characters like <CR>, <CTRL-Z>, quotation marks, etc. have a specific meaning and they cannot be used like data in the command itself. The command is so extended with a specific acceptance state identified by the @ prompt
  - This feature can be successfully used when there is need to send a byte stream which belongs to a protocol that has any kind of characters in the ASCII range [0x00,0xFF]
  - In binary mode the module does not display the echo of data bytes
  - Binary syntax is not affected by HEX mode option

18.12 Read Socket Data +USORD

+USORD						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 1 s (except URC)	TCP/UDP/IP Error +CME Error

18.12.1 Description

Reads the specified amount of data from the specified socket, like the BSD read routine. This command can be used to know the total amount of unread data.

For the TCP socket type the URC **+UUSORD: <socket>,<length>** notifies the data bytes available for reading, either when buffer is empty and new data arrives or after a partial read by the user.

For the UDP socket type the URC **+UUSORD: <socket>,<length>** notifies that a UDP packet has been received, either when buffer is empty or after a UDP packet has been read and one or more packets are stored in the buffer.

In case of a partial read of a UDP packet **+UUSORD: <socket>,<length>** will show the remaining number of data bytes of the packet the user is reading.

(about UDP socket) Due to the UDP specific AT command, it is preferred to use the +USORF command to read data from UDP socket. +USORF command does not require the usage of +USOCO before reading data.

When applied to UDP active sockets if the UDP socket is not set in listening mode (see +USOLI) it will not be possible to receive any packet if a previous write operation is not performed.

If the HEX mode is enabled (refer to AT+UDCONF=1 command) the received data will be displayed using an hexadecimal string.

18.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+USORD=<socket>,<length>	+USORD: <socket>,<length>,<data in the ASCII [0x00,0xFF] range> OK	AT+USORD=3,16 +USORD: 3,16,"16 bytes of data" OK
Test	AT+USORD=?	+USORD: (list of supported <socket>s),(list of supported <length>s) OK	+USORD: (0-6),(0-1024) OK
URC		+UUSORD: <socket>,<length>	+UUSORD: 3,16

18.12.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6.
<length>	Number	Number of data bytes • to read stored in buffer, in range 0-1024 in the set command • read from buffer, in range 0-1024 • stored in buffer for the URC
<data>	String	Data bytes to be read

18.12.4 Notes

- The returned data may be any ASCII character in the range [0x00,0xFF] i.e. control characters. The starting quotation marks shall not be taken into account like data; the first byte of data starts after the first quotation marks. Then the other characters are provided for a <length> amount. An application

should rely on the <length> info to count the received number of characters (after the starting quotation marks) especially if any protocol control characters are expected.
- If an application deals with letter and number characters only i.e. all of the expected characters are outside the [0x00, 0x1F] range and are not quotation marks, the AT+USORD response quotation marks can be assumed to identify the start and the end of the received data packet. Always check <length> to identify the valid data stream.
- If the number of data bytes requested to be read from the buffer is bigger than the number of bytes stored in the buffer only the available amount of data bytes will be read.
- When <length>= 0, the command returns the total amount of data present in the network buffer.
  Example: 23 unread bytes in the socket.

```
AT+USORD=3,0
+USORD: 3,23
OK
```

- If the HEX mode is enabled, the length of <data> will be 2 times <length>.

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- In case there are no bytes returned or available, the <length> parameter is omitted in the information text response to the set command.
  Example: information text response does not have any length information.

```
AT+USORD=0,7
+USORD: 0,""
OK
```

18.13 Receive From command (UDP only) +USORF

+USORF						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 1 s (except URC)	TCP/UDP/IP Error +CME Error

18.13.1 Description

Reads the specified amount of data from the specified UDP socket, like the BSD recvfrom routine. The URC **+UUSORF: <socket>,<length>** (or also +UUSORD: <socket>,<length>) notifies that new data is available for reading, either when new data arrives or after a partial read by the user for the socket. This command can also return the total amount of unread data.

This command can be applied to UDP sockets only, and it can be used to read data after both +UUSORD and +UUSORF unsolicited indication.

☞ If the HEX mode is enabled (see +UDCONF=1) the received data will be displayed using an hexadecimal string.

18.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+USORF=<socket>,<length>	+USORF: <socket>,<remote_ip_addr>,<remote_port>,<length>,<data in the ASCII [0x00,0xFF] range> OK	AT+USORF=3,16 +USORF: 3,"151.9.34.66",2222,16,"16 bytes of data" OK
Test	AT+USORF=?	+USORF: (list of supported <socket>s),(list of supported <length>s) OK	+USORF: (0-6),(0-1024) OK

Type	Syntax	Response	Example
URC		+UUSORF: <socket>,<length>	+UUSORF: 3,16

18.13.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6
<remote_ip_addr>	String	Remote host IP address. For IP address format reference see the IP addressing.
<remote_port>	Number	Remote host port, in range 1-65535
<length>	Number	Number of data bytes to read, in range 0-1024
<data>	String	Data bytes to be read

18.13.4 Notes

- Each packet received from the network is stored in a separate buffer and the command is capable to read only a packet (or e portion of it) at time. This means that if <length> is greater than the packet size, the command will return a maximum amount of data equal to the packet size, also if there are other packets in the buffer. The remaining data (i.e. the remaining UDP packets) can be read with further reads.
- The returned data may have any kind of ASCII character in the range [0x00,0xFF] i.e. control characters too. The starting quotation marks shall not be taken into account like data; the first byte of data starts after the first quotation marks. Then the other characters are provided for a <length> amount. At the end of the length byte stream, another quotation marks followed by <CR><LF> are provided for user convenience and visualization purposes. An application should rely on the <length> info to count the received number of characters (after the starting quotation marks) especially if any protocol control characters are expected.
- If an application deals with letter and number characters only i.e. all of the expected characters are outside the [0x00, 0x1F] range and are not quotation marks, the AT+USORD response quotation marks can be assumed to identify the start and the end of the received data packet, anyway the <length> field usage to identify the valid data stream is recommended.
- When <length>= 0, the command returns the total amount of data present in the network buffer.
  Example: 23 unread bytes in the socket.

```
AT+USORF=3,0
+USORF: 3,23
OK
```

- If the HEX mode is enabled, the length of <data> will be 2 times <length>.

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- In case there are no bytes returned or available, the <length> parameter is omitted in the information text response to the set command.

18.14 Set Listening Socket +USOLI

+USOLI						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 1 s (except URC)	TCP/UDP/IP Error +CME Error

18.14.1 Description

Sets the specified socket in listening mode on the specified port of service, waiting for incoming connections (TCP) or data (UDP):

- For **TCP sockets**, incoming connections will be automatically accepted and notified via the URC **+UUSOLI: <socket>,<ip_address>,<port>,<listening_socket>,<local_ip_address>,<listening_port>,** carrying the connected socket identifier, the remote IP address and port.

- For **UDP sockets**, incoming data will be notified via URC **+UUSORF: <listening_socket>,<length>.** To know from which remote IP address and port the data is coming from, use the AT+USORF command.

18.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOLI=<socket>,<port>	OK	**TCP sockets** AT+USOLI=2,1200 OK +UUSOLI: 3,"151.63.16.7",1403,2,"82.89.67.164",1200
			UDP sockets AT+USOLI=0,1182 OK +UUSORF: 0,1024
Test	AT+USOLI=?	+USOLI: (list of supported <socket>s),(list of supported <port>s) OK	+USOLI: (0-6),(1-65535) OK
URC (TCP)		+UUSOLI: <socket>,<ip_address>,<port>,<listening_socket>,<local_ip_address>,<listening_port>	+UUSOLI: 3,"151.63.16.7",1403,0,"82.89.67.164",200
URC (UDP)		+UUSORF: <listening_socket>,<length>	+UUSORF: 1,967

18.14.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6
<port>	Number	Port of service, range 1-65535. Port numbers below 1024 are not recommended since they are usually reserved
<ip_address>	String	Remote host IP address (only in URC +UUSOLI). For IP address format reference see the IP addressing.
<listening_socket>	Number	Socket identifier specified within the AT+USOLI command, indicates on which listening socket the connection has been accepted (only in +UUSOLI URC)
<local_ip_address>	String	TE IP address (only in +UUSOLI URC). For IP address format reference see the IP addressing.
<listening_port>	Number	Listening port that has accepted the connection. This port is specified within the AT +USOLI command (only in +UUSOLI URC)
<length>	Number	Data length received on the UDP listening socket (only in +UUSORF unsolicited indication). In order to know the sender IP address and port, use the AT+USORF command.

18.14.4 Notes

- In case of notification via the URC +UUSOLI <port> is intended as the remote port.

18.15 HEX mode configuration +UDCONF=1

+UDCONF=1						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

18.15.1 Description

Enables/disables the HEX mode for +USOWR, +USOST, +USORD and +USORF AT commands.

18.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=1,<hex_mode_disable>	OK	AT+UDCONF=1,0 OK
Read	AT+UDCONF=1	+UDCONF: 1,<hex_mode_disable> OK	AT+UDCONF=1 +UDCONF: 1,1 OK

18.15.3 Defined values

Parameter	Type	Description
<hex_mode_disable>	Number	Enables/disables the HEX mode for +USOWR, +USOST, +USORD and +USORF AT commands. Allowed values: • 0 (factory-programmed value): HEX mode disabled • 1: HEX mode enabled

18.16 Set socket in Direct Link mode +USODL

+USODL						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	< 1 s	+CME Error

18.16.1 Description

Establishes a transparent end to end communication with an already connected TCP or UDP socket via the serial interface. The data can be sent to the socket and can be received via the serial interface: the HW flow control usage is strongly recommended to avoid data loss.

The transparent TCP/UDP connection mode can be exited via the +++ sequence, entered after at least 2 s of suspension of transmission to the port. The socket will remain connected and communication can be re-established any time.

The +UDCONF=5, +UDCONF=6, +UDCONF=7, +UDCONF=8 commands allow the configuration of UDP and TCP direct link triggers.

⚠ When using Direct Link with UDP sockets, if no network signal is available, outgoing UDP packet may be lost.

⚠ SARA-R404M / SARA-R410M-01B / SARA-R410M-02B
The HW flow control is not supported.

18.16.2 Syntax

Type	Syntax	Response	Example
Set	AT+USODL=<socket>	CONNECT	AT+USODL=0 CONNECT
Test	AT+USODL=?	+USODL: (list of supported <socket>s) OK	+USODL: (0-6) OK

18.16.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6.

18.16.4 Enhanced Direct Link

The enhanced DL functionality allows the user set up to three kinds of trigger for data transmission:

- Timer Trigger
- Data Length Trigger
- Character Trigger

The triggers can be applied independently to each socket. A socket may be set with more than one trigger.

The trigger must be set after the socket creation and before switching to direct link mode.

By default Timer Trigger and Data Length Trigger are enabled for UDP sockets.

By default no triggers are enabled for TCP sockets.

See the +UDCONF=5, +UDCONF=6, +UDCONF=7, +UDCONF=8 commands description for the transmission triggers configuration.

18.16.4.1 Timer Trigger (TT)

The user can configure a timeout for sending the data. The timer starts every time a character is read from the serial interface. When the timer expires, buffered data is sent.

The timer range is between 100 and 120000 ms; the special value 0 (zero) means that the timer is disabled.

By default the timer trigger is disabled for TCP sockets and enabled with a value of 500 ms for UDP sockets.

The +UDCONF=5 command can configure the timer trigger.

18.16.4.2 Data Length Trigger (DLT)

The user can configure a maximum buffered data length to reach before sending the data. When this length is reached the data is sent.

The minimum data length is 3, the maximum data length is 2048 bytes for TCP and 1472 bytes for UDP. If the data length is set to 0 (zero) the trigger is disabled (every data chunk received from the serial port is immediately sent to the network).

By default the data length trigger is disabled for TCP sockets and set to 1024 for UDP sockets.

The +UDCONF=6 command can configure the data length trigger.

18.16.4.3 Character Trigger (CT)

The user can configure a character that will trigger the data transmission. When the character is detected the data (including the trigger character) is sent.

If the specified character is -1, the character trigger is disabled.

By default it is disabled for both TCP and UDP sockets.

The +UDCONF=7 command can configure the character trigger.

18.16.4.4 Combined Triggers

The user can enable multiple triggers together. The triggers work with an OR logic. This means that the first trigger reached fires the data transmission.

18.16.4.5 About serial data chunks

A data chunk is the amount of data that SIO recognizes as a single data transmission.

☞ If the baud rate is lower than 115200 b/s the time to receive 255 characters is always calculated with timings for 115200 b/s.

18.16.4.6 Data from the network

The data received from the network is immediately forwarded to the serial interface.

18.16.4.7 Congestion timer

Is it also possible to set a congestion timer after which, in case of network congestion, the module exits from direct link.

The timer range is between 1000 and 720000 ms, the special value 0 (zero) means that the timer is disabled.

By default the congestion timer is set to 60000 (60 s) for both TCP and UDP sockets.

The +UDCONF=8 command can configure the congestion timer.

18.17 UDP Direct Link Packet Size configuration +UDCONF=2

+UDCONF=2						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

18.17.1 Description

Set the packet size for the UDP direct link packet.

18.17.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=2,<socket_id>,<packet_size>	OK	AT+UDCONF=2,1,1024 OK
Read	AT+UDCONF=2,<socket_id>	+UDCONF: 2,<socket_id>,<packet_size> OK	AT+UDCONF=2,1 +UDCONF: 2,1,1024 OK

18.17.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings. Valid range is 0-6
<packet_size>	Number	Packet size (in bytes) for UDP direct link; valid range is 100-1472; the factory-programmed value is 1024 bytes

18.18 UDP Direct Link Sending timer configuration +UDCONF=3

+UDCONF=3						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

18.18.1 Description

Configures the UDP direct link set sending timer.

18.18.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=3,<socket_id>,<sending_timer_timeout>	OK	AT+UDCONF=3,1,1000 OK
Read	AT+UDCONF=3,<socket_id>	+UDCONF: 3,<socket_id>,<sending_timer_timeout> OK	AT+UDCONF=3,1 +UDCONF: 3,1,1000 OK

18.18.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings. Allowed range is 0-6
<sending_timer_timeout>	Number	Sending timer (in milliseconds) for UDP direct link; valid range is 100-120000; the default value is 1000 ms

18.19 Timer Trigger configuration for Direct Link +UDCONF=5

+UDCONF=5						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

18.19.1 Description

Sets the timer trigger of the interested socket identifier for the data transmission enhanced Direct Link.

18.19.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=5,<socket_id>,<timer_trigger>	OK	AT+UDCONF=5,0,500 OK
Read	AT+UDCONF=5,<socket_id>	+UDCONF: 5,<socket_id>,<timer_trigger> OK	AT+UDCONF=5,0 +UDCONF: 5,0,500 OK

18.19.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings. The range is 0-6.
<timer_trigger>	Number	Enhanced Direct Link sending timer trigger (in milliseconds); valid range is 0, 100-120 000; the factory-programmed value is 500 ms for UDP, 0 for TCP, 0 means trigger disabled.

18.19.4 Notes

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- The factory-programmed value is 1000 ms for TCP.

18.20 Data Length Trigger configuration for Direct Link +UDCONF=6

+UDCONF=6						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

18.20.1 Description

Sets the data length trigger of the interested socket identifier for the data transmission enhanced Direct Link.

18.20.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=6,<socket_id>,<data_length_trigger>	OK	AT+UDCONF=6,0,1024 OK
Read	AT+UDCONF=6,<socket_id>	+UDCONF: 6,<socket_id>,<data_length_trigger> OK	AT+UDCONF=6,0 +UDCONF: 6,0,1024 OK

18.20.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings. Valid range is 0-6
<data_length_trigger>	Number	Enhanced Direct Link data length trigger in bytes, valid range is 0, 3 1472 for UDP and 0, 3-2048 for TCP, the factory-programmed value is 1024 for UDP, 0 for TCP, 0 means trigger disabled

18.21 Character trigger configuration for Direct Link +UDCONF=7

+UDCONF=7						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

18.21.1 Description

Sets the character trigger of the interested socket identifier for the data transmission enhanced Direct Link.

18.21.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=7,<socket_id>,<character_trigger>	OK	AT+UDCONF=7,0,13 OK
Read	AT+UDCONF=7,<socket_id>	+UDCONF: 7,<socket_id>,<character_trigger> OK	AT+UDCONF=7,0 +UDCONF: 7,0,13 OK

18.21.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the Direct Link settings. The allowed range is 0-6
<character_trigger>	Number	Enhanced Direct Link character trigger, the value represents the ASCII code (in base 10) of the character to be used as character trigger. The allowed range is -1, 0-255, the factory-programmed value is -1; -1 means trigger disabled

18.22 Socket control +USOCTL

+USOCTL						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

18.22.1 Description

Allows interaction with the low level socket layer.

18.22.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCTL=<socket>,<param_id>	+USOCTL: <socket>,<param_id>,<param_val>[,<param_val2>] OK	AT+USOCTL=0,2 +USOCTL: 0,2,38 OK

Type	Syntax	Response	Example
Test	AT+USOCTL=?	+USOCTL: (list of supported <socket>s),(list of supported <param_id>s) OK	+USOCTL: (0-6),(0-4,10-11) OK

18.22.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6.
<param_id>	Number	Control request identifier. Possible values are: • 0: query for socket type • 1: query for last socket error • 2: get the total amount of bytes sent from the socket • 3: get the total amount of bytes received by the socket • 4: query for remote peer IP address and port • 10: query for TCP socket status (only TCP sockets) • 11: query for TCP outgoing unacknowledged data (only TCP sockets) • 5-9, 12-99: RFU
<param_val>	Number / String	This value may assume different means depending on the <param_id> parameter. If <param_id>= 0, <param_val> can assume these values: • 6 TCP socket • 17: UDP socket If <param_id>= 1, <param_val> can assume these values: • N: last socket error If <param_id>= 2, <param_val> can assume these values: • N: the total amount (in bytes) of sent (acknowledged + unacknowledged) data If <param_id>= 3, <param_val> can assume these values: • N: the total amount (in bytes) of received (read) data If <param_id>= 4, <param_val> can assume these values: • A string representing the remote peer IP address expressed in dotted decimal form If <param_id>= 10, <param_val> can assume these values: • 0: the socket is in INACTIVE status (it corresponds to CLOSED status defined in RFC793 "TCP Protocol Specification" [112]) • 1: the socket is in LISTEN status • 2: the socket is in SYN_SENT status • 3: the socket is in SYN_RCVD status • 4: the socket is in ESTABILISHED status • 5: the socket is in FIN_WAIT_1 status • 6: the socket is in FIN_WAIT_2 status • 7: the sokcet is in CLOSE_WAIT status • 8: the socket is in CLOSING status • 9: the socket is in LAST_ACK status • 10: the socket is in TIME_WAIT status If <param_id>= 11, <param_val> can assume these values: • N: the total amount of outgoing unacknowledged data
<param_val2>	Number	This value is present only when <param_id> is 4. It represents the remote peer IP port. For IP address format reference see the IP addressing.

18.22.4 Notes

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- <param_id>=4 and 11 are not supported.

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- <param_id>=2 and 3 are not supported.

18.23 Configure Dormant Close Socket Behavior +USOCLCFG

+USOCLCFG						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

18.23.1 Description

Enables or disables the TCP socket Graceful Dormant Close feature. When enabled, if the RRC connection is released and a TCP socket is closed with the +USOCL, the module will re-establish the RRC connection to close the socket both locally and remotely. When this feature is disabled, the module will close the socket locally without re-establishing the RRC connection. In this case the socket will remain open on the remote side until it is closed.

18.23.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCLCFG=<GDC_enable>	OK	AT+USOCLCFG=0 OK
Read	AT+USOCLCFG?	+USOCLCFG: <GDC_enable> OK	+USOCLCFG: 0 OK
Test	AT+USOCLCFG=?	+USOCLCFG: (list of supported <GDC_enable>s) OK	+USOCLCFG: (0,1) OK

18.23.3 Defined values

Parameter	Type	Description
<GDC_enable>	Number	Status of TCP socket Graceful Dormant Close. Allowed values: • 0: disabled • 1 (factory-programmed value): enabled

19 SSL/TLS

19.1 Introduction

SSL/TLS provides a secure connection between two entities using TCP socket for communication (i.e. HTTP/FTP server and HTTP/FTP client).

The SSL/TLS with digital certificates support provides different connection security aspects:

- **Server authentication**: use of the server certificate verification against a specific trusted certificate or a trusted certificates list;
- **Client authentication**: use of the client certificate and the corresponding private key;
- **Data security and integrity**: data encryption and Hash Message Authentication Code (HMAC) generation.

The security aspects used in the current connection depend on the SSL/TLS configuration and features supported by the communicating entities.

u-blox cellular modules support all the described aspects of SSL/TLS security protocol with these AT commands:

- AT+USECMNG: import, removal, list and information retrieval of certificates or private keys;
- AT+USECPRF: configuration of USECMNG (u-blox SECurity MaNaGement) profiles used for an SSL/TLS connection.

The USECMNG provides a default SSL/TLS profile which cannot be modified. The default USECMNG profile provides the following SSL/TLS settings:

Setting	Value	Meaning
Certificates validation level	Level 0	The server certificate will not be checked or verified.
Minimum SSL/TLS version	Any	The server can use any of the TLS1.0/TLS1.1/TLS1.2 versions for the connection.
Cipher suite	Automatic	The cipher suite will be negotiated in the handshake process.
Trusted root certificate internal name	"" (none)	No certificate will be used for the server authentication.
Expected server host-name	"" (none)	No server host-name is expected.
Client certificate internal name	"" (none)	No client certificate will be used.
Client private key internal name	"" (none)	No client private key will be used.

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The default USECMNG profile does not provide the client certificate internal name and the client private key internal name.

The secure re-negotiation and the SSL/TLS session resumption are currently not supported, and if mandated by the server the SSL/TLS connection will fail with an Generic SSL/TLS handshake alert.

19.2 SSL/TLS certificates and private keys manager +USECMNG

+USECMNG						
Modules	SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

19.2.1 Description

Manages the X.509 certificates and private keys with the following functionalities:

- Import of certificates and private keys
- List and information retrieval of imported certificates and private keys
- Removal of certificates and private keys
- MD5 calculation of imported certificate or private key

SARA-R4 / SARA-N4
The command accepts certificates and private keys in DER (Distinguished Encoding Rules) or CER formats only. If the provided format is PEM, the imported certificate or private key will be invalid.

The certificates and private keys are kept in DER format and are not retrievable (i.e. cannot be downloaded from the module); for data validation purposes an MD5 hash string of the stored certificate or private key (stored in DER format) can be retrieved.

Up to 16 certificates or private keys can be imported.

Data for certificate or private key import can be provided with a stream of byte similar to +UDWNFILE or from a file stored on the FS.

When using the stream of byte import functionality:
- If the data transfer is stopped before its competition, a guard timer of 20 s will ensure the termination of the data transmission. In this case the prompt will switch back in AT command mode and an error result code will be returned.
- If the module shuts down during the data transfer, all the bytes are discarded.
- If any error occurs during the data transfer, all bytes are discarded.

All the imported certificates or private keys are listed if the type of the security data is omitted.

The imported certificates and private keys are:
- PERSISTED after the module FW is upgraded using +UFWINSTALL, +UFWSINSTALL or +UFWUPD AT commands.
- PERSISTED after a factory reset using +UFACTORY AT command.
- NOT PERSISTED after the module FW is upgraded using EasyFlash.

The X.509 certificate DN (Distinguished Name) is composed of value fields which uniquely define an entity being authenticated. For security reasons some limitations (related to DN fields) described below are applied:
- The USECMNG import functionality allows the following DN value fields:
  - commonName (http://oid-info.com/get/2.5.4.3)
  - serialNumber (http://oid-info.com/get/2.5.4.5)
  - countryName (http://oid-info.com/get/2.5.4.6)
  - localityName (http://oid-info.com/get/2.5.4.7)
  - stateOrProvinceName (http://oid-info.com/get/2.5.4.8)
  - organizationName (http://oid-info.com/get/2.5.4.10)
  - organizationalUnitName (http://oid-info.com/get/2.5.4.11)
  - userID (http://oid-info.com/get/0.9.2342.19200300.100.1.1)
  - domainComponent (http://oid-info.com/get/0.9.2342.19200300.100.1.25)
  - pkcs9_emailAddress (http://oid-info.com/get/1.2.840.113549.1.9.1)
  - pkcs9_unstructuredName (http://oid-info.com/get/1.2.840.113549.1.9.2)
- The import of an X.509 certificate with DN containing other value fields (not in the above list) will result in an import error (error result code: USECMNG invalid certificate/key format).

19.2.2 Syntax

Type	Syntax	Response	Example
Generic syntax:			
Action	AT+USECMNG=<op_code>,[<type>[,<internal_name>[,<param1>[,<param2>]]]]	OK	-
Import a certificate or private key from serial I/O:			
Action	AT+USECMNG=0,<type>,<internal_name>,<data_size>[,<password>]	> Start transfer of data ... +USECMNG: 0,<type>,<internal_name>,<md5_string> OK	AT+USECMNG=0,0,"AddTrustCA",1327 >-----BEGIN CERTIFICATE----- (...other certificate data bytes...)

Type	Syntax	Response	Example
			+USECMNG: 0,0,"AddTrustCA", "77107370ec4db40a0 8a6e36a64a1435b" OK
Import a certificate or private key from a file stored on FS:			
Action	AT+USECMNG=1,<type>,<internal_ name>,<filename>[,<password>]	+USECMNG: 1,<type>,<internal_ name>,<md5_string> OK	AT+USECMNG=1,0,"AddTrustCA", "addtrust.cert" +USECMNG: 1,0,"AddTrustCA","7710 7370ec4db40a08a6e36a64a1435b" OK
Remove an imported certificate or private key:			
Action	AT+USECMNG=2,<type>,<internal_ name>	OK	AT+USECMNG=2,0,"AddTrustCA" OK
List imported certificates or private keys:			
Read	AT+USECMNG=3[,<type>]	<cert_type>,<internal_name>[, <common_name>,<expiration_ date>] ... OK	AT+USECMNG=3 "CA","AddTrustCA","AddTrust External CA Root","2020/05/30" "CA","GlobalSignCA","GlobalSign", "2029/03/18" "CC","JohnDoeCC","GlobalSign","20 10/01/01" "PK","JohnDoePK" OK
Retrieve the MD5 of an imported certificate or private key:			
Read	AT+USECMNG=4,<type>,<internal_ name>	+USECMNG: 4,<type>,<internal_ name>,<md5_string> OK	AT+USECMNG=4,0,"AddTrustCA" +USECMNG: 4,0,"AddTrustCA", "77107370ec4db40a0 8a6e36a64a1435b" OK
Test	AT+USECMNG=?	+USECMNG: (list of supported <op_ code>s),(list of supported <type>s) OK	+USECMNG: (0-4),(0-2) OK

19.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	Type of operation: • 0: import a certificate or a private key (data provided by the stream of byte) • 1: import a certificate or a private key (data provided from a file on FS) • 2: remove an imported certificate or private key • 3: list imported certificates or private keys • 4: retrieve the MD5 of an imported certificate or private key
<type>	Number	Type of the security data: • 0: trusted root CA (certificate authority) certificate • 1: client certificate • 2: client private key • 3: RFU • 4: signature verification certificate • 5: signature verification public key
<cert_type>	String	Type of the security data in verbose format: • "CA": trusted root CA (certificate authority) certificate • "CC": client certificate • "PK": client private key • "SC": server certificate • "VC": signature verification certificate

Parameter	Type	Description
		• "PU": signature verification public key
<internal_name>	String	Unique identifier of an imported certificate or private key. If an existing name is used the data will be overridden. The maximum length is 200 characters.
<data_size>	Number	Size in bytes of a certificate or private key being imported. The maximum allowed size is 8192 bytes.
<password>	String	Decryption password; applicable only for PKCS8 encrypted client private keys. The maximum length is 128 characters.
<filename>	String	Name of the FS file containing the certificate or private key data to be imported. The maximum allowed file size is 8192 bytes.
<md5_string>	String	MD5 formatted string.
<common_name>	String	Certificate subject (issued to) common name; applicable only for trusted root and client certificates.
<expiration_date>	String	Certificate expiration (valid to date); applicable only for trusted root and client certificates.
<param1>	Number/ String	Type and supported content depend on the related <op_code> parameter; see the <op_code> specification.
<param2>	Number/ String	Type and supported content depend on the related <op_code> parameter; see the <op_code> specification.

19.2.4 Notes

SARA-R4 / SARA-N4

- The <password>, <common_name> and <expiration_date> parameters are not supported.

SARA-R410M

- The certificates in the PEM format are not supported; they will not be automatically converted to the DER format.

SARA-R4 / SARA-N4

- The parameters:
  - <type>= 3, 4, 5 are not supported.
  - <cert_type>= "SC","VC","PU" are not supported.
- The imported certificates and private keys are:
  - NOT PERSISTED (deleted) after the module FW is upgraded using +UFWINSTALL, +UFWSINSTALL or +UFWUPD AT commands.

19.3 SSL/TLS security layer profile manager +USECPRF

+USECPRF						
Modules	SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

19.3.1 Description

Manages security profiles for the configuration of the following SSL/TLS connections properties:

- **Certificate validation level:**
  - Level 0: no certificate validation; the server certificate will not be checked or verified. No additional certificates are needed.
  - Level 1: certificate validation against a specific or a list of imported trusted root certificates.
  - Level 2: certificate validation with an additional URL integrity check (the server certificate common name must match the server hostname).
  - Level 3: certificate validation with an additional check on the certificate validity date.

  CA certificates should be imported with the +USECMNG AT command
- **Minimum SSL/TLS version to be used:**
  - Any
  - TLS 1.0

  - TLS 1.1
  - TLS 1.2
- **Exact cipher suite to be used** (the cipher suite register of Internet Assigned Numbers Authority (IANA) is provided in brackets):
  - (0x002f) TLS_RSA_WITH_AES_128_CBC_SHA
  - (0x003C) TLS_RSA_WITH_AES_128_CBC_SHA256
  - (0x0035) TLS_RSA_WITH_AES_256_CBC_SHA
  - (0x003D) TLS_RSA_WITH_AES_256_CBC_SHA256
  - (0x000a) TLS_RSA_WITH_3DES_EDE_CBC_SHA
  - (0x008c) TLS_PSK_WITH_AES_128_CBC_SHA
  - (0x008d) TLS_PSK_WITH_AES_256_CBC_SHA
  - (0x008b) TLS_PSK_WITH_3DES_EDE_CBC_SHA
  - (0x0094) TLS_RSA_PSK_WITH_AES_128_CBC_SHA
  - (0x0095) TLS_RSA_PSK_WITH_AES_256_CBC_SHA
  - (0x0093) TLS_RSA_PSK_WITH_3DES_EDE_CBC_SHA
  - (0x00ae) TLS_PSK_WITH_AES_128_CBC_SHA256
  - (0x00af) TLS_PSK_WITH_AES_256_CBC_SHA384
  - (0x00b6) TLS_RSA_PSK_WITH_AES_128_CBC_SHA256
  - (0x00b7) TLS_RSA_PSK_WITH_AES_256_CBC_SHA384

  See Table 24 for the applicability of cipher suite depending on the module series.
- **Additional cipher suite** to be used with IANA enumeration set command, see Syntax description:

IANA enumeration	Cipher suite description	Byte_1	Byte_2
0x0000	IANA_CS_REG_TLS_NULL_WITH_NULL_NULL	"00"	"00"
0x0004	IANA_CS_REG_TLS_RSA_WITH_RC4_128_MD5	"00"	"04"
0x0005	IANA_CS_REG_TLS_RSA_WITH_RC4_128_SHA	"00"	"05"
0x0009	IANA_CS_REG_TLS_RSA_WITH_DES_CBC_SHA	"00"	"09"
0x000A	IANA_CS_REG_TLS_RSA_WITH_3DES_EDE_CBC_SHA	"00"	"0A"
0x0015	IANA_CS_REG_TLS_DHE_RSA_WITH_DES_CBC_SHA	"00"	"15"
0x0016	IANA_CS_REG_TLS_DHE_RSA_WITH_3DES_EDE_CBC_SHA	"00"	"16"
0x001A	IANA_CS_REG_TLS_DH_anon_WITH_DES_CBC_SHA	"00"	"1A"
0x001B	IANA_CS_REG_TLS_DH_anon_WITH_3DES_EDE_CBC_SHA	"00"	"1B"
0x002F	IANA_CS_REG_TLS_RSA_WITH_AES_128_CBC_SHA	"00"	"2F"
0x0033	IANA_CS_REG_TLS_DHE_RSA_WITH_AES_128_CBC_SHA	"00"	"33"
0x0034	IANA_CS_REG_TLS_DH_anon_WITH_AES_128_CBC_SHA	"00"	"34"
0x0035	IANA_CS_REG_TLS_RSA_WITH_AES_256_CBC_SHA	"00"	"35"
0x0039	IANA_CS_REG_TLS_DHE_RSA_WITH_AES_256_CBC_SHA	"00"	"39"
0x003A	IANA_CS_REG_TLS_DH_anon_WITH_AES_256_CBC_SHA	"00"	"3A"
0x003C	IANA_CS_REG_TLS_RSA_WITH_AES_128_CBC_SHA256	"00"	"3C"
0x003D	IANA_CS_REG_TLS_RSA_WITH_AES_256_CBC_SHA256	"00"	"3D"
0x0067	IANA_CS_REG_TLS_DHE_RSA_WITH_AES_128_CBC_SHA256	"00"	"67"
0x0068	IANA_CS_REG_TLS_DH_DSS_WITH_AES_256_CBC_SHA256	"00"	"68"
0x0069	IANA_CS_REG_TLS_DH_RSA_WITH_AES_256_CBC_SHA256	"00"	"69"
0x006A	IANA_CS_REG_TLS_DHE_DSS_WITH_AES_256_CBC_SHA256	"00"	"6A"
0x006B	IANA_CS_REG_TLS_DHE_RSA_WITH_AES_256_CBC_SHA256	"00"	"6B"
0x006C	IANA_CS_REG_TLS_DH_anon_WITH_AES_128_CBC_SHA256	"00"	"6C"
0x006D	IANA_CS_REG_TLS_DH_anon_WITH_AES_256_CBC_SHA256	"00"	"6D"
0x008B	IANA_CS_REG_TLS_PSK_WITH_3DES_EDE_CBC_SHA	"00"	"8B"
0x008C	IANA_CS_REG_TLS_PSK_WITH_AES_128_CBC_SHA	"00"	"8C"
0x008D	IANA_CS_REG_TLS_PSK_WITH_AES_256_CBC_SHA	"00"	"8D"
0x008F	IANA_CS_REG_TLS_DHE_PSK_WITH_3DES_EDE_CBC_SHA	"00"	"8F"
0x0090	IANA_CS_REG_TLS_DHE_PSK_WITH_AES_128_CBC_SHA	"00"	"90"
0x0091	IANA_CS_REG_TLS_DHE_PSK_WITH_AES_256_CBC_SHA	"00"	"91"
0x0093	IANA_CS_REG_TLS_RSA_PSK_WITH_3DES_EDE_CBC_SHA	"00"	"93"
0x0094	IANA_CS_REG_TLS_RSA_PSK_WITH_AES_128_CBC_SHA	"00"	"94"
0x0095	IANA_CS_REG_TLS_RSA_PSK_WITH_AES_256_CBC_SHA	"00"	"95"

IANA enumeration	Cipher suite description	Byte_1	Byte_2
0x00A8	IANA_CS_REG_TLS_PSK_WITH_AES_128_GCM_SHA256	"00"	"A8"
0x00A9	IANA_CS_REG_TLS_PSK_WITH_AES_256_GCM_SHA384	"00"	"A9"
0x00AA	IANA_CS_REG_TLS_DHE_PSK_WITH_AES_128_GCM_SHA256	"00"	"AA"
0x00AB	IANA_CS_REG_TLS_DHE_PSK_WITH_AES_256_GCM_SHA384	"00"	"AB"
0x00AC	IANA_CS_REG_TLS_RSA_PSK_WITH_AES_128_GCM_SHA256	"00"	"AC"
0x00AD	IANA_CS_REG_TLS_RSA_PSK_WITH_AES_256_GCM_SHA384	"00"	"AD"
0x00AE	IANA_CS_REG_TLS_PSK_WITH_AES_128_CBC_SHA256	"00"	"AE"
0x00AF	IANA_CS_REG_TLS_PSK_WITH_AES_256_CBC_SHA384	"00"	"AF"
0x00B2	IANA_CS_REG_TLS_DHE_PSK_WITH_AES_128_CBC_SHA256	"00"	"B2"
0x00B3	IANA_CS_REG_TLS_DHE_PSK_WITH_AES_256_CBC_SHA384	"00"	"B3"
0x00B6	IANA_CS_REG_TLS_RSA_PSK_WITH_AES_128_CBC_SHA256	"00"	"B6"
0x00B7	IANA_CS_REG_TLS_RSA_PSK_WITH_AES_256_CBC_SHA384	"00"	"B7"
0xC003	IANA_CS_REG_TLS_ECDH_ECDSA_WITH_3DES_EDE_CBC_SHA	"C0"	"03"
0xC004	IANA_CS_REG_TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA	"C0"	"04"
0xC005	IANA_CS_REG_TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA	"C0"	"05"
0xC008	IANA_CS_REG_TLS_ECDHE_ECDSA_WITH_3DES_EDE_CBC_SHA	"C0"	"08"
0xC009	IANA_CS_REG_TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA	"C0"	"09"
0xC00A	IANA_CS_REG_TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA	"C0"	"0A"
0xC00D	IANA_CS_REG_TLS_ECDH_RSA_WITH_3DES_EDE_CBC_SHA	"C0"	"0D"
0xC00E	IANA_CS_REG_TLS_ECDH_RSA_WITH_AES_128_CBC_SHA	"C0"	"0E"
0xC00F	IANA_CS_REG_TLS_ECDH_RSA_WITH_AES_256_CBC_SHA	"C0"	"0F"
0xC012	IANA_CS_REG_TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA	"C0"	"12"
0xC013	IANA_CS_REG_TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA	"C0"	"13"
0xC014	IANA_CS_REG_TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA	"C0"	"14"
0xC017	IANA_CS_REG_TLS_ECDH_anon_WITH_3DES_EDE_CBC_SHA	"C0"	"17"
0xC018	IANA_CS_REG_TLS_ECDH_anon_WITH_AES_128_CBC_SHA	"C0"	"18"
0xC019	IANA_CS_REG_TLS_ECDH_anon_WITH_AES_256_CBC_SHA	"C0"	"19"
0xC023	IANA_CS_REG_TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256	"C0"	"23"
0xC024	IANA_CS_REG_TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384	"C0"	"24"
0xC025	IANA_CS_REG_TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA256	"C0"	"25"
0xC026	IANA_CS_REG_TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA384	"C0"	"26"
0xC027	IANA_CS_REG_TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256	"C0"	"27"
0xC028	IANA_CS_REG_TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384	"C0"	"28"
0xC029	IANA_CS_REG_TLS_ECDH_RSA_WITH_AES_128_CBC_SHA256	"C0"	"29"
0xC02A	IANA_CS_REG_TLS_ECDH_RSA_WITH_AES_256_CBC_SHA384	"C0"	"2A"
0xC02B	IANA_CS_REG_TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256	"C0"	"2B"
0xC02C	IANA_CS_REG_TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384	"C0"	"2C"
0xC02D	IANA_CS_REG_TLS_ECDH_ECDSA_WITH_AES_128_GCM_SHA256	"C0"	"2D"
0xC02E	IANA_CS_REG_TLS_ECDH_ECDSA_WITH_AES_256_GCM_SHA384	"C0"	"2E"
0xC02F	IANA_CS_REG_TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256	"C0"	"2F"
0xC030	IANA_CS_REG_TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384	"C0"	"30"
0xC031	IANA_CS_REG_TLS_ECDH_RSA_WITH_AES_128_GCM_SHA256	"C0"	"31"
0xC032	IANA_CS_REG_TLS_ECDH_RSA_WITH_AES_256_GCM_SHA384	"C0"	"32"
0xC0AE	IANA_CS_REG_TLS_ECDHE_ECDSA_WITH_AES_128_CCM_8	"C0"	"AE"

Table 22: Additional cipher suite

- **Certificate to be used for server and mutual authentication:**
  - The trusted root certificate. The CA certificate should be imported with the AT+USECMNG command.
  - The client certificate that should be imported with the AT+USECMNG command.
  - The client private key that should be imported with the AT+USECMNG command.
- **Expected server hostname, when using certificate validation level 2 or 3.**
- **Password for the client private key, if it is password protected.**
- **Pre-shared key used for connection. Defines a pre-shared key and key-name (PSK), when a TLS_PSK_* cipher suite is used.**

- **SNI (Server Name Indication).** SNI is a feature of SSL/TLS which uses an additional SSL/TLS extension header to specify the server name to which the client is connecting to. The extension was introduced to support the certificate handling used with virtual hosting provided by the various SSL/TLS enabled servers mostly in cloud based infrastructures. With the SNI a server has the opportunity to present a different server certificate (or/and whole SSL/TLS configuration) based on the host indicated by the SNI extension.

Table 23 provides the list the applicability of SSL connection properties depending on the module series.

	Certificate validation level	Minimum SSL/TLS version	Cipher suite	Trusted root certificate internal name	Expected server hostname	Password for the client private key	Pre-shared key used for connection	SNI
SARA-R4 SARA-N4	*	*	*	*	*			

Table 23: SSL/TLS connections properties applicability

☞ To set all the parameters in security profile, a set command for each <op_code> needs to be issued (e.g. certificate validation level, minimum SSL/TLS version, ...).

☞ To reset (set to factory-programmed value) all the parameters of a specific security profile, issue the AT +USECPRF=<profile_id> command.

19.3.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+USECPRF=<profile_id>[,<op_code>[,<param_val>]]	OK	AT+USECPRF=0,0,0 OK
Cipher suite selection using IANA enumeration			
Set	AT+USECPRF=<profile_id>,2,99,<byte_1>,<byte_2>	OK	AT+USECPRF=0,2,99,"C0","2B" OK
Server certificate pinning			
Set	AT+USECPRF=<profile_id>,12,<param_val>,<pinning_level>	OK	AT+USECPRF=0,12,"my_srv_cert",0 OK
Read	AT+USECPRF=<profile_id>,<op_code>	+USECPRF: <profile_id>,<op_code>,<param_val> OK	AT+USECPRF=0,0 +USECPRF: 0,0,0 OK
Test	AT+USECPRF=?	+USECPRF: (list of supported <profile_id>s),(list of supported <op_code>s) OK	+USECPRF: (0-4),(0-6) OK

19.3.3 Defined values

Parameter	Type	Description
<profile_id>	Number	USECMNG security profile identifier, in range 0-4; if it is not followed by other parameters the profile settings will be reset (set to factory-programmed value).
<op_code>	Number	• 0: certificate validation level; allowed values for <param_val>: o 0 (factory-programmed value): Level 0 - No validation; the server certificate will not be checked or verified. The server in this case is not authenticated.

Parameter	Type	Description
		o 1: Level 1 - Root certificate validation without URL integrity check. The server certificate will be verified with a specific trusted certificates or with each of the imported trusted root certificates. o 2: Level 2 - Root certificate validation with URL integrity check. Level 1 validation with an additional URL integrity check. o 3: Level 3 - Root certificate validation with check of certificate validity date. Level 2 validation with an additional check of certificate validity date. • 1: SSL/TLS version to use; allowed values for <param_val>: o 0 (factory-programmed value): any; server can use any version for the connection. o 1: TLSv1.0; connection allowed only to TLS/SSL servers which support TLSv1.0 o 2: TLSv1.1; connection allowed only to TLS/SSL servers which support TLSv1.1 o 3: TLSv1.2; connection allowed only to TLS/SSL servers which support TLSv1.2 • 2: cipher suite; allowed values for <param_val> define which cipher suite will be used: o 0 (factory-programmed value): (0x0000) Automatic the cipher suite will be negotiated in the handshake process o 1: (0x002f) TLS_RSA_WITH_AES_128_CBC_SHA o 2: (0x003C) TLS_RSA_WITH_AES_128_CBC_SHA256 o 3: (0x0035) TLS_RSA_WITH_AES_256_CBC_SHA o 4: (0x003D) TLS_RSA_WITH_AES_256_CBC_SHA256 o 5: (0x000a) TLS_RSA_WITH_3DES_EDE_CBC_SHA o 6: (0x008c) TLS_PSK_WITH_AES_128_CBC_SHA o 7: (0x008d) TLS_PSK_WITH_AES_256_CBC_SHA o 8: (0x008b) TLS_PSK_WITH_3DES_EDE_CBC_SHA o 9: (0x0094) TLS_RSA_PSK_WITH_AES_128_CBC_SHA o 10: (0x0095) TLS_RSA_PSK_WITH_AES_256_CBC_SHA o 11: (0x0093) TLS_RSA_PSK_WITH_3DES_EDE_CBC_SHA o 12: (0x00ae) TLS_PSK_WITH_AES_128_CBC_SHA256 o 13: (0x00af) TLS_PSK_WITH_AES_256_CBC_SHA384 o 14: (0x00b6) TLS_RSA_PSK_WITH_AES_128_CBC_SHA256 o 15: (0x00b7) TLS_RSA_PSK_WITH_AES_256_CBC_SHA384 o 99: cipher suite selection using IANA enumeration, <byte_1> and <byte_2> are strings containing the 2 bytes that compose the IANA enumeration, see Table 22. • 3: trusted root certificate internal name; o <param_val> (string) is the internal name identifying a trusted root certificate; the maximum length is 200 characters. The factory-programmed value is an empty string. • 4: expected server hostname; o <param_val> (string) is the hostname of the server, used when certificate validation level is set to Level 2; the maximum length is 256 characters. The factory-programmed value is an empty string. • 5: client certificate internal name; o <param_val> (string) is the internal name identifying a client certificate to be sent to the server; the maximum length is 200 characters. The factory-programmed value is an empty string. • 6: client private key internal name; o <param_val> (string) is the internal name identifying a private key to be used; the maximum length is 200 characters. The factory-programmed value is an empty string. • 7: client private key password; o <param_val> (string) is the password for the client private key if it is password protected; the maximum length is 128 characters. The factory-programmed value is an empty string. • 8: pre-shared key; o <param_val> (string) is the pre-shared key used for connection; the maximum length is 64 characters. The factory-programmed value is an empty string. • 9: pre-shared key name; o <param_val> (string) is the pre-shared key name used for connection; the maximum length is 128 characters. The factory-programmed value is an empty string. • 10: SNI (Server Name Indication); o <param_val> (string) value for the additional negotiation header SNI (Server Name Indication) used in SSL/TLS connection negotiation; the maximum length is 128 characters. The factory-programmed value is an empty string. • 11: RFU

Parameter	Type	Description
		• 12: Server certificate pinning; o <param_val> (string) internal name identifying a certificate configured to be used for server certificate pinning; the maximum length is 200 characters. The factory-programmed value is an empty string. o <pinning_level> defines the certificate pinning information level. Allowed values for <pinning_level> - 0: pinning based on information comparison of received and configured certificate public key - 1: pinning based on binary comparison of received and configured certificate public key - 2: pinning based on binary comparison of received and configured certificate
<byte_1>	String	First byte of IANA cipher suite enumeration
<byte_2>	String	Second byte of IANA cipher suite enumeration

19.3.4 Notes

•

	TLS_RSA_WITH_AES_128_CBC_SHA	TLS_RSA_WITH_AES_128_CBC_SHA256	TLS_RSA_WITH_AES_256_CBC_SHA	TLS_RSA_WITH_AES_256_CBC_SHA256	TLS_RSA_WITH_3DES_EDE_CBC_SHA	TLS_PSK_WITH_AES_128_CBC_SHA	TLS_PSK_WITH_AES_256_CBC_SHA	TLS_PSK_WITH_3DES_EDE_CBC_SHA	TLS_RSA_PSK_WITH_AES_128_CBC_SHA	TLS_RSA_PSK_WITH_AES_256_CBC_SHA	TLS_RSA_PSK_WITH_3DES_EDE_CBC_SHA	TLS_PSK_WITH_AES_128_CBC_SHA256	TLS_PSK_WITH_AES_256_CBC_SHA384	TLS_RSA_PSK_WITH_AES_128_CBC_SHA256	TLS_RSA_PSK_WITH_AES_256_CBC_SHA384
SARA-R4 SARA-N4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
SARA-R410M-01B	*	*	*	*	*										

Table 24: Cipher suite applicability

SARA-R4 / SARA-N4

- <op_code>=7, 8, 9 and 10 are not supported.
- <op_code>=12 (server certificate pinning) is not supported.
- <param_val>=99 (cipher suite selection using IANA enumeration) is not supported.

SARA-R410M-01B

- The unique certificate validation level (<op_code>=0) supported is the level 0 (no validation, <param_val>=0).
- The unique minimum SSL/TLS version (<op_code>=1) supported is <param_val>=0 (the server can use any version for the connection).

19.4 AT+USECMNG command example

SARA-R4 / SARA-N4

Here below is reported an example with a DER encoded trusted root certificate. This example is applicable only for an AT terminal where it is possible to convert the HEX string to binary format (i.e. m-center).

Command	Response	Description
Step 1: Import a trusted root certificate using the stream of byte similar to +UDWNFILE		
AT+USECMNG=0,0, "DERCertificate",947	>	Start the data transfer using the stream of byte.
DER encoded trusted root certificate data. The <CR><LF> shall be ignored during the import.	+USECMNG: 1,0,"DERCertificate","8ccadc0b22cef5be72ac411a11a8d812" OK	Input PEM formatted trusted root certificate data bytes. Output MD5 hash string of the stored trusted root certificate DER.

Command	Response	Description
Step 2: List all available certificates and private keys		
AT+USECMNG=3	CA, "DERCertificate","thawte Primary Root CA","2036/07/17" OK	List all available certificates and private keys.
Step 3: Set the security profile 2 validation level to trusted root		
AT+USECPRF=2,0,1	OK	Security profile 2 has the validation level set to trusted root.
Step 4: Set the security profile 2 trusted root certificate to the CA certificate imported as "DERCertificate"		
AT+USECPRF=2,3, "DERCertificate"	OK	Security profile 2 will use the CA certificate imported as "DERCertificate" for server certificate validation.
Step 5: Use the configured USECMNG profile 2 with the UHTTP application		
AT+UHTTP=0,1,"www.ssl_tls_test_server.com"	OK	Configure the UHTTP server name.
AT+UHTTP=0,6,1,2	OK	Enable the SSL/TLS for the UHTTP profile #0 and specify the SSL/TLS security profile 2.
AT+UHTTPC=0,1,"/","https.resp"	OK	Execute the HTTP GET command.
	+UUHTTPCR: 0,1,1	HTTP GET URC response.

In the above example the following DER encoded trusted certificate is used:

```
308203af30820297a0030201020210083be056904246b1a1756ac95991c74a300d06
092a864886f70d0101050500306131 0b3009060355040613025553311530130603 55
040a130c446967694365727420496e6331193017060355040b13107777772e646967
69636572742e636f6d3120301e060355040313174469676943657274204 76c6f6261
6c20526f6f74204341301e170d303631313130303030303030305a170d333131313130
3030303030305a3061310b3009060355040613025553311530130603 55040a130c44
6967694365727420496e6331193017060355040b13107777772e6469676963657274
2e636f6d3120301e060355040313174469676943657274204 76c6f62616c20526f6f
74204341308201223 00d06092a864886f70d01010105000382010f003082010a0282
010100e23be11172dea8a4d3a357aa50a28f0b7790c9a2a5ee12ce965b010920cc01
93a74e30b753f743c46900579de28d22dd870640008109cece1b83bfdfcd3b7146e2
d666c705b37627168f7b9e1e957deeb748a308dad6af7a0c3906657f4a5d1fbc17f8
abbeee28d7747f7a78995985686e5c23324bbf4ec0e85a6de370bf7710bffc01f685
d9a844105832a97518d5d1a2be47e2276af49a33f84908608bd45fb43a84bfa1aa4a
4c7d3ecf4f5f6c765ea04b37919edc22e66dce141a8e6acbfecdb3146417c75b299e
32bff2eefad30b42d4abb74132da0cd4eff881d5bb8d583fb51be84928a270da3104
ddf7b216f24c0a4e07a8ed4a3d5eb57fa390c3af270203010001a3633061300e0603
551d0f0101ff040403020186300f0603551d130101ff040530030101ff301d060355
1d0e0416041403de503556d14cbb66f0a3e21b1bc397b23dd155301f0603551d2304
183016801403de503556d14cbb66f0a3e21b1bc397b23dd155300d06092a864886f7
0d01010505000382010100cb9c37aa4813120afadd449c4f52b0f4dfae04f5797908
a32418fc4b2b84c02db9d5c7fef4c11f58cbb86d9c7a74e79829ab11b5e370a0a1cd
4c8899938c9170e2ab0f1cbe93a9ff63d5e40760d3a3bf9d5b09f1d58ee353f48e63
fa3fa7dbb466df6266d6d16e418df22db5ea774a9f9d58e22b59c04023ed2d288245
3e7954922698e08048a837eff0d6796016deace80ecd6eac4417382f49dae1453e2a
b93653cf3a5006f72ee8c4574 96c612118d504ad783c2c3a806ba7ebaf1514e9d88
9c1b9386ce2916c8aff64b977255730c01b24a3e1dce9df477cb5b424080530ec2db
d0bbf45bf50b9a9f3eb980112adc888c698345f8d0a3cc6e9d595956dde
```

19.5 Notes

Due to significant memory fingerprint of an SSL/TLS connection, the number of concurrent SSL/TLS connections is limited. The USECMNG and the underlying SSL/TLS infrastructure allows 4 concurrent SSL/TLS connections (i.e. 4 HTTPS requests or 2 HTTPS and 2 FTPS request).

20 FTP

Proprietary u-blox AT commands. FTP AT commands set can be used for sending and receiving files over the available bearer, transparently retrieving and storing them in the file system. Standard file and directory management operations on the remote FTP server are as well possible. PSD or CSD connection must be activated before using FTP client services.

Basically, two AT commands are necessary for an FTP client service: one AT command (+UFTP) to configure the FTP profile, a second AT command to execute a specific FTP command (+UFTPC). The final result of an FTP command will be notified through the +UUFTPCR URC whereas data will be provided through +UUFTPCD URC.

When these commands report an error which is not a +CME ERROR, the error code can be queried using the +UFTPER AT command.

☞ SARA-R4 / SARA-N4
No need to establish a PSD connection explicitly. This device automatically establishes a PSD connection as part of the network registration and attach procedure.

20.1 FTP service configuration +UFTP

+UFTP						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	Appendix A.6.1

20.1.1 Description

Sets up a parameter for FTP service, or resets a parameter to its factory-programmed value. The set/reset command needs to be executed for each single <op_code>. The read command returns the current setting of all the FTP parameters, one per line (i.e. the FTP profile). The FTP parameter values set with this command are all volatile (not stored in non-volatile memory).

☞ If the set command is issued without <param1> parameter, the corresponding <op_code> parameter is reset to the default value.

20.1.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UFTP=<op_code>[,<param1>[,<param2>]]	OK	AT+UFTP=7,21 OK
FTP server IP address			
Set	AT+UFTP=0[,<IP_address>]	OK	AT+UFTP=0,"192.168.1.0" OK
FTP server name			
Set	AT+UFTP=1[,<server_name>]	OK	AT+UFTP=1,"ftp.server.com" OK
Username			
Set	AT+UFTP=2[,<username>]	OK	AT+UFTP=2,"user_test" OK
Password			
Set	AT+UFTP=3[,<password>]	OK	AT+UFTP=3,"PWD" OK
Account			
Set	AT+UFTP=4[,<account>]	OK	AT+UFTP=4,"test" OK
Inactivity timeout			

Type	Syntax	Response	Example
Set	AT+UFTP=5[,<timeout>]	OK	AT+UFTP=5,21 OK
FTP mode			
Set	AT+UFTP=6[,<FTP_mode>]	OK	AT+UFTP=6,1 OK
FTP server port			
Set	AT+UFTP=7[,<FTP_server_port>]	OK	AT+UFTP=7,30 OK
FTP Secure option in explicit mode			
Set	AT+UFTP=8[,<FTP_secure>[,<USECMNG_profile>]]	OK	AT+UFTP=8,1,2 OK
Timer Trigger configuration for Direct Link			
Set	AT+UFTP=9,<timer_trigger>	OK	AT+UFTP=9,500 OK
Data Length Trigger configuration for Direct Link			
Set	AT+UFTP=10,<data_length_trigger>	OK	AT+UFTP=10,1024 OK
Character trigger configuration for Direct Link			
Set	AT+UFTP=11,<character_trigger>	OK	AT+UFTP=11,13 OK
Read	AT+UFTP?	+UFTP: 0,<IP_address> +UFTP: 1,<server_name> +UFTP: 2,<username> +UFTP: 4,<account> +UFTP: 5,<timeout> +UFTP: 6,<FTP_mode> +UFTP: 7,<FTP_server_port> [+UFTP: 8,<FTP_secure>[,<USECMNG_profile>]] +UFTP: 9,<timer_trigger> +UFTP: 10,<data_length_trigger> +UFTP: 11,<character_trigger> OK	+UFTP: 0,"216.239.59.147" +UFTP: 1,"" +UFTP: 2,"username" +UFTP: 4,"account" +UFTP: 5,0 +UFTP: 6,0 +UFTP: 7,21 +UFTP: 8,0 +UFTP: 9,500 +UFTP: 10,1024 +UFTP: 11,13 OK
Test	AT+UFTP=?	+UFTP: (list of supported <param_tag>s) OK	+UFTP: (0-11) OK

20.1.3 Defined values

Parameter	Type	Description
<op_code>	String	FTP parameter: • 0: FTP server IP address • 1: FTP server name • 2: FTP username • 3: FTP password • 4: FTP additional user account • 5: FTP inactivity timeout period • 6: FTP mode • 7: remote FTP server listening port • 8: FTP secure • 9: timer trigger • 10: data length trigger

Parameter	Type	Description
		• 11: character trigger
<IP_address>	String	FTP server IP address. The default value is an empty string. For IP address format reference see the IP addressing.
<server_name>	String	FTP server name (e.g. "ftp.server.com"). The maximum length is 128 characters. The default value is an empty string.
<username>	String	User name (the maximum length is 30 characters) for the FTP login procedure. The default value is an empty string.
<password>	String	Password (the maximum length is 30 characters) for the FTP login procedure. The default value is an empty string.
<account>	String	Additional user account (if required) for the FTP login procedure. The maximum length is 30 characters. The default value is an empty string.
<timeout>	Number	Inactivity timeout period in seconds. The range goes from 0 to 86400 s; 0 means no timeout (the FTP session will not be terminated in the absence of incoming traffic). The default value is 30 s.
<FTP_mode>	Number	FTP mode: • 0 (default value): active • 1: passive
<FTP_server_port>	Number	Remote FTP server listening port; it must be a valid TCP port value. The range goes from 1 to 65535; the default value is 21.
<FTP_secure>	Number	Enables / disables the Secure option (explicit mode) of FTP client service. FTP Secure option in explicit mode (SSL encryption of FTP control channel; FTP data channel is not encrypted): • 0 (default value): no SSL encryption • 1: enable SSL encryption of FTP control connection
<USECMNG_profile>	Number	USECMNG profile (number). Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see USECMNG section).
<timer_trigger>	Number	Enhanced Direct Link sending timer trigger (in milliseconds); valid range is 0(factory-programmed value), 100-120000; 0 means trigger disabled.
<data_length_trigger>	Number	Enhanced Direct Link data length trigger in bytes, valid range is 0 (factory-programmed value), 3-2048; 0 means trigger disabled.
<character_trigger>	Number	Enhanced Direct Link character trigger, the value represents the ASCII code (in base 10) of the character to be used as character trigger. The allowed range is -1, 0-255, the factory-programmed value is -1; -1 means trigger disabled.
<param1>	Number / String	Type and supported content depend on related <op_code> (details are given above). If <param1> is not specified the value of the corresponding parameter <op_code> is reset to default value.
<param2>	Number / String	Type and supported content depend on related <op_code> (details are given above). If <param2> is not specified the value of the corresponding parameter <op_code> is reset to default value.

20.1.4 Notes

- The information text response to the read command does not display the password.
- The FTP server IP address and the FTP server name are mutually exclusive. If value for <op_code>=0 is specified by user, then value for <op_code>=1 is reset or vice versa.
- Some network operators do not allow incoming connections. Due to these limitations introduced by network operators it is possible to encounter problems using FTP active mode. If the FTP active mode fails to exchange files, try the passive mode to solve the problem.
- Some network operators do not allow FTPS. In this case the +UFTPC=1 command (FTP login) will return a failure response via +UUFTPCR URC after an SSL timeout of 30 s.

SARA-R4 / SARA-N4

- <op_code>=9, 10 and 11 are not supported.
- <timer_trigger>, <data_length_trigger> and <character_trigger> parameters are not supported.

SARA-R404M / SARA-R410M-01B

- <op_code>=8 is not supported.

SARA-R4 / SARA-N4

- During connection to FTP remote server (via FTP login command) the FTP profile parameters cannot be changed or reset to factory-programmed values until disconnection takes place (FTP logout). Only <op_code>=5 (inactivity timeout), and <op_code>=6 (FTP mode), can be updated while the FTP connection is on the go.

20.2 FTP command +UFTPC

+UFTPC						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	Appendix A.6.1

20.2.1 Description

Triggers the FTP actions corresponding to the <op_code> parameter. The final result code indicates if sending the command request to the FTP process was successful or not. The +UUFTPCR (FTP command result) URC returns to the user the final result of the FTP command previously sent with +UFTPC. As well, the +UUFTPCD FTP unsolicited data URC provides the data requested by the user (e.g. file or directory lists) and received from the FTP server.

☞ The timing before the +UUFTPCR URC is issued on the AT terminal also depends by the DNS resolution. For further details about the estimated response time related to the DNS resolution, see the +UDNSRN AT command.

20.2.2 Syntax

Type	Syntax	Response	Example
General syntax			
Set	AT+UFTPC=<op_code>[,<param1>[,<param2>[,<param3>]]]	OK	AT+UFTPC=4,"data.zip","data.zip" OK
FTP logout			
Set	AT+UFTPC=0	OK	AT+UFTPC=0 OK
FTP login			
Set	AT+UFTPC=1	OK	AT+UFTPC=1 OK
Delete the file from the FTP server			
Set	AT+UFTPC=2,<file_name>	OK	AT+UFTPC=2,"mytest" OK
Rename a file of FTP server			
Set	AT+UFTPC=3,<file_name>,<new_file_name>	OK	AT+UFTPC=3,"old_name","final_name" OK
Retrieve the file from the FTP server			
Set	AT+UFTPC=4,<remote_file_name>,<local_file_name>[,<retrieving_mode>]	OK	AT+UFTPC=4,"data.zip","data.zip" OK
Store the file on the FTP server			
Set	AT+UFTPC=5,<local_file_name>,<remote_file_name>[,<number_of_byte>]	OK	AT+UFTPC=5,"data.zip","data.zip",30 OK
Retrieve a file from the FTP server using direct link mode			
Set	AT+UFTPC=6,<remote_file_name>[,<number_of_byte>]	OK	AT+UFTPC=6,"data.zip",30 OK
Send a file to the FTP server using the direct link mode			

Type	Syntax	Response	Example
Set	AT+UFTPC=7,<remote_file_name>[,<number_of_byte>]	OK	AT+UFTPC=7,"data.zip",30 OK
Change the working directory to the specified one			
Set	AT+UFTPC=8,<directory_name>	OK	AT+UFTPC=8,"data_folder" OK
Create a directory on the FTP host			
Set	AT+UFTPC=10,<directory_name>	OK	AT+UFTPC=10,"new_data_folder" OK
Remove the directory from the remote FTP server			
Set	AT+UFTPC=11,<directory_name>	OK	AT+UFTPC=11,"data_folder" OK
Information of a file or a directory			
Set	AT+UFTPC=13[,<file_directory_name>]	OK	AT+UFTPC=13,"data_folder" OK
List the file names in a specified directory			
Set	AT+UFTPC=14[,<file_directory_name>]	OK	AT+UFTPC=14,"data.zip" OK
Retrieve the FOTA update file			
Set	AT+UFTPC=100,<remote_file_name>	OK	AT+UFTPC=100,"data.zip" OK
Test	AT+UFTPC=?	+UFTPC: (list of supported <op_code>s) OK	+UFTPC: (0-5,8,10,11,13,14,100) OK
URC		+UUFTPCD: <op_code>,<ftp_data_len>,<ftp_data>	+UUFTPCD: 13,16,"16 bytes of data"
URC		+UUFTPCR: <op_code>,<ftp_result>[,<md5_sum>]	+UUFTPCR: 1,1

20.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	FTP command request. Allowed values: • 0: FTP logout; terminates the FTP session by performing a logout. • 1: FTP login; connects to the FTP server using the parameters of the current FTP profile (set via AT+UFTP command). • 2: deletes the file from the FTP server. • 3: renames the file. This AT command just sends requests to the FTP process. • 4: retrieves the file from the FTP server. • 5: stores the file on the FTP server. • 6: retrieves a file from the FTP server using direct link mode. This command handles the initial steps of the FTP protocol for retrieving a file; after that it will establish a transparent end to end communication with the data connection TCP socket via the serial interface. After the CONNECT result code, the file content will be directly sent to the serial interface. When the data transfer is completed, the module will automatically exit from direct link mode (no need to send +++ sequence). • 7: sends a file to the FTP server using the direct link mode. This command handles the initial steps of the FTP protocol for sending a file; after that it will establish a transparent end to end communication with the data connection TCP socket via the serial interface. After the CONNECT result code, the user can send the file content via the serial interface. Once finished, the user must wait at least 2 s before sending the +++ sequence to switch off the direct link mode. This operation may take a few seconds because the command also handles the final steps of the FTP protocol • 8: changes the working directory to the specified one. • 9: RFU. • 10: creates a directory on the FTP host. • 11: removes the directory from the remote FTP server.

Parameter	Type	Description
		• 12: RFU. • 13: information of a file or a directory. The URC +UUFTPCD returns the information of the specified file or directory from the FTP server. • 14: lists the file names in a specified directory. The URC +UUFTPCD returns the list of the file names received from FTP server. If the directory name is omitted, the list of the files names of current working directory is requested. • 100: retrieves the FOTA update file. The downloaded file will not be accessible to the user. The +UUFTPCR URC will display the MD5 checksum of the downloaded file.
<file_name>	String	File name to be deleted/renamed from the FTP host. For the limit of the length of the string, see Command line.
<new_file_name>	String	New file name. For the limit of the length of the string, see Command line.
<remote_file_name>	String	Remote file name to be retrieved from the FTP host or stored in it. The maximum parameter length is 256 characters.
<local_file_name>	String	Local file name (module file system) text string to be stored/sent on the file system. For the limit of the length of the string, see the File system limits.
<retrieving_mode>	Number	Allowed values: • 0 (default value): the file is retrieved from beginning. • 1: restart the data retrieving from the last data received during the previous download interrupted due to error.
<number_of_byte>	Number	Represents the number of bytes already sent to the FTP server or received from it. • During a file retrieval the server writes the file from the offset indicated with this parameter. • During a file storing the server sends the data from the value indicated with this parameter.
<directory_name>	String	Directory name on the FTP server. For the limit of the length of the string, see Command line.
<file_directory_name>	String	Path file/directory name to be listed. If not specified, the current directory list is requested. For the limit of the length of the string, see Command line. • <param1> optional parameter; the text string of the path (file or directory) to be name listed. If not specified, the list of the files names of current working directory is requested.
<ftp_data_len>	Number	Amount of data in bytes
<ftp_data>	String	Data available from the FTP server in the ASCII [0x00,0xFF] range. The starting quotation mark shall not be taken into account like data, the first byte of data starts after the first quotation mark. The total number of bytes is <ftp_data_len>. At the end of the byte stream, another quotation mark is provided for user convenience and visualization purposes.
<ftp_result>	Number	• 0: fail • 1: success
<md5_sum>	String	MD5 checksum of the FOTA update file downloaded via +UFTPC=100 AT command. This parameter is issued only for +UFTPC=100 AT command.
<param1>	String	Content depend on related <op_code> (details are given above)
<param2>	String	Content depend on related <op_code> (details are given above)
<param3>	String	Content depend on related <op_code> (details are given above)

20.2.4 Notes

- If <op_code>=6 the user must switch off the direct link mode (sending +++ to the serial interface) when the data stream is finished. This operation may take up to 10 s because the command also handles the final steps of the FTP protocol.

SARA-R4 / SARA-N4

- <md5_sum> is not supported.

20.3 FTP error +UFTPER

+UFTPER						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	Appendix A.6.1

20.3.1 Description

This command retrieves the error class and code of the last FTP operation.

20.3.2 Syntax

Type	Syntax	Response	Example
Action	AT+UFTPER	+UFTPER: <error_class>,<error_code> OK	+UFTPER: 1,1 OK

20.3.3 Defined values

Parameter	Type	Description
<error_class>	Number	Value of error class. Values are listed in Appendix A.6
<error_code>	Number	Value of class-specific error code (reply code if <error_class> is 0). The values are listed in Appendix A.6.1

21 HTTP

The section describes the u-blox proprietary AT commands that can be used for sending requests to a remote HTTP server, receiving the server response and transparently storing it in the file system. The supported methods are: HEAD, GET, DELETE, PUT, POST file and POST data. A PSD or CSD connection must be activated before using HTTP AT commands.

When these commands report an HTTP error, the error code can be queried using the +UHTTPER AT command.

SARA-R4
No need to establish a PSD connection explicitly. This device automatically establishes a PSD connection as part of the network registration and attach procedure.

21.1 HTTP control +UHTTP

+UHTTP						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	Appendix A.6

21.1.1 Description

Configures, reads or resets (to the factory-programmed values) the HTTP application profile parameters. Up to 4 different HTTP profiles can be defined. To set all the parameters in an HTTP profile a set command for each <op_code> needs to be issued.

The configured HTTP profile parameters are not saved in the non volatile memory.

The read command has two possible usages. The functionality of the command differs with the number of command parameters issued:

- Only the first command parameter (<profile_id>) issued: the module resets all the profile parameters (to the factory-programmed values) for the profile specified with <profile_id>
- Only the first and second command parameters used (<profile_id>, <op_code>): the module returns the current value of the profile parameter specified with <op_code> and related to the profile specified with <profile_id>

21.1.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UHTTP=<profile_id>,<op_code>,<param_val>[,<param_val1>]	OK	AT+UHTTP=2,0,"125.24.51.133" OK
Read	AT+UHTTP=<profile_id>,<op_code>	+UHTTP: <profile_id>,<op_code>,<param_val>[,<param_val1>] OK	AT+UHTTP=2,0 +UHTTP: 2,0,"125.24.51.133" OK
HTTP server IP address			
Set	AT+UHTTP=<profile_id>,0,<HTTP_server_IP_address>	OK	AT+UHTTP=2,0,"125.24.51.133" OK
Read	AT+UHTTP=<profile_id>,0	+UHTTP: <profile_id>,0,<HTTP_server_IP_address> OK	AT+UHTTP=2,0 +UHTTP: 2,0,"125.24.51.133" OK
HTTP server name			
Set	AT+UHTTP=<profile_id>,1,<HTTP_server_name>	OK	AT+UHTTP=2,1,"www.u-blox.com" OK
Read	AT+UHTTP=<profile_id>,1	+UHTTP: <profile_id>,1,<HTTP_server_name> OK	AT+UHTTP=2,1 +UHTTP: 2,1,"www.u-blox.com"

Type	Syntax	Response	Example
			OK
Username			
Set	AT+UHTTP=<profile_id>,2,<username>	OK	AT+UHTTP=2,2,"my_user" OK
Read	AT+UHTTP=<profile_id>,2	+UHTTP: <profile_id>,2,<username> OK	AT+UHTTP=2,2 +UHTTP: 2,2,"my_user" OK
Password			
Set	AT+UHTTP=<profile_id>,3,<password>	OK	AT+UHTTP=2,3,"pwd" OK
Read	AT+UHTTP=<profile_id>,3	+UHTTP: <profile_id>,3,<password> OK	AT+UHTTP=2,3 +UHTTP: 2,3,"pwd" OK
Authentication type			
Set	AT+UHTTP=<profile_id>,4,<HTTP_authentication>	OK	AT+UHTTP=2,4,1 OK
Read	AT+UHTTP=<profile_id>,4	+UHTTP: <profile_id>,4,<HTTP_authentication> OK	AT+UHTTP=2,4 +UHTTP: 2,4,1 OK
HTTP server port			
Set	AT+UHTTP=<profile_id>,5,<HTTP_port>	OK	AT+UHTTP=2,5,30 OK
Read	AT+UHTTP=<profile_id>,5	+UHTTP: <profile_id>,5,<HTTP_port> OK	AT+UHTTP=2,5 +UHTTP: 2,5,30 OK
HTTP secure option			
Set	AT+UHTTP=<profile_id>,6,<HTTP_secure>[,<USECMNG_profile>]	OK	AT+UHTTP=2,6,1 OK
Read	AT+UHTTP=<profile_id>,6	+UHTTP: <profile_id>,6,<HTTP_secure>[,<USECMNG_profile>] OK	AT+UHTTP=2,6 +UHTTP: 2,6,1 OK
HTTP add custom request headers			
Set	AT+UHTTP=<profile_id>,9,<custom_request_header>	OK	AT+UHTTP=2,9,"0:hdr0:val0" OK
Read	AT+UHTTP=<profile_id>,9	+UHTTP: <profile_id>,9,<custom_request_header> OK	AT+UHTTP=2,9 +UHTTP: 2,9,"0:hdr0:val0" OK
Read	AT+UHTTP=<profile_id>	OK	AT+UHTTP=2 OK
Test	AT+UHTTP=?	+UHTTP: (list of supported <profile_id>s),(list of supported <op_code>s) OK	+UHTTP: (0-3),(0-9) OK

21.1.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<op_code>	Number	• 0: HTTP server IP address; • 1: HTTP server name; • 2: username • 3: password

Parameter	Type	Description
		• 4: authentication type • 5: HTTP server port • 6: HTTP Secure option (SSL encryption) • 7: reserved for internal use only • 8: reserved for internal use only • 9: HTTP add custom request headers
<HTTP_server_IP_address>	String	HTTP server IP address; The factory-programmed value is an empty text string. For IP address format reference see the IP addressing.
<HTTP_server_name>	String	HTTP server name; the maximum length is 128 characters (e.g. "http.server.com"). The factory-programmed value is an empty text string.
<username>	String	User name; the maximum length is 30 characters; it is used for the HTTP login procedure if the authentication is used. The factory-programmed value is an empty text string.
<password>	String	Password; the maximum length is 30 characters; it is used for the HTTP login procedure if the authentication is used. The factory-programmed value is an empty text string.
<HTTP_authentication>	Number	HTTP authentication method; the allowed values are: • 0 (factory-programmed value): no authentication • 1: basic authentication (the password and username must be set)
<HTTP_port>	Number	HTTP server port; range 1-65535. It means the HTTP server port to be used in a HTTP request; the factory-programmed value is 80.
<HTTP_secure>	Number	HTTP Secure option (SSL encryption). It enables or disables the HTTPS (SSL secured connection for HTTP application) usage: • 0 (factory-programmed value): HTTPS (SSL encryption) disabled and the HTTP server port set to 80 • 1: HTTPS (SSL encryption) enabled and the HTTP server port set to 443; an USECMNG profile can be specified with an additional parameter.
<USECMNG_profile>	Number	Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used
<custom_request_header>	String	Sets/clears the custom request header (string); the custom header option follows a defined format "hdr_id:hdr_name:hdr_value"; the hdr_id is a number in the range [0-4]; the hdr_name and hdr_value are strings having a maximum length of 64 characters (see examples below). • "0:hdr0:val0": set header 0 with name hdr0 and value val0 • "0:": clear header 0 • "1:hdr1:val1": set header 1 with name hdr1 and value val1 • "1:": clear header 1 • "2:hdr2:val2": set header 2 with name hdr2 and value val2 • "2:": clear header 2 • "3:hdr3:val3": set header 3 with name hdr3 and value val3 • "3:": clear header 3 • "4:hdr4:val4": set header 4 with name hdr4 and value val4 • "4:": clear header 4 The following character is not allowed in the <custom_request_header> parameter: • 0x3A (:)
<param_val>	Number / String	Type and supported content depend on the related <op_code> parameter; details are given above
<param_val1>	Number / String	Type and supported content depend on the related <op_code> parameter; details are given above.

21.1.4 Notes

- HTTP server IP address and HTTP server name are mutually exclusive. If the HTTP server IP address is specified by the user, then the value for the HTTP server name is reset, or vice versa.

SARA-R4 / SARA-N4

- Set the secure option (<op_code>=6) before configuring the custom HTTP header with <op_code>=9 to ensure the proper default port number is used in the header.

SARA-R404M / SARA-R410M-01B

- <op_code>=6 (HTTP Secure option), 9 (HTTP add custom request headers) are not supported.

21.2 HTTP advanced control+UHTTPAC

+UHTTPAC						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	Appendix A.6

21.2.1 Description

Configures, reads or resets (to the factory-programmed values) the HTTP application profile advanced parameters.

☞ The configured HTTP profile advanced parameters are not saved in the non volatile memory.

21.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UHTTPAC=<profile_id>,<param_tag>,<key>,<value>	OK	AT+UHTTPAC=0,0,0,"UBLX_SESSION_COOKIE_0" OK
Read	AT+UHTTPAC=<profile_id>,<param_tag>,<key>	+UHTTPAC: <profile_id>,<param_tag>,<key>,<value> OK	AT+UHTTPAC=0,0,0 +UHTTP: 0,0,0,"UBLX_SESSION_COOKIE_0" OK
Test	AT+UHTTPAC=?	+UHTTPAC: (list of supported <profile_id>s),(list of supported <param_tag>s),(list of supported <key>s) OK	+UHTTPAC: (0-3),(0),(0-3) OK

21.2.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<param_tag>	Number	• 0: HTTP request COOKIES; manage request COOKIES sent to the HTTP server. o <key>: index of the cookie (number); range 0-3. Identifies the cookie to be read if <value> is omitted or configured if <value> is a valid string. o <value>: value of the cookie (string); the maximum length is 256 characters. The cookie values respect the following rules: - Empty string (""): the cookie will be cleared and will not be present in the request; - Simple one-value cookie: the cookie will be set and sent in the request; - Complex multi-value cookie: the cookies will be set and sent in the request. The multiple cookies must be separated by a left-attached semicolon(";") and a space(" ");
<key>	Number/ String	Content depends on the related <param_tag> (see above).
<value>	Number/ String	Content depends on the related <param_tag> (see above).

21.2.4 Examples and use cases

In this section some AT+UHTTPAC command examples and use cases are listed.

Command	Response	Description
Example 1		

Command	Response	Description
AT+UHTTPAC=0,0,""	OK	Clear HTTP request cookie at index 0
Example 2		
AT+UHTTPAC=0,0,"SIMPLE_COOKIE"	OK	Set simple HTTP request cookie at index 0
Example 3		
AT+UHTTPAC=0,0,"COMPLEX_COOKIE; COMPLEX_ COOKIE"	OK	Overwrite HTTP request cookie at index 0 with a complex cookie

21.3 HTTP command +UHTTPC

+UHTTPC						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	Appendix A.6

21.3.1 Description

Triggers the HTTP command specified with <http_command> parameter, using the HTTP application profile parameters (previously set up by +UHTTP AT command), specified with <profile_id>. The response indicates if sending the command request to HTTP process was successful or not. The final result of HTTP command will be returned to the user via the +UUHTTPCR URC.

The timing before the +UUHTTPCR URC is issued on the AT terminal also depends by the DNS resolution. For further details about the estimated response time related to the DNS resolution, see the +UDNSRN AT command.

21.3.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UHTTPC=<profile_id>,<http_ command>,<path>,<filename>[, <param1>[,<param2>[,<param3>]]]	OK	AT+UHTTPC=0,1,"/path/file.html", "responseFilename" OK
HEAD command			
Set	AT+UHTTPC=<profile_id>,0,<path>, <filename>	OK	AT+UHTTPC=0,0,"/path/file.html", "responseFilename" OK
GET command			
Set	AT+UHTTPC=<profile_id>,1,<path>, <filename>	OK	AT+UHTTPC=0,1,"/path/file.html", "responseFilename" OK
DELETE command			
Set	AT+UHTTPC=<profile_id>,2,<path>, <filename>	OK	AT+UHTTPC=0,2,"/path/file.html", "responseFilename" OK
PUT command			
Set	AT+UHTTPC=<profile_id>,3,<path>, <filename>,<filesystem_name>[, <HTTP_content_type>[,<user_ defined_content_type>]]	OK	AT+UHTTPC=0,3,"/path/ file.html","responseFilename", "filesystemName" OK
POST file command			
Set	AT+UHTTPC=<profile_id>,4,<path>, <filename>,<filesystem_name>, <HTTP_content_type>[,<user_ defined_content_type>]	OK	AT+UHTTPC=0,4,"/path/ file.html","responseFilename", "filesystemName",0 OK
POST data command			
Set	AT+UHTTPC=<profile_id>,5, <path>,<filename>,<data>,<HTTP_	OK	AT+UHTTPC=0,5,"/path/file.html", "responseFilename","data",0

Type	Syntax	Response	Example
	content_type>[,<user_defined_ content_type>]		OK
GET FOTA update file			
Set	AT+UHTTPC=<profile_id>,100, <path>	OK	AT+UHTTPC=0,100,"/path/file.html" OK
Test	AT+UHTTPC=?	+UHTTPC: (list of supported <profile_id>s),(list of supported <http_command>s) OK	+UHTTPC: (0-3),(0-5),100 OK
URC		+UUHTTPCR: <profile_id>,<http_ command>,<http_result>[,<http_ status_code>,<md5_sum>]	+UUHTTPCR: 0,1,1

21.3.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<http_command>	Number	• 0: HEAD command; issue an HEAD request to the HTTP server • 1: GET command; perform a GET request to the HTTP server • 2: DELETE command; send a DELETE request to the HTTP server • 3: PUT command; perform a PUT request to the HTTP server. • 4: POST a file command; issue a POST request for sending a file to the HTTP server • 5: POST data command; send a POST request to the HTTP server using the data specified in <data> parameter • 100: GET FOTA update file; download the FOTA update file
<path>	String	Path of HTTP server resource; the maximum length is 128 characters.
<filename>	String	Filename where the HTTP server response will be stored. If the file already exists, it will be overwritten. If the parameter is an empty string (""), the default "http_last_ response_<profile_id>" filename will be used. For file system file name and data size limits see File system limits.
<filesystem_name>	String	File system filename representing the file system filename to be sent to the HTTP server within the POST / PUT request. For file system file name and data size limits see File system limits.
<HTTP_content_ type>	Number	HTTP Content-Type identifier. It represents the HTTP Content-Type identifier. Allowed values: • 0: application/x-www-form-urlencoded • 1: text/plain • 2: application/octet-stream • 3: multipart/form-data • 4: application/json (supported only for PUT and POST file command) • 5: application/xml • 6: user defined with <user_defined_content_type>
<user_defined_ content_type>	Number	Used only when <HTTP_content_type>=6 (user defined Content-Type). The maximum length is 64 characters.
<data>	String	It represents the data to be sent to the HTTP server with the POST request. The maximum length is 128 bytes. The data must be formatted according to the Content-Type specified in <HTTP_content_type> parameter.
<param1>	String	Content depends on the related <http_command> (see above).
<param2>	Number	Content depends on the related <http_command> (see above).
<param3>	String	Content depends on the related <http_command> (see above).
<http_result>	Number	• 0: fail • 1: success
<http_status_code>	Number	HTTP status code reported in the server response header after a GET FOTA update file request. This parameter is issued only for AT+UHTTPC=<profile_id>,100,<path> AT command.
<md5_sum>	String	MD5 checksum of the FOTA update file. This parameter is issued only for AT +UHTTPC=<profile_id>,100,<path> AT command.

21.3.4 Notes

- The +UHTTPC command has a default timeout setting set to 180 s. The timeout is counted from the last successful network read or send operation performed by the HTTP application, so in a real timeout case the application might be executing a command more than 180 s.
- The data string must not exceed the maximum length of 128 bytes.
- If <http_command>=4 (POST a file) and the <HTTP_content_type>=3 (multipart/form-data), then the module automatically encapsulates the file content in the following multipart/form-data HTTP request:

```
--U1Blox2Http3Unique4Boundary5\r\n
Content-Disposition: form-data; name="file_post"; filename="<user_defined_content_type>"\r\n
Content-Length: <length of file specified with <user_defined_content_type>>\r\n
Content-Type: application/octet-stream\r\n
\r\n
<content of file specified with <user_defined_content_type>>\r\n
--U1Blox2Http3Unique4Boundary5--\r\n
\r\n
```

SARA-R4 / SARA-N4

- <http_command> = 100 is not supported.

21.4 HTTP protocol error +UHTTPER

+UHTTPER						
Modules	SARA-R404M SARA-R410M-01B SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	Appendix A.6

21.4.1 Description

Retrieves the error class and code of the latest HTTP operation on the specified HTTP profile.

21.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UHTTPER=<profile_id>	+UHTTPER: <profile_id>,<error_class>,<error_code> OK	AT+UHTTPER=1 +UHTTPER: 1,0,0 OK

21.4.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<error_class>	Number	List of the allowed values is available in Appendix A.6
<error_code>	Number	Value of class-specific error codes (reply code if class is 0). When <error_class>=10 (wrong HTTP API usage), the allowed <error_code>; values are listed in Appendix A.6.2

22 GNSS

22.1 NMEA

u-blox cellular modules support reading NMEA strings from the GNSS receiver through AT commands.

Before being able to read a specific NMEA string, it is necessary to activate the storage of the last value of that particular NMEA string. If storing a particular NMEA string was not activated, the response to the query will be "0,NULL". The last value of a specific NMEA string is saved in RAM and is made available even after the GNSS receiver switch off.

The NMEA standard differentiates between GPS, GLONASS and Multi-GNSS receivers using a different 'Talker ID'. Depending upon device model and system configuration, the u-blox receiver could output messages using any one of these Talker IDs.

By default, the receivers configured to support GPS, SBAS and QZSS use the 'GP' Talker ID, receivers configured to support GLONASS use the 'GL' Talker ID, receivers configured to support BeiDou use the 'GB' Talker ID and receivers configured for any combinations of multiple GNSS use the 'GN' Talker ID.

Even if the NMEA specification indicates that the GGA message is GPS specific, u-blox receivers support the output of a GGA message for each of the Talker IDs.

☞ As a factory-programmed setting, the cellular modules configure the GNSS receiver through +UGPS AT command to not provide the NMEA sentences.

☞ When reading an NMEA message, if the response value is "1,Not available" then the storing of the NMEA string is activated but this information has not been still sent to the user, if this persist check that the relative NMEA message is enabled. To enable it use the +UGUBX command (for further information see the UBX-CFG-MSG message in the u-blox GNSS Protocol Specification).

22.2 GNSS power management +UGPS

+UGPS						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

22.2.1 Description

Switches on or off a u-blox GNSS receiver connected to the cellular module via a dedicated DDC (I^2C) interface. For more details about the connection between cellular module and u-blox GNSS receiver see the corresponding module system integration manual.

Furthermore the command sets the aiding type to be used to enhance GNSS performance, e.g. decreasing Time To First Fix (TTFF), thus allowing to calculate the position in a shorter time with higher accuracy. The following aiding types are supported:

- Local aiding: the cellular module automatically uploads data such as ephemeris, almanac, last position, time, etc. from the GNSS receiver into its local memory, and restores back the GNSS receiver at the next power up of the GNSS module (if the data are still valid, otherwise it uses GSM information such as country code for a rough position estimation)
- AssistNow Online: a connection profile (either PSD or CSD) must be defined and activated before selecting the AssistNow Online; see the +UGAOP and +UGSRV command descriptions. If CellLocate® is used, the first HTTP profile will be properly configured
- AssistNow Offline: a connection profile (either PSD or CSD) must be defined and activated before selecting the AssistNow Offline if the almanac file must be downloaded; see the +UGAOF and +UGSRV command descriptions.
- AssistNow Autonomous: based on a broadcast ephemeris downloaded from the satellite (or obtained by AssistNow Online) the receiver can autonomously generate an accurate satellite orbit representation («AssistNow Autonomous data») that is usable for navigation much longer than the underlying broadcast

ephemeris was intended for. This makes downloading new ephemeris or aiding data for the first fix unnecessary for subsequent start-ups of the receiver.

☞ The AssistNow Autonomous feature may be not fully supported on all Multi-GNSS receivers. For more details on AssistNow Autonomous feature see the corresponding u-blox-GNSS receiver description.

For a more detailed description on aiding modes and possible suggestions, see the GNSS Implementation Application Note [52].

It is possible to combine different aiding modes: to enable them the sum of the <mode> value of the interested aiding modes is needed (e.g.: aiding <mode>=3 means local aiding plus AssistNow Offline). Moreover it is also possible to switch from one aiding mode to another one without powering off the GNSS receiver. If the following sequence is provided (AT+UGPS=1,1 and then AT+UGPS=1,5) at the beginning the GNSS receiver will power on with local aiding support and after the second command will be added the AssistNow Online. After the second command the local aiding is not restarted, therefore the +UUGIND URC for it will not be sent again.

The latest u-blox GNSS products are multi-GNSS receivers capable of receiving and processing signals from multiple Global Navigation Satellite Systems (GNSS). u-blox concurrent GNSS receivers are multi-GNSS receivers that can acquire and track satellites from more than one GNSS system at the same time, and utilize them for positioning. The <GNSS_systems> parameter configures the GNSS receiver into the required mode of operation. It is possible to combine different GNSS systems. The combinations of systems, which can be configured simultaneously depends on the receivers capability to receive several carrier frequencies. See the corresponding GNSS receiver data sheet for the supported GNSS systems. If the Assisted GNSS unsolicited indication is enabled, the +UUGIND URC will provide the current activated combinations of systems.

22.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPS=<mode>[,<aid_mode>[,<GNSS_systems>]]	OK	AT+UGPS=1,0,1 OK
Read	AT+UGPS?	+UGPS: <mode>[,<aid_mode>[,<GNSS_systems>]] OK	+UGPS: 1,0,1 OK
Test	AT+UGPS=?	+UGPS: (list of supported <mode>s),(list of supported <aid_mode>),(list of supported <GNSS_systems>) OK	+UGPS: (0-1),(0-15),(1-127) OK

22.2.3 Defined values

Parameter	Type	Description
<mode>	Number	• 0 (default value): GNSS receiver powered off • 1: GNSS receiver powered on
<aid_mode>	Number	Supported aiding modes; the parameter is mandatory if <mode>=1; all these allowed values can be combined together: • 0 (default value): no aiding • 1: automatic local aiding • 2: AssistNow Offline • 4: AssistNow Online • 8: AssistNow Autonomous
<GNSS_systems>	Number	Bitmask for combining the supported GNSS types; the parameter is optional and the allowed values can be combined together. The default value is 3 (GPS+SBAS): • 1: GPS • 2: SBAS • 4: Galileo • 8: BeiDou • 16: IMES • 32: QZSS • 64: GLONASS

22.2.4 Notes

- To know the allowed combinations of GNSS type for <GNSS_systems> see the corresponding GNSS receiver documentation.
- If <GNSS_systems> type is not supported by the GNSS receiver, the set command turns on the GNSS receiver with built-in supported type. The current <GNSS_systems> can be queried by means of the read command or the +UUGIND URC.
- An error result code is provided in the following cases:
  - <mode>, <aid_mode> or <GNSS_systems> values are out of range
  - <mode> is set to 1 without <aid_mode> value
  - Attempt to power off the GNSS when it is already off
  - The value of <aid_mode> to be set is equal to the current GNSS aiding mode and the value of <GNSS_systems> to be set is equal to the last requested <GNSS_systems>
- The parameter <GNSS_systems> is displayed in the information text response of the read command only if the connected GNSS receiver supports Multi-GNSS

22.3 Assisted GNSS unsolicited indication +UGIND

+UGIND						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

22.3.1 Description

Enables or disables sending of URCs from MT to TE in the case of GNSS aiding operations. The <mode> parameter controls the processing of URCs specified within this command.

The URC returns the result of an assisted GNSS operation. This information is sent to all the interfaces. The URC is provided only if one or more aiding modes are enabled (for more details see the +UGPS and +UGAOP command descriptions).

There can be more than a +UUGIND URC for a single aiding operation: the +UUGIND is reported for each error. For instance if the local aiding is enabled and there are no space left in the file system after +UGPS=0, there will be an error for every failure writing on FFS.

The commands +UGAOS=0 and +UGAOS=1 both relate to the GNSS local aiding, so the unsolicited message will be +UUGIND=1,x in both cases.

Local aiding and AssistNow Autonomous will produce URC both after GNSS power on and before GNSS power off because some data are transferred from the GNSS receiver to the cellular module.

If the connected GNSS receiver is Multi-GNSS then an additional +UUGIND=0,<GNSS_systems> URC for the currently activated GNSS systems is displayed.

22.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGIND=<mode>	OK	AT+UGIND=1 OK
Read	AT+UGIND?	+UGIND: <mode> OK	+UGIND: 1 OK
Test	AT+UGIND=?	+UGIND: (list of supported <mode>'s) OK	+UGIND: (0-1) OK
URC		Current activated GNSS system: +UUGIND: 0,<GNSS_systems>	+UUGIND: 0,3
		GNSS aiding status: +UUGIND: <aid_mode>,<result>	+UUGIND: 4,5

22.3.3 Defined values

Parameter	Type	Description
<mode>	Number	URC configuration: • 0 (default value): disabled • 1: enabled
<aid_mode>	Number	Provides the supported aiding mode: • 0: GNSS system(s) • 1: automatic local aiding • 2: AssistNow Offline • 4: AssistNow Online • 8: AssistNow Autonomous
<GNSS_systems>	Number	Current activated GNSS types; the allowed values can be combined together: • 1: GPS • 2: SBAS • 4: Galileo • 8: BeiDou • 16: IMES • 32: QZSS • 64: GLONASS
<result>	Number	Represents the result of the aiding operation: • 0: No error • 1: Wrong URL (for AssistNow Offline) • 2: HTTP error (for AssistNow Offline) • 3: Create socket error (for AssistNow Online) • 4: Close socket error (for AssistNow Online) • 5: Write to socket error (for AssistNow Online) • 6: Read from socket error (for AssistNow Online) • 7: Connection/DNS error (for AssistNow Online) • 8: File system error • 9: Generic error • 10: No answer from GNSS (for local aiding and AssistNow Autonomous) • 11: Data collection in progress (for local aiding) • 12: GNSS configuration failed (for AssistNow Autonomous) • 13: RTC calibration failed (for local aiding) • 14: feature not supported (for AssistNow Autonomous) • 15: feature partially supported (for AssistNow Autonomous) • 16: authentication token missing (required for aiding for u-blox M8 and future versions)

22.4 GNSS profile configuration +UGPRF

+UGPRF						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

22.4.1 Description

Configures the data flow to and from a u-blox GNSS receiver connected to the cellular module. The data flow is possible to and from the:

- UART (via multiplexer)
- USB (or alternatively AUX UART)
- Over the air to a remote host: To send data over the air an internet connection must be active and there must be at least one free TCP socket (the GNSS shares the socket pool with the other applications). Setting up an Internet connection and network registration is not part of this command and must be handled by the user separately from this command.

- Into a file on the cellular module: A file with GNSS data can be accessed via +ULSTFILE command. The file name is automatically chosen by the cellular module as a unique ID based on date and time or a further incremental number (e.g. "GPS_200910061500" or "GPS_20091006_001" according to the used cellular module). When the files size reaches 500 kB the file is closed and no more data is saved. It is possible to save further data by restarting the GNSS (this will create a new file)

It is possible to send GNSS data to multiple destinations at the same time by summing the <GNSS_I/O_configuration> values of each required destinations (e.g. if AT+UGPRF=6 the data will be sent on multiplexer and stored in a file in the file system).

The messages to be output by the u-blox GNSS receiver need to be activated separately with UBX-CFG-MSG configuration messages according to the GNSS Receiver Protocol Specification.

☞ It is not possible to select the GNSS data flow to and from USB (or alternatively AUX UART) and multiplexer concurrently.

☞ The configuration of the GNSS profile must be performed only when GNSS is switched off, otherwise an error result code will be displayed.

22.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPRF=<GNSS_I/O_configuration>[,<IP Port>,<server address string>]	OK	AT+UGPRF=0 OK
Read	AT+UGPRF?	+UGPRF: <GNSS_I/O_configuration>,<IP port>,<server address string> OK	+UGPRF: 0,0,"" OK
Test	AT+UGPRF=?	+UGPRF: (list of supported <GNSS_I/O_configuration>),(list of supported <IP port>),<server address string> OK	+UGPRF: (0-127),(0-65535),"addr" OK

22.4.3 Defined values

Parameter	Type	Description
<GNSS_IO_configuration>	Number	• 0 (default value and factory-programmed value): no data flow to multiplexer, file or IP address • 1: GNSS data flow to and from USB (or alternatively AUX UART) • 2: GNSS data flow to and from multiplexer • 4: GNSS data flow saved to file • 8: GNSS data flow over the air to an Internet host • 16: GNSS data ready function • 32: GNSS RTC sharing function • 64: reserved • 128: reset the GNSS after the GNSS power on (see AT+UGPS command description) • 256: use the auxiliary GNSS receiver instead of the default one. If the feature is not provided then an error result code will be displayed
<IP port>	Number	IP port of the server where the GNSS data are sent (default value and factory-programmed value: 0). If GNSS data flow over the air is enabled the parameter is mandatory otherwise is forbidden.
<server address string>	String	Address string of the server where the GNSS data are sent (default value and factory-programmed value: ""). If GNSS data flow over the air is enabled the parameter is mandatory otherwise is forbidden. The address could be provided in both URL or IP format and the maximum length of the string is 47 characters.

22.4.4 Notes

SARA-R4 / SARA-N4

- <GNSS_IO_configuration>=128 (GNSS reset after the GNSS power on) and <GNSS_IO_configuration>=256 (use an auxiliary GNSS receiver) are not supported.

22.5 Aiding server configuration +UGSRV

+UGSRV						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

22.5.1 Description

Configures the network connection to a Multi GNSS Assistance (MGA) server. The configuration is saved in NVM and applied at the next GNSS power cycle. The MGA server is accessed with the HTTP. This assistance mode requires a packet data connection to exchange information with u-blox servers. By default, the cellular module connects to u-blox' primary MGA server; if the connection fails then the cellular module connects to u-blox' secondary MGA server. Authorization tokens are used as a means of authorizing access to the u-blox services and for gathering anonymised statistics. To obtain a token customers should use the form in http://www.u-blox.com/services-form.html. The set command registers a token for gathering assistance data from MGA servers. Once a token is set it cannot be cleared so that registered hostnames in +UGAOP and +UGAOF commands are discarded.

☞ Setting up Internet connection and network registration is not part of this command and must be handled by the user separately to this command.

22.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGSRV=[<mga_primary_server>],[<mga_secondary_server>],<auth_token>[,<days>[,<period>[,<resolution>[,<GNSS_types>[,<mode>[,<datatype>]]]]]]	OK	AT+UGSRV="cell-live1.services.u-blox.com","cell-live2.services.u-blox.com","123456789abcdefghijklm",14,4,1,65,0,1 OK
Read	AT+UGSRV?	+UGSRV: <mga_primary_server>,<mga_secondary_server>,<auth_token>,<days>,<period>,<resolution>,<GNSS_types>,<mode>,<datatype> OK	+UGSRV: "cell-live1.services.u-blox.com","cell-live2.services.u-blox.com","123456789abcdefghijklm",14,4,1,65,0,1 OK
Test	AT+UGSRV=?	+UGSRV: <mga_primary_server>,<mga_secondary_server>,<auth_token>,(list of supported <days>s),(list of supported <period>s),(list of supported <resolution>s),(list of supported <GNSS_types>s),(list of supported <mode>s),(list of supported <datatype>s) OK	+UGSRV: "srv1","srv2","token",(1,2,3,5,7,10,14),(1-5),(1-3),(1,64,65),(0-2),(0-15) OK

22.5.3 Defined values

Parameter	Type	Description
<mga_primary_server>	String	Host name of the primary MGA server; the maximum length is 254 characters. Empty string is not allowed. The default and factory-programmed value is "cell-live1.services.u-blox.com". If the primary MGA server is omitted, the current stored value is preserved.
<mga_secondary_server>	String	Host name of the secondary MGA server; the maximum length is 254 characters. Empty string is not allowed. The default and factory-programmed value is "cell-live2.services.u-blox.com". If the secondary MGA server is omitted, the current stored value is preserved.
<auth_token>	String	Authentication Token for MGA server access.

Parameter	Type	Description
<days>	Number	The number of days into the future the Offline data for u-blox 7 and previous version should be valid for. The allowed values are: 1, 2, 3, 5, 7, 10 and 14. The default and factory-programmed value is 14.
<period>	Number	The number of weeks into the future the Offline data for u-blox M8 should be valid for. The range of the allowed values goes from 1 to 5. The default and factory-programmed value is 4.
<resolution>	Number	Resolution of offline data for u-blox M8. Allowed values: • 1 (default and factory-programmed value): every day • 2: every other day • 3: every third day
<GNSS_types>	Number	Bitmask for combining the desired GNSS for the (offline) aiding • 1: GPS • 64: GLONASS The default and factory-programmed value is all (65). If the parameter is omitted, the current stored value is preserved.
<mode>	Number	Mode of operation of AssistNow Online data management • 0 (default and factory-programmed value): AssistNow Online data are downloaded at GNSS receiver power up • 1: AssistNow Online data automatically kept alive • 2: manual AssistNow Online data download
<datatype>	Number	Bitmask for combining the desired data types for the (online) aiding • 0: time • 1: position • 2: ephemeris • 4: almanac • 8: auxiliary • 16: ephemeris of satellites which are likely to be visible from the position estimated by current registered network. This flag has no effect if the ephemeris flag is set to 0. The default and factory-programmed value is all aidings without filter on visible satellites (15)

22.5.4 Notes

SARA-R4 / SARA-N4

- <datatype>=16 is not supported.

22.6 GNSS aiding request command +UGAOS

+UGAOS						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

22.6.1 Description

Triggers the manual download of AssistNow Online and AssistNow Offline data from the configured server in case automatic AssistNow operation is not enabled. The command returns only when the received data from the server are valid or an error occurs.

The command is also used to trigger the manual upload of local aiding data (e.g. ephemeris, almanac, last position, time, etc) from a u-blox GNSS receiver prior to shutting it down and to restore it into the receiver after the power up of the GNSS receiver (for more details refer to command +UGPS, Chapter 22.2).

22.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGAOS=<aid_mode>	OK	AT+UGAOS=0 OK

Type	Syntax	Response	Example
Test	AT+UGAOS=?	AT+UGAOS: (list of supported <aid_mode>s) OK	+UGAOS: (0-8) OK

22.6.3 Defined values

Parameter	Type	Description
<aid_mode>	Number	• 0: Upload of local aiding data from GNSS receiver to cellular module • 1: Download of local aiding data from the cellular module to the GNSS receiver • 2: AssistNow Offline file download request (file loaded into cellular module) • 4: AssistNow Online data download request (data loaded into the GNSS receiver). This is only needed if AssistNow Online is not used with automatic operation • 8: AssistNow autonomous • Other values are reserved for future use

22.7 Send of UBX string +UGUBX

+UGUBX						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

22.7.1 Description

Sends UBX protocol messages, embedded in an AT command, to a u-blox GNSS receiver. The command is transparent, that is the data is sent to the GNSS receiver without any check: it is up to the user to control if the UBX data is valid. The checksum in +UGUBX command string is ignored, this is calculated when the data is sent to the GNSS receiver.

When the GNSS is off the UBX string is saved in RAM and, later, passed to the GNSS as configuration for "GNSS data ready" function when the GNSS receiver is used. This message is used only if the GNSS receiver HW is unknown (newer than the cellular module FW). In this case the UBX checksum bytes must be filled correctly.

☞ It is recommended to not send UBX messages to reset the GNSS receiver while it is in use, this will cause a misalignment between the configuration of the cellular module and the one of the GNSS receiver. Furthermore it is recommended to not configure the GNSS power saving with the "GNSS data ready" active, because the GNSS receiver could send wrong reading requests to the cellular module.

22.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGUBX=<UBX_string>	+UGUBX: <UBX_string_response> OK	AT+UGUBX="B562060108000106000100000000017DA" +UGUBX: "B5620501020006010F38" OK

22.7.3 Defined values

Parameter	Type	Description
<UBX_string>	String	UBX message in hexadecimal format. The messages can include spaces to simplify copy/paste from u-center separated with spaces, e.g. AT+UGUBX="B5 62 06 01 08 0 0 01 06 00 01 00 00 00 00 17 DA" (this is important when copying messages from u-center). For the limit of the length of the string, see Command line.
<UBX_string_response>	String	The response message depends by the request sent: query/poll UBX messages will return the requested data in hexadecimal format, while the configuration message will return the corresponding acknowledge or not-acknowledge. See the UBX protocol specification

22.7.4 Notes

- If a +UGUBX command triggers multiple strings answer only a single UBX string is returned. E. g. polling GPS Aiding Ephemeris Data (AID-EPH) is done by sending a single message to the receiver but returns 32 messages; only the first one is sent to AT interface.
- The answer can be split in multiple information text responses all starting with "+UGUBX:".

22.8 GNSS indications timer +UGTMR

+UGTMR						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

22.8.1 Description

Sets the date and time format. With the <time_zone> parameter is possible to set the time zone value; the time and the date will be updated as the local time. With the action command is possible to synchronize the UTC timing.

22.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGTMR=<time_zone>	OK	AT+UGTMR=-1 OK
Read	AT+UGTMR?	+UGTMR: <time_zone> OK	+UGTMR: -1 OK
Test	AT+UGTMR=?	+UGTMR: (list of supported <time_zone>s) OK	+UGTMR: (-96 - 96) OK

22.8.3 Defined values

Parameter	Type	Description
<time_zone>	Number	Indicates the time zone value set by the user; the module can provide an error result code if the offset has not been calculated. The factory-programmed time zone value is 0. • -96, 96: defined range

22.8.4 Notes

- The time zone is expressed in quarters of hour.
- The time is updated with the current UTC time plus the time zone and the time zone is unchanged, for example:

Command	Response	Remarks
AT+UGTMR=-36	OK	The command returns the "OK" final result code and sets the new date and time if the GNSS has this information, otherwise a generic error result code is returned.
AT+CCLK?	+CCLK: "12/05/23,21:54:21+00"	

22.9 Get GNSS time and date +UGZDA

+UGZDA						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	< 10 s	+CME Error

22.9.1 Description

Enables/disables the storing of the last value of NMEA $ZDA messages, and get the current messaging state. If the <state> parameter is enabled, the last value of NMEA $ZDA messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $ZDA messages are volatile.

22.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGZDA=<state>	OK	AT+UGZDA=1 OK
Read	AT+UGZDA?	+UGZDA: <state>,<$ZDA msg> OK	+UGZDA: 1,$GPZDA,142351.00,12,12,2013,00,00*66 OK +UGZDA: 0,NULL OK
Test	AT+UGZDA=?	+UGZDA: (list of supported <state>s) OK	+UGZDA: (0-1) OK

22.9.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): disable the NMEA $ZDA messages • 1: enable the NMEA $ZDA messages
<$ZDA msg>	String	NMEA $ZDA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

22.10 Get GNSS fix data +UGGGA

+UGGGA						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	< 10 s	+CME Error

22.10.1 Description

Enables/disables the storing of the last value of NMEA $GGA messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $GGA messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GGA messages are volatile.

22.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGGA=<state>	OK	AT+UGGGA=1 OK

Type	Syntax	Response	Example
Read	AT+UGGGA?	+UGGGA: <state>,<$GGA msg> OK	+UGGGA: 1,$GPGGA,142351.00,,,,,0,00,99.99,,,,,,*66 OK +UGGGA: 0,NULL OK
Test	AT+UGGGA=?	+UGGGA: (list of supported <state>s) OK	+UGGGA: (0-1) OK

22.10.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GGA messages • 1: to enable the NMEA $GGA messages
<$GGA msg>	String	NMEA $GGA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

22.11 Get geographic position +UGGLL

+UGGLL						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	< 10 s	+CME Error

22.11.1 Description

Enables/disables the storing of the last value of NMEA $GLL messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $GLL messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GLL messages are volatile.

22.11.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGLL=<state>	OK	AT+UGGLL=1 OK
Read	AT+UGGLL?	+UGGLL: <state>,<$GLL msg> OK	+UGGLL: 1,$GPGLL,,,,,142351.00,V,N*4A OK +UGGLL: 0,NULL OK
Test	AT+UGGLL=?	+UGGLL: (list of supported <state>s) OK	+UGGLL: (0-1) OK

22.11.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GLL messages • 1: to enable the NMEA $GLL messages
<$GLL msg>	String	NMEA $GLL messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

22.12 Get number of GNSS satellites in view +UGGSV

+UGGSV						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	< 10 s	+CME Error

22.12.1 Description

Enable/disables the storing of the last value of NMEA $GSV messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $GSV messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GSV messages are volatile.

22.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGSV=<state>	OK	AT+UGGSV=1 OK
Read	AT+UGGSV?	+UGGSV: <state>,<$GSV msg> OK	+UGGSV: 1,$GPGSV,3,1,11,03,67,298,22,06,88,149,29,07,06,302,,08,05,332,25*73 $GPGSV,3,2,11,09,02,334,25,14,02,141,,15,10,041,43,16,46,209,16*7D $GPGSV,3,3,11,18,48,066,35,21,26,070,35,27,80,314,25*40 $GLGSV,1,1,03,73,13,248,,74,23,298,20,75,09,348,19*51 OK +UGGSV: 0,NULL OK
Test	AT+UGGSV=?	+UGGSV: (list of supported <state>s) OK	+UGGSV: (0-1) OK

22.12.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GSV messages • 1: to enable the NMEA $GSV messages
<$GSV msg>	String	NMEA $GSV messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

22.12.4 Notes

- Since the $GSV message reports satellite information, the output of the different GNSS systems is not combined, but it is reported in sequence as in the example above with GPS and GLONASS.

22.13 Get recommended minimum GNSS data +UGRMC

+UGRMC						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	< 10 s	+CME Error

22.13.1 Description

Enable/disables the storing of the last value of NMEA $RMC messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $RMC messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $RMC messages are volatile.

22.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGRMC=<state>	OK	AT+UGRMC=1 OK
Read	AT+UGRMC?	+UGRMC: <state>,<$RMC msg> OK	+UGRMC: 1,$GPRMC,142351.00,V,,,,,,,121213,,,N*7F OK +UGRMC: 0,NULL OK
Test	AT+UGRMC=?	+UGRMC: (list of supported <state>s) OK	+UGRMC: (0-1) OK

22.13.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $RMC messages • 1: to enable the NMEA $RMC messages
<$RMC msg>	String	NMEA $RMC messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

22.14 Get course over ground and ground speed +UGVTG

+UGVTG						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	< 10 s	+CME Error

22.14.1 Description

Enables/disables the storing of the last value of NMEA $VTG messages, and gets know the current messaging state. If the <state> parameter is enabled, the last value of NMEA $VTG messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $VTG messages are volatile.

22.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGVTG=<state>	OK	AT+UGVTG=1 OK
Read	AT+UGVTG?	+UGVTG: <state>,<$VTG msg>	+UGVTG: 1,$GPVTG,,,,,,,,,N*30

Type	Syntax	Response	Example
		OK	OK +UGVTG: 0,NULL OK
Test	AT+UGVTG=?	+UGVTG: (list of supported <state>s) OK	+UGVTG: (0-1) OK

22.14.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $VTG messages • 1: to enable the NMEA $VTG messages
<$VTG msg>	String	NMEA $VTG messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

22.15 Get satellite information +UGGSA

+UGGSA						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	< 10 s	+CME Error

22.15.1 Description

Enables/disables the storing of the last value of NMEA $GSA messages, and gets the current messaging state. If <state> parameter is enabled, the last value of NMEA $GSA messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GSA messages are volatile.

22.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGSA=<state>	OK	AT+UGGSA=1 OK
Read	AT+UGGSA?	+UGGSA: <state>,<$GSA msg> OK	+UGGSA: 1,$GPGSA,A,1,,,,,,,,,,,,99.99,99.99,99.99*30 OK +UGGSA: 0,NULL OK
Test	AT+UGGSA=?	+UGGSA: (list of supported <state>s) OK	+UGGSA: (0-1) OK

22.15.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GSA messages • 1: to enable the NMEA $GSA messages
<$GSA msg>	String	NMEA $GSA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

22.16 Ask for localization information +ULOC

+ULOC						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

22.16.1 Description

Requests cellular module to provide the location data; the location can be determined using:

- GNSS receiver
- CellLocate® (location based on network cells data)
- Combination of both technologies (hybrid)

The final result code indicates if sending the command request to the localization information process was successful or not. The URC is issued to provide the requested information via +ULOC set command.

The GNSS interface and CellLocate® can be used at the same time: if the GNSS sensor is reserved to another interface an error result code is provided ("+CME ERROR: GPS busy" if +CMEE=2).

It is possible to configure the Hybrid Positioning through +ULOCGNSS and +ULOCCELL AT commands even if it is running: the parameters are stored in NVM and will be applied at the next +ULOC command.

☞ If the +ULOC command is sent while a previous +ULOC activity is still in progress the previous activity is aborted, the available position is immediately output and the next +ULOC request is served.

☞ The data connection cannot be immediately dropped at the +ULOC timeout expiration. This could lead to a delay in the expected response time.

☞ Depending on the aiding chosen, a data connection could be required; see the AT+UGPS command description.

☞ If no position is available (no GNSS coverage, no network information and no previous data available) then the <lat> latitude and <long> longitude will be set to '0'.

☞ If the previous position degradated by the elapsed time satisfies the desired accuracy then the sensor '0' is reported in the information text response.

☞ If multi-hypothesis is required the GNSS solution and the CellLocate® solutions are reported, if available. If no GNSS or CellLocate® solutions are present, the previous position degradated is used instead.

☞ If multi-hypothesis is required but the sensor is set to GNSS (<sensor>=1), only one solution will be provided: the GNSS one (or the previous position degradated if GNSS solution not available).

☞ If a valid GNSS fix with an accuracy below the required value (<accuracy>) occurs before the end of the network scan, the GNSS-only solution will be available, even if multi-hypothesis has been required.

22.16.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULOC=<mode>,<sensor>,<response_type>,<timeout>,<accuracy>[,<num_hypothesis>]	OK	AT+ULOC=2,3,0,120,1 OK
Read	AT+ULOC?	+ULOC: <mode>,<sensor>,<response_type>,<timeout>,<accuracy>,<num_hypotesis> OK	+ULOC: 2,3,1,0,20,0 OK
Test	AT+ULOC=?	+ULOC: (list of supported <mode>s),(list of supported <sensor>s),(list of supported <response_type>s),(list of supported <timeout>s),(list of supported <accuracy>s),(list of supported <num_hypotesis>s) OK	+ULOC: (0-2),(0-3),(0-2),(1-999),(1-999999),(1-16) OK

Type	Syntax	Response	Example
URC		If <response_type>=0: +UULOC: <date>,<time>,<lat>,<long>,<alt>,<uncertainty>	+UULOC: 13/04/2011,09:54:51.000,45.6334520,13.0618620,49,1
		If <response_type>=1: +UULOC: <date>,<time>,<lat>,<long>,<alt>,<uncertainty>,<speed>,<direction>,<vertical_acc>,<sensor_used>,<SV_used>,<antenna_status>,<jamming_status>	+UULOC: 25/09/2013,10:13:29.000,45.7140971,13.7409172,266,17,0,0,18,1,6,3,9
		If <response_type>=2, <sensor_used>= 1 and <num_hypothesis>=N: +UULOC: <sol>,<num>,<sensor_used>,<date>,<time>,<lat>,<long>,<alt>,<uncertainty>,<speed>,<direction>,<vertical_acc>,<SV_used>,<antenna_status>,<jamming_status>	+UULOC: 1,2,1,08/04/2015,09:02:32.000,45.7141652,13.7410666,266,47,0,0,40,3,0,0
		If <response_type>=2, <sensor_used> = 2 and <num_hypothesis>= N: +UULOC: <sol>,<num>,<sensor_used>,<date>,<time>,<lat>,<long>,<alt>,<lat50>,<long50>,<major50>,<minor50>,<orientation50>,<confidence50>[,<lat95>,<long95>,<major95>,<minor95>,<orientation95>,<confidence95>]	+UULOC: 2,2,2,08/04/2015,09:02:19.000,45.7140665,13.7411681,0,45.7240260,13.7511276,113,10,0,50,45.7240260,13.7511276,143,41,0,95
		If <response_type>=2, <sensor_used>= 0: +UULOC: <sol>,<num>,<sensor_used>,<date>,<time>,<lat>,<long>,<alt>,<uncertainty>	+UULOC: 1,1,0,08/04/2015,09:03:45.000,45.7140290,13.7410695,0,32

22.16.3 Defined values

Parameter	Type	Description
<mode>	Number	• 0: reserved • 1: reserved • 2: single shot position
<sensor>	Number	Sensor selection: it is possible to combine different sensors summing <sensor> values of the selected sensors: • 0: use the last fix in the internal database and stop the GNSS receiver • 1: use the GNSS receiver for localization • 2: use CellLocate® location information
<response_type>	Number	Type of response: • 0: standard (single-hypothesis) response • 1: detailed (single-hypothesis) response • 2: multi-hypotheses response
<timeout>	Number	Timeout period in seconds (1 - 999)
<accuracy>	Number	Target accuracy in meters (1 - 999999)
<num_hypothesis>	Number	Maximum desired number of responses from CellLocate® (up to 16): multiple positions followed by their ellipsoidal uncertainties. This value has to be increased by 1 (GNSS solution) to get the maximum number of possible solutions. This optional parameter can be used only if <response_type>=2. The default value is 1.
<date>	String	GPS date[2] (DD/MM/YY) of the estimated position
<time>	String	GPS time[2] (hh:mm:ss.sss) of the estimated position

[2] Coming either from the CellLocate® server or the GNSS receiver (GPS time)

Parameter	Type	Description
<lat>	String	Estimated latitude, in degrees
<long>	String	Estimated longitude, in degrees
<alt>	Number	Estimated altitude, in meters[3]
<uncertainty>	Number	Maximum possible error, in meters (0 - 20000000)
<speed>	Number	Speed over ground m/s[3]
<direction>	Number	Course over ground in degree (0 deg - 360 deg)(3)
<vertical_acc>	Number	Vertical accuracy, in meters[3]
<sensor_used>	Number	Sensor used for the position calculation
<SV_used>	Number	Number of satellite used to calculate the position[3]
<sol>	Number	Solution index (between 1 and <num>)
<num>	Number	Total number of the available hypotheses (less than or equal to <num_hypothesis>)
<lat50>/<lat95>	String	Estimated latitude (50/95% confidence levels), in degrees
<long50>/<long95>	String	Estimated longitude (50/95% confidence levels), in degrees
<major50>/ <major95>	Number	Semi-major axis of the ellipse (50/95% confidence levels), in meters
<minor50>/ <minor95>	Number	Semi-minor axis of the ellipse (50/95% confidence levels), in meters
<orientation50>/ <orientation95>	Number	Orientation of the ellipse (50/95% confidence levels), in degrees
<confidence50>/ <confidence95>	Number	50/95% confidence levels, in percentage
<antenna_status>	Number	Antenna status (0 - 4)(3). For more details see the u-blox GNSS receiver protocol specification
<jamming_status>	Number	Jamming status[3]. For more details see the u-blox GNSS receiver protocol specification

22.16.4 Notes

- If AssistNow Online aiding data has been configured by means of the <aiding> parameter of +ULOCGNSS AT command, the +ULOC request using <sensor>=1 (GNSS receiver only) can provide a +UULOC URC reporting a CellLocate solution (<sensor_used>=2). This can happen if:
  - a GNSS fix is not available.
  - the CellLocate solution is more accurate (i.e. CellLocate solution's uncertainty is better than the GNSS's one).
- The <jamming_status> value must be ignored if the jamming is disabled through +ULOCGNSS command.
- The <date>, <time>, <lat>, <long> values are not enclosed in double quotes in the URC.

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- <sensor>=2 is not supported.

22.17 Localization information request status unsolicited indication +ULOCIND

+ULOCIND						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

22.17.1 Description

Configures sending of URCs from MT to TE in the case of +ULOC operations. The URC provides the result of the steps of an +ULOC operation.

[3] only for GNSS positioning, 0 in case of CellLocate®

22.17.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULOCIND=<mode>	OK	AT+ULOCIND=1 OK
Read	AT+ULOCIND?	+ULOCIND: <mode> OK	+ULOCIND: 1 OK
Test	AT+ULOCIND=?	+ULOCIND: (list of supported <mode>'s) OK	+ULOCIND: (0-1) OK
URC		+UULOCIND: <step>,<result> OK	+UULOCIND: 1,0 OK

22.17.3 Defined values

Parameter	Type	Description
<mode>	Number	URC configuration: • 0 (default value): disabled • 1: enabled
<step>	Number	Informs the user about the operation in progress: • 0: network scan start • 1: network scan end • 2: requesting data to the server • 3: received data from the server • 4: sending feedback to the server
<result>	Number	Represents the result of the aiding operation: • 0: no error • 1: wrong URL • 2: HTTP error • 3: create socket error • 4: close socket error • 5: write to socket error • 6: read from socket error • 7: connection/DNS error • 8: authentication token missing or wrong (required for aiding for u-blox M8 and future versions) • 9: generic error • 10: user terminated • 11: no data from server

22.18 GNSS sensor configuration +ULOCGNSS

+ULOCGNSS						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

22.18.1 Description

Configures the GNSS sensor used with the +ULOC command.

22.18.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULOCGNSS=<aiding>[,<psv_mode>[,<minSV>[,<minCNO>[,<ini_3d_fix>[,<staticHoldMode>[,<SBAS>[,<jamming>[,<antenna>[,	OK	AT+ULOCGNSS=15 OK

Type	Syntax	Response	Example
	<BBthreshold>[,<CWthreshold>[,<GNSS_system>[,<reserved1>[,<reserved2>]]]]]]]]]]]		
Read	AT+ULOCGNSS?	+ULOCGNSS: <aiding>,<psv_mode>,<minSV>,<minCNO>,<ini_3d_fix>,<staticHoldMode>,<SBAS>,<jamming>,<antenna>,<BBthreshold>,<CWthreshold>,<GNSS_system>,<reserved1>,<reserved2> OK	+ULOCGNSS: 15,1,6,8,0,1,1,1,1,1,1,0,0,0 OK
Test	AT+ULOCGNSS=?	+ULOCGNSS: (list of supported <aiding>),(list of supported <psv_mode>),(list of supported <minSV>),(list of supported <minCNO>),(list of supported <ini_3d_fix>),(list of supported <staticHoldMode>),(list of supported <SBAS>),(list of supported <jamming>),(list of supported <antenna>),(list of supported <BBthreshold>),(list of supported <CWthreshold>),(list of supported <GNSS_system>),(0),(0) OK	+ULOCGNSS: (0-15),(0-1),(3-32),(0-50),(0-1),(0-255),(0-1),(0-1),(0-2),(0-15),(0-31),(1-127),(0),(0) OK

22.18.3 Defined values

Parameter	Type	Description
<aiding>	Number	GNSS aiding mode configuration; it is possible the combination of different aiding modes: to enable more aiding modes it is needed to sum the <mode> value of the interested aiding modes: • 1: local aiding (including RTC sharing) • 2: AssistNow Offline • 4: AssistNow Online • 8: AssistNow Autonomous All the modes (15) are enabled as a factory programmed setting.
<psv_mode>	Number	Power Save Mode (UBX-CFG-PM2): • 0 (factory-programmed value): disabled • 1: enabled
<minSV>	Number	• Minimum number of satellites for navigation (UBX-CFG-NAVX5). The range goes from 3 to 32. (factory-programmed value: 3)
<minCNO>	Number	• Minimum satellite signal level for navigation (UBX-CFG-NAVX5). The range goes from 0 to 50. (factory-programmed value: 7)
<ini_3d_fix>	Number	Initial Fix must be 3D flag (UBX-CFG-NAVX5): • 0 (factory-programmed value): disabled • 1: enabled
<staticHoldMode>	Number	Static Hold Mode (UBX-CFG-NAV5). The range goes from 0 to 255 cm/s. (factory-programmed value: 0). If the parameter is omitted, the Static Hold Mode threshold will not be configured to GNSS.
<SBAS>	Number	SBAS configuration: • 0 (factory-programmed value): disabled • 1: enabled
<jamming>	Number	Jamming indicator (UBX-CFG-ITFM): • 0 (factory-programmed value): disabled • 1: enabled
<antenna>	Number	Antenna setting: • 0 (factory-programmed value): unknown • 1: passive • 2: active

Parameter	Type	Description
<BBthreshold>	Number	Broadband jamming detection threshold (dB) (UBX-CFG- ITFM). The range goes from 0 to 15. (factory-programmed value: 0)
<CWthreshold>	Number	Continuous wave jamming detection threshold (dB) (UBX-CFG- ITFM). The range goes from 0 to 31. (factory-programmed value: 0)
<GNSS_systems>	Number	Supported GNSS types; the parameter is optional, the allowed values can be combined together: • 1 (factory-programmed value): GPS • 2: SBAS • 4: Galileo • 8: BeiDou • 16: IMES • 32: QZSS • 64: GLONASS
<Reserved1>	Number	0 (reserved value)
<Reserved2>	Number	0 (reserved value)

22.18.4 Notes

- To enable SBAS system opportunely configure both <SBAS> and <GNSS_systems> parameters.
- If a parameter is omitted, the current set value is kept.
- For more details on parameter description see the corresponding u-blox-GNSS receiver description.

23 I²C

23.1 Introduction

The I²C AT commands support communication with more than one connected device via one of the controllers, but require opening and closing a logical channel for each connected device. Only one logical channel at a time can be opened.

☞ The availability and hardware description of the I²C interfaces are out of the scope of this document and are described in a separate document. Refer to the corresponding module System Integration Manual.

The procedure for communicating with two different devices is:

- Open the logical channel for device1 (with AT+UI2CO)
- Read/write to/from device1 (with AT+UI2CR, AT+UI2CW and +UI2CREGR)
- Close the logical channel for device1 (with AT+UI2CC)
- Open the logical channel for device2 (with AT+UI2CO)
- Read/write to/from device2 (with AT+UI2CR, AT+UI2CW and +UI2CREGR)
- Close the logical channel for device2 (with AT+UI2CC)

Once the controller has been configured, it is possible to start I²C communication (read/write) with I²C slave peripherals.

☞ The I²C controllers available on the u-blox cellular modules module work only in Master Mode so they can be connected to slave devices only.

☞ In case of a controller/device malfunction, the command's response is only "ERROR".

23.2 I²C open logical channel +UI2CO

+UI2CO						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

23.2.1 Description

Changes the hardware and logical configuration of the selected I²C controller.

It is only possible to configure the I²C controller in Master Mode.

This command selects:

- The controller available in the u-blox cellular module
- The bus mode type
- The bit rate
- The address size (7-10 bit address)
- The slave device address

Once the selected controller has been configured, a logical channel between it and the selected slave device is set up and there is no need to further specify it. All the following I²C write, read and close commands refer to the currently opened logical channel. It is not possible to use the I²C write, read and open commands for writing or reading to/from a different slave device without first closing the I²C logical channel.

23.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UI2CO=<I2C_controller_number>,<bus_mode>,<bit_rate>,<device_address>,<address_width>	OK	AT+UI2CO=1,0,0,0x42,0 OK
Test	AT+UI2CO=?	+UI2CO: (list of supported <I2C_controller_number>s),(list of	+UI2CO: (1),(0-1),(0-1),(0x000-0x3FF),(0-1)

Type	Syntax	Response	Example
		supported <bus_mode>s),(list of supported <bit_rate>),(<device_ address> range),(list of supported <address_width>s) OK	OK

23.2.3 Defined values

Parameter	Type	Description
<I2C_controller_ number>	Number	I^2C HW controller to use: • 1: controller 1
<bus_mode>	Number	I^2C bus mode type: • 0: Bus Mode Standard (0 - 100 kbaud) • 1: Bus Mode Fast (0 - 400 kbaud)
<bit_rate>	Number	I^2C bit rate: • 0: 100 kb/s • 1: 400 kb/s
<device_address>	Hex Number	Device address in HEX format
<address_width>	Number	I^2C size of the controller address: • 0: 7 bit address • 1: 10 bit address

23.3 I^2C write to peripheral +UI2CW

+UI2CW						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

23.3.1 Description

Writes the HEX data to the I^2C slave device of the current logical channel. The HEX data formats are without 0x prefix (see example).

23.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UI2CW=<hex_data>,<nof_byte_ to_write>	OK	AT+UI2CW="0011AABBCCDDEEFF", 8 OK
Test	AT+UI2CW=?	+UI2CW: (byte to write),(range of supported <nof_byte_to_write>) OK	+UI2CW: "data", (1-100) OK

23.3.3 Defined values

Parameter	Type	Description
<hex_data>	String	Hex data sequence without prefix 0x, enclosed in double quotes, to be written to the I^2C slave device
<nof_bytes_to_ write>	Number	Number of byte to write to the slave I^2C device. Range: 1-100

23.4 I²C read from peripheral +UI2CR

+UI2CR						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

23.4.1 Description

Reads <nof_bytes_to_read> of data from the I²C slave device of the current logical channel and prints them in HEX format in separate rows.

23.4.2 Syntax

Type	Syntax	Response	Example
Read	AT+UI2CR=<nof_bytes_to_read>	+UI2CR: <index_1>: <byte_1>	AT+UI2CR=3
		[+UI2CR: <index_n>: <byte_n>	+UI2CR: 0: 0xA3
		[..]]	+UI2CR: 1: 0x0F
		OK	+UI2CR: 2: 0xDB
			OK
Test	AT+UI2CR=?	+UI2CR: (list of supported <nof_byte_to_read>s)	+UI2CR: (1-100)
		OK	OK

23.4.3 Defined values

Parameter	Type	Description
<nof_bytes_to_read>	Number	Number of bytes to read from the slave I²C device: • SARA-R4 / SARA-N4 - The range goes from 1 to 87.
<index1>,...,<index_n>	Number	Index of the byte being printed.
<byte_1>,...,<byte_n>	Number	n-th byte of the data, in hex mode (unquoted, prefixed by 0x).

23.5 I²C read from peripheral register +UI2CREGR

+UI2CREGR						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

23.5.1 Description

Reads <nof_bytes_to_read> of data from the slave register of the I²C slave device of the current logical channel and prints them in HEX format in separate rows.

23.5.2 Syntax

Type	Syntax	Response	Example
Read	AT+UI2CREGR=<register_address>, <nof_bytes_to_read>	+UI2CREGR: <index_1>: <byte_1>	AT+UI2CREGR=0x42,3
		[+UI2CREGR: <index_n>: <byte_n>	+UI2CREGR: 0: 0xA3
		[..]]	+UI2CREGR: 1: 0x0F
		OK	+UI2CREGR: 2: 0xDB
			OK
Test	AT+UI2CREGR=?	+UI2CREGR: (list of supported <register_address>s),(list of supported <nof_bytes_to_read>s)	+UI2CREGR: (0x00-0xFF),(1-100)
			OK

Type	Syntax	Response	Example
		OK	

23.5.3 Defined values

Parameter	Type	Description
<register_address>	Number	Device address in HEX format
<nof_bytes_to_read>	Number	Number of bytes to read from the slave I²C register. The range goes from 1 to 100.
<index1>,...,<index_n>	Number	Index of the byte being printed.
<byte_1>,...,<byte_n>	Number	n-th byte of the data, in hex mode (unquoted, prefixed by 0x).

23.6 I²C close logical channel +UI2CC

+UI2CC						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

23.6.1 Description

Closes the I²C logical channel being used.

☞ The logical channel must be closed before opening a new one.

23.6.2 Syntax

Type	Syntax	Response	Example
Action	AT+UI2CC	OK	AT+UI2CC OK
Test	AT+UI2CC=?	OK	OK

24 MQTT

24.1 Introduction

MQTT AT commands are implemented according with MQTT version 3.1.1. For a more detailed overview on MQTT protocol, see MQTT Version 3.1.1 - OASIS Standard [163].

The Message Queueing Telemetry Transport (MQTT) protocol specifies a simple and lightweight messaging protocol, designed for constrained devices and low-bandwidth, high-latency, or unreliable networks. An MQTT client uses publish and subscribe methods to interact over a TCP connection with an MQTT message broker (henceforth referred to as an MQTT server). The u-blox modules can be configured to operate as an MQTT client.

To publish or subscribe, the MQTT client must first establish a TCP connection to an MQTT server.

The MQTT protocol specifies case-sensitive Topics, with Topic Names containing Topic Level separators "/" to which messages will be published. For example, a message of "78 Fahrenheit or 25 Celsius" could be published to the Topic Name of "/heat/sensor/SD/bldg5/DelMarConfRm". MQTT clients subscribe to Topic Filters to determine if the client receives messages published to a given Topic name.

The Topic Filters may exactly specify a Topic Name or may contain either of the following wildcards:

- **'+'** - (Single level wildcard) applies to a single Topic Level
- **'#'** - (Multi-level wildcard) applies to potentially many Topic Levels (and must be the last character specified in a Topic Filter);

'#' can be specified on its own or following a topic level separator ('/'). For example, the Topic Filter, "/heat/sensor/SD/#", would receive any messages published to the "/heat/sensor/SD/bldg5/DelMarConfRm" Topic Name.

MQTT specification states that Topic Filters starting with either wildcard will not match any Topic Name that starts with "$".

The MQTT protocol also specifies a Quality of Service (QoS) level to be applied to message transactions:

- **0** (default setting) - at most once delivery
- **1** - at least once delivery
- **2** - exactly once delivery

The MQTT protocol also allows an MQTT client to create a Will message, which the MQTT remote server will store and only publish (to the Topic name specified as the Will Topic name) when the MQTT client gets disconnected from the MQTT server, but not if the MQTT client explicitly sends a disconnect command.

24.2 MQTT profile configuration +UMQTT

+UMQTT						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error MQTT Error

24.2.1 Description

Configures or reads the parameter value of an MQTT client profile. Issue a set command for each <op_code> parameter to set all of the parameters in an MQTT client profile.

SARA-R4 / SARA-N4
The information text response to the read command provides a continuation string, **(more)**, if more information remains to be displayed. By issuing again the read command, the MQTT will attempt to continue the previous display attempt.

24.2.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UMQTT=<op_code>[,<param1>[,<param2>]]	+UMQTT: <op_code>,<result> OK	AT+UMQTT=12,1 +UMQTT: 12,1 OK
MQTT unique client ID			
Set	AT+UMQTT=0,<client_id>	+UMQTT: 0,<result> OK	AT+UMQTT=0,"352753090041680" +UMQTT: 0,1 OK
MQTT local TCP port number			
Set	AT+UMQTT=1,<local_port>	+UMQTT: 1,<result> OK	AT+UMQTT=1,1883 +UMQTT: 1,1 OK
MQTT server name			
Set	AT+UMQTT=2,<server_name>[,<server_port>]	+UMQTT: 2,<result> OK	AT+UMQTT=2,"www.commercialmqttbroker.com" +UMQTT: 2,1 OK
MQTT server IP address			
Set	AT+UMQTT=3,<IP_address>[,<server_port>]	+UMQTT: 3,<result> OK	AT+UMQTT=3,"192.168.1.0",1883 +UMQTT: 3,1 OK
User name and password			
Set	AT+UMQTT=4,<username>,<password>	+UMQTT: 4,<result> OK	AT+UMQTT=4,"test","abc123" +UMQTT: 4,1 OK
Last will QOS			
Set	AT+UMQTT=6,<will_qos>	OK	AT+UMQTT=6,1 OK
Last will retain			
Set	AT+UMQTT=7,<will_retain>	OK	AT+UMQTT=7,1 OK
Last will topic			
Set	AT+UMQTT=8,<will_topic>	OK	AT+UMQTT=8,"u-blox/publish" OK
Last will message			
Set	AT+UMQTT=9,<will_message>[,<hex_mode>]	OK	AT+UMQTT=9,"Unrequested disconnect." OK
Inactivity timeout			
Set	AT+UMQTT=10,<timeout>	+UMQTT: 10,<result> OK	AT+UMQTT=10,3600 +UMQTT: 10,1 OK
MQTT secure option			
Set	AT+UMQTT=11,<MQTT_secure>[,<USECMNG_profile>]	+UMQTT: 11,<result> OK	AT+UMQTT=11,1,2 +UMQTT: 11,1 OK
MQTT clean session			
Set	AT+UMQTT=12,<clean_session>	+UMQTT: 12,<result> OK	AT+UMQTT=12,1 +UMQTT: 12,1

Type	Syntax	Response	Example
			OK
Read	AT+UMQTT=<op_code>	+UMQTT: <op_code>,<param1>[,<param2>] OK	+UMQTT: 4,"my_username" OK
Read	AT+UMQTT?	+UMQTT: 0,<client_id> +UMQTT: 2,<server_name>,<server_port> +UMQTT: 3,IP_address>,<server_port> +UMQTT: 4,<username> +UMQTT: 6,<will_qos> +UMQTT: 7,<will_retain> +UMQTT: 8,<will_topic> +UMQTT: 9,<will_message_length>,<will_message> +UMQTT: 10,<timeout> +UMQTT: 11,<MQTT_secure>[,<USECMNG_profile>] OK	+UMQTT: 0,"352848080012186" +UMQTT: 2,"",1883 +UMQTT: 3,"",1883 +UMQTT: 4,"" +UMQTT: 6,0 +UMQTT: 7,0 +UMQTT: 8,"" +UMQTT: 9,0,"" +UMQTT: 10,0 +UMQTT: 11,0 OK
Test	AT+UMQTT=?	+UMQTT: (list of supported <op_code>s) OK	+UMQTT: (0-4,10-12) OK
URC		+UUMQTT<op_code>: <param1>[,<param2>]	+UUMQTT0: "352753090041680"

24.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	MQTT parameter: • 0: MQTT unique client id • 1: MQTT local port number • 2: MQTT server name • 3: MQTT IP address • 4: MQTT username and password • 6: MQTT will QoS value • 7: MQTT will retain • 8: MQTT will topic • 9: MQTT will message • 10: MQTT inactivity timeout period • 11: MQTT secure • 12: MQTT clean session • 14: MQTT terse/verbose mode; the set command is not supported
<result>	Number	• 0: failure • 1: success
<client_id>	String	Client identifier for the MQTT session. The maximum length is 23 characters. The default value is the IMEI of the MT.
<local_port>	Number	MQTT client TCP port. The range goes from 1 to 65535. If the MQTT client port number is not specified, the default port number is the IANA assigned port of 1883 for non-TLS MQTT and 8883 for TLS MQTT.
<server_name>	String	Remote server name. The maximum length is 128 characters. The default value is an empty string.
<IP_address>	String	Remote server IP address. The default value is an empty string. For IP address format reference, see the IP addressing.
<server_port>	Number	MQTT server port. The range goes from 1 to 65535. The default value is 1883 for non-TLS MQTT, 8883 for TLS MQTT.

Parameter	Type	Description
<username>	String	User name for the MQTT login procedure. The default value is an empty string. • SARA-R4 / SARA-N4 - The maximum length is 30 characters.
<password>	String	Password for the MQTT login procedure. The default value is an empty string. • SARA-R4 / SARA-N4 - The maximum length is 30 characters.
<timeout>	Number	Inactivity timeout expressed in seconds. According to the MQTT specification, an MQTT server must disconnect a client if it receives nothing from the client within 1.5x the inactivity timeout. An inactivity timeout value of 0 indicates no timeout. The default value is 0. The maximum value is 65535 (corresponding to 18 hours, 12 minutes and 15 seconds).
<will_qos>	Number	MQTT last will Quality of Service: • 0 (default value): at most once delivery • 1: at least once delivery • 2: exactly once delivery
<will_retain>	Number	Whether or not the last will message will be retained across disconnects: • 0 (default value): the last will message will not be retained by the MQTT broker • 1: the last will message will be retained by the MQTT broker
<will_topic>	String	Last will topic name. The maximum length is 256 characters. The default value is an empty string.
<will_message>	String	Last will message: ASCII or hexidecimal data.
<hex_mode>	Number	Allowed values: • 0 (default value): ASCII input for <will_message> • 1: hexidecimal input for <will_message>
<will_message_length>	Number	Number of octects in <will_message>.
<MQTT_secure>	Number	Enables / disables the secure option of MQTT service: • 0 (default value): no TLS encryption • 1: enable the MQTT TLS encryption
<USECMNG_profile>	Number	USECMNG profile (number). Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see +USECMNG AT command description).
<clean_session>	Number	Clean Session value. Allowed values: • 0: indicates that the client subscription and delivered messages received by the client should be remembered across disconnects by both the MQTT client and the MQTT server • 1: (default value) indicates that disconnects clean all session state information
<param1>	Number / String	Type and supported content depend on the related <op_code> parameter (details are given above). If <param1> is not specified the value of the corresponding parameter <op_code> is reset to the default value.
<param2>	Number / String	Type and supported content depend on the related <op_code> parameter (details are given above). If <param2> is not specified the value of the corresponding parameter <op_code> is reset to the default value.

24.2.4 Notes

- The information text response to the read command does not display the password.
- Some network operators do not allow secure MQTT. In this case the AT+UMQTTC=1 command (MQTT login) will return a failure response by means of the +UUMQTTC URC after an TLS timeout of 30 s.

SARA-R4 / SARA-N4

- For individual MQTT parameter fields, especially the string fields (double-quote delimited), the continuation symbol + indicates whether the current display is a continuation from a previous display or whether the current display has more information to be displayed.
- If the continuation symbol precedes the first double-quote, e.g., **Topic: +"is continuing from previous display"**, then this MQTT parameter field continues from a previous display command. If the continuation symbol trails the last double-quote, e.g., Topic: **"This message won't fit within the limita"+**, then it indicates that more information from this MQTT parameter remains to be displayed. If the continuation symbol appears on both sides of the double-quotes, then this message is the continuation of a previous display (and requires future displays to complete), e.g., **Topic: +"is in the middle of a long messa"+**.

- The profile parameters 6, 7, 8, 9 and 14 are provided in the read response for informational purposes. They cannot be set using the +UMQTT set command:
  - Profile parameters 6 (MQTT will QoS value), 7 (MQTT will retain) and 8 (MQTT will topic) are set with the +UMQTTWTOPIC AT command.
  - Profile parameter 9 (MQTT will message) is set with the +UMQTTWMSG AT command.
  - Parameter 14 is set with the +UMQTTC AT command.
- When displaying all of the MQTT client profile parameters, (AT+UMQTT?), only the non-default string parameters are displayed. Thus, if Will Message, Will Topic, server name, IP address, username, or password are not entered, they will not be displayed.
- Only IPv4 is supported.
- Client subscriptions and delivered messages across disconnects by either the server or the client <clean_session>=0 is not supported.
- The MQTT <op_code>=8 has no effect on the server behavior because the MQTT client automatically sends an MQTT ping to the MQTT server prior to the <timeout>
- <op_code>=6, <op_code>=7, <op_code>=8 and <op_code>=9 are not supported.
- The MQTT server IP address and the MQTT server name are mutually exclusive. If value for <op_code>=2 is specified by the user, then the value for <op_code>=3 is reset or vice versa.
- After logout (AT+UMQTTC=0), MQTT settings need to be re-set individually or restored from the NVM with the AT+UMQTTNV=1 command to login again.

SARA-R410M-02B

- Secure MQTT (TLS) is not supported.
- <op_code>=6, 7, 8 and 9 are not supported.

24.3 MQTT Will Topic configuration +UMQTTWTOPIC

+UMQTTWTOPIC						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error MQTT Error

24.3.1 Description

Configures the MQTT profile parameters related to the MQTT's Will Message ("Last Will and Testament"). In the MQTT protocol, an MQTT client can configure a Will Message to be broadcast from the MQTT message broker (MQTT server) whenever the server disconnects the MQTT client outside of a specific MQTT client disconnect request. Upon disconnect, the MQTT server will publish the Will Message for a given connection to the specified Will Topic name, with the specified Will QoS (Quality of Service). The Will Retain flag indicates whether the MQTT server saves the Will Message (and the corresponding Will Message parameters) across MQTT disconnects.

24.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMQTTWTOPIC=<Will_QoS>,<Will_Retain>,<Will_Topic>	[+UMQTTWTOPIC: <result>] OK	AT+UMQTTWTOPIC=0,0,"sensor/heat/SD/bldg5/DelMarConfRm/status" +UMQTTWTOPIC: 1 OK
Read	AT+UMQTTWTOPIC?	OK	
Test	AT+UMQTTWTOPIC=?	+UMQTTWTOPIC: (list of supported <Will_QoS>),(list of supported <Will_Retain>) OK	+UMQTTWTOPIC: (0-2),(0-1) OK
URC		+UUMQTTWTOPIC: <Will_QoS>,<Will_Retain>,<Will_Topic>	+UUMQTTWTOPIC: 0,0,"user/u-blox"

24.3.3 Defined values

Parameter	Type	Description
<Will_QoS>	Number	MQTT Will Quality of Service: • 0 (default value): at most once delivery • 1: at least once delivery • 2: exactly once delivery
<Will_Retain>	Number	Whether or not the Will Message will be retained across disconnects: • 0 (default value): the Will Message will not be retained by the MQTT broker • 1: the Will Message will be retained by the MQTT broker
<Will_Topic>	String	Last will topic name. The maximum length is 256 characters.
<result>	Number	Operation result: • 0: failure • 1: success

24.3.4 Notes

- If a connection is attempted when the Will Message is not valid (i.e., either the empty string or the default value), then the <Will_QoS> and <Will_Retain> parameters revert to default values.

24.4 MQTT Will Message configuration +UMQTTWMSG

+UMQTTWMSG						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error MQTT Error

24.4.1 Description

Configures the Will Message associated with the other MQTT profile parameters for an MQTT client's connection. In the MQTT Protocol, an MQTT client can configure a Will Message to be broadcast from the MQTT message broker (MQTT server) whenever it disconnects the MQTT client outside of a specific MQTT client disconnect request.

24.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMQTTWMSG=<will_message>[,<hex_mode>]	[+UMQTTWMSG: <result>] OK	AT+UMQTTWMSG="Unrequested Disconnect. Please check network connectivity or battery life." +UMQTTWMSG: 1 OK
Read	AT+UMQTTWMSG?	+UMQTTWMSG: <will_message_length>,<will_message> OK	+UMQTTWMSG: 74,"Unrequested Disconnect. Please check network connectivity or battery life." OK
Test	AT+UMQTTWMSG=?	OK	
URC		+UUMQTTWMSG: <will_message>	+UUMQTTWMSG: "Unrequested Disconnect. Please check network connectivity or battery life."

24.4.3 Defined values

Parameter	Type	Description
<will_message>	String	Last will message. ASCII or hexidecimal data, the maximum length is 256 octects. The default value is an empty string.
<hex_mode>	Number	Allowed values: • 0 (default value): ASCII input for <will_message>

Parameter	Type	Description
		• 1: hexidecimal input for <will_message>
<will_message_length>	Number	Number of octects in <will_message>.
<result>	Number	Operation result: • 0: failure • 1: success

24.4.4 Notes

SARA-R4 / SARA-N4

- The read command does not provide the information text response.
- The <hex_mode> and <will_message_length> parameters are not supported.

24.5 Save/Restore MQTT profile from NVM +UMQTTNV

+UMQTTNV						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

24.5.1 Description

Either saves all of the MQTT client profile parameters to NVM (non-volatile memory) or sets all of the MQTT client profile parameters to either factory-programmed or non-volatile stored values.

For the complete list of parameters that can be stored in the NVM, see the +UMQTT AT command.

24.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMQTTNV=<NVM_mode>	[+UMQTTNV: <NVM_mode>, <result>] OK	AT+UMQTTNV=2 +UMQTTNV: 2,1 OK
Test	AT+UMQTTNV=?	+UMQTTNV: (list of <NVM_mode>s) OK	+UMQTTNV: (0-2) OK

24.5.3 Defined values

Parameter	Type	Description
<NVM_mode>	Number	Operation to set or save the MQTT client profile parameters as follows: • 0: restore MQTT client profile parameters to the factory-programmed setting • 1: set MQTT client profile parameters to values previously stored in the NVM • 2: store current MQTT client profile parameters to the NVM
<result>	Number	Operation result: • 0: failure • 1: success

24.6 MQTT command +UMQTTC

+UMQTTC						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 60 s	#unique_1055 MQTT Error

24.6.1 Description

Triggers the MQTT actions corresponding to the <op_code> parameter. The final result code indicates if sending the command request to the MQTT process was successful or not.

The +UUMQTTC URC provides the result of the requested action from the MQTT broker. In addition, the +UUMQTTC URC also provides notification that unread messages are available from the MQTT server. The +UUMQTTC URC is by default enabled.

SARA-R4 / SARA-N4
The +UUMQTTC URC provides the result only for login and subscribe.
The +UUMQTTCM URC provides the contents of the received message when after having issued the AT +UMQTTC=6 command. The +UUMQTTCM URC is enabled by default.

24.6.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UMQTTC=<op_code>[,<param1>,[<param2>],[<param3],[<param4],[<param5]]	+UMQTTC: <op_code>,<MQTT_result> OK	AT+UMQTTC=0 +UMQTTC: 0,1 OK
MQTT logout			
Set	AT+UMQTTC=0	+UMQTTC: 0,<MQTT_result> OK	AT+UMQTTC=0 +UMQTTC: 0,1 OK
MQTT login			
Set	AT+UMQTTC=1	+UMQTTC: 1,<MQTT_result> OK	AT+UMQTTC=1 +UMQTTC: 1,1 OK
URC		+UUMQTTC: 1,<login_result>	+UUMQTTC: 1,0
MQTT publish to a topic			
Set	AT+UMQTTC=2,<QoS>,<retain>,[<hex_mode>],<topic>,<message>	+UMQTTC: 2,<MQTT_result> OK	AT+UMQTTC=2,0,0,"sensor/heat/SD/bldg5/DelMarConfRm","23 degrees Celsius" +UMQTTC: 2,1 OK
MQTT publish a file to a topic			
Set	AT+UMQTTC=3,<QoS>,<retain>,<topic_name>,<filename>	+UMQTTC: 3,<MQTT_result> OK	AT+UMQTTC=3,0,0,"/home/u-blox","/home/greetings/will.txt" +UMQTTC: 3,1 OK
MQTT subscribe to the specified topic filter			
Set	AT+UMQTTC=4,<max_QoS>,<topic_filter>	+UMQTTC: 4,<MQTT_result> OK	AT+UMQTTC=4,0,"sensor/heat/SD/#" +UMQTTC: 4,1 OK
URC		+UUMQTTC: 4,<reason>,<QoS>,<topic_name>	+UUMQTTC: 4,0,2,"sensor/heat/SD/#"

Type	Syntax	Response	Example
MQTT unsubscribe from the specified Topic Filter			
Set	AT+UMQTTC=5,<topic_filter>	+UMQTTC: 5,<MQTT_result> OK	AT+UMQTTC=5,"sensor/heat/SD/#" +UMQTTC: 5,1 OK
MQTT read message			
Set	AT+UMQTTC=6	+UMQTTC: 6,<MQTT_result> OK	AT+UMQTTC=6 +UMQTTC: 6,1 OK
URC		+UUMQTTC: 6,<num_unread_msgs>	+UUMQTTC: 6,3
MQTT verbose/terse Reception format			
Set	AT+UMQTTC=7,<format>	+UMQTTC: 7,<MQTT_result> OK	AT+UMQTTC=7,1 +UMQTTC: 7,1 OK
Ping MQTT server			
Set	AT+UMQTTC=8,<mqtt_server>	+UMQTTC: 8,<MQTT_result> OK	AT+UMQTTC=8,"192.168.1.0" +UMQTTC: 8,1 OK
Test	AT+UMQTTC=?	+UMQTT: (list of supported <op_codes>s) OK	+UMQTTC: (0-8) OK
Generic syntax			
URC		+UUMQTTC: <op_code>,<param1>[,<param2>,<param3>	+UUMQTTC: 4,0,2,"sensor/heat/SD/#"
MQTT Message			
URC		+UUMQTTCM: <op_code>,<num_unread_msgs> [Topic: <topic_name>] [Len: <msg_length> Qos: <Qos>] Message: <message>	+UUMQTTCM: 6,1 Topic: sensor/heat/SD/bldg5/DelMarConfRm Len: 16 QoS: 0 Message: 16 bytes of data

24.6.3 Defined values

Parameter	Type	Description
<op_code>	Number	MQTT command request. Allowed values: • 0: logs out/disconnects from MQTT server. Will message will not be sent • 1: logs in/connects to MQTT server • 2: publish a message to a specific topic to the MQTT message broker • 3: publish a message from a file to a specific topic to the MQTT message broker • 4: subscribe to a topic from the MQTT message broker • 5: unsubscribe to a topic from the MQTT message broker. This should exactly match the Topic Filter used during the Subscribe • 6: read all unread messages received from MQTT message broker, at the terse/verbose mode set at the time of message reception • 7: sets the terse/verbose format for received messages (i.e. the amount of information and headers with each received MQTT message) • 8: ping the MQTT message broker
<MQTT_result>	Number	Result of an MQTT command request: • 0: fail; for more details, see the +UMQTTER AT command • 1: success
<login_result>	Number	Result of an MQTT login request. Allowed values: • 0: connection accepted • 1: the server does not support the level of the MQTT protocol requested by the Client • 2: the client identifier is correct UTF-8 but not allowed by the Server • 3: the network connection has been made but the MQTT service is unavailable • 4: the data in the user name or password is malformed • 5: the client is not authorized to connect

Parameter	Type	Description
		• 6-255: reserved for future use
<QoS>	Number	Quality of service: • 0 (default value): at most once delivery • 1: at least once delivery • 2: exactly once delivery
<retain>	Number	Whether or not the message will be retained across disconnects. Allowed values: • 0 (default value): the message will not be retained by the MQTT broker • 1: the message will be retained by the MQTT broker
<hex_mode>	Number	Allowed values: • 0 (default value): ASCII input for <message> • 1: hexidecimal input for <message>
<message>	String	ASCII or hexidecimal data. The starting quotation mark shall not be taken into account like data. At the end of the byte stream, another quotation mark is provided for user convenience and visualization purposes.
<file_name>	String	File name containing the message to be published. The maximum parameter length is 250 characters.
<max_qos>	Number	Maximum qos level at which the MQTT broker can send messages to the MT. For more details, see MQTT specification [163]. • 0: at most once delivery • 1: at least once delivery • 2: exactly once delivery
<topic_filter>	String	An expression to indicate an interest in one or more topics, wildcard characters are used to subscribe/unsubscribe to multiple topics at once. See MQTT introduction.
<topic_name>	String	Indicates the topic to which the given MQTT message was published
<reason>	Number	Result of an MQTT subscribe request: • 0: success • 128: failure
<num_unread_msgs>	Number	Indicates the number of unread received messages.
<format>	Number	Specifies the format of the messages when read using the <op_code>=6. Allowed values: • 0: no formating. All messages will be concatenated into a single line with no separation between meeages • 1 (default value): each messages will contain the <topic_name> and <message> • 2: each messages will contain the <topic_name>, <msg_length>, <QoS> and <message>
<mqtt_server>	String	IP address or URL of MQTT server
<one_message>	Number	Allowed values: • 0: read all received messages. • 1: read only one message.
<topic_msg_length>	Number	Sum of topic and message length
<topic_length>	Number	Topic length
<msg_length>	Number	Specifies the number of octets in <message>
<ping_ON_OFF>	Number	Allowed values: • 0 (default value): ping disabled • 1: ping enabled the MT will ping the MQTT broker. The ping is issued when the MQTT inactivity timeout period expires. See AT+UMQTT=10,<timeout>.

24.6.4 Notes

- The topic name should not include any wildcards for the Publish commands.
- The topic filter could include the '+' wildcard to substitute for a single topic folder or the '#' wildcard to substitute for any number of topic folders. The '#' wildcard must be the last character in a topic filter.

SARA-R4 / SARA-N4

- <op_code>= 3 and 8 are not supported.
- In case of a successful result the <reason> parameter can assume these values: 0, 1, 2.

- Login to the MQTT server will have two responses, an immediate "+UMQTTC: 1,1" response that indicates that the module has sent the MQTT login request to the MQTT server. The MQTT server's login response will happen asynchronously when the MQTT server has finished processing the MQTT login request and decided whether or not to accept it.
- Subscription to a given Topic Filter will have two responses, an immediate "+UMQTTC: 4,1" response that indicates that the module has sent the MQTT Subscription Request to the MQTT server. The MQTT server's Subscription Response will happen asynchronously when the MQTT server has finished processing the MQTT Subscription Request and decided whether or not to accept it.

24.7 MQTT error +UMQTTER

+UMQTTER						
Modules	SARA-R410M-02B SARA-R410M-52B SARA-R412M					
	SARA-N4					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	#unique_1055 MQTT Error

24.7.1 Description

Retrieves the error code and module (plus possible supplemental information) of the last MQTT operation that resulted in an error response.

24.7.2 Syntax

Type	Syntax	Response	Example
Action	AT+UMQTTER	+UMQTTER: <error_code1>,<error_code2> OK	AT+UMQTTER +UMQTTER: 1,1 OK

24.7.3 Defined values

Parameter	Type	Description
<error_code1>	Number	• SARA-R4 / SARA-N4 - Value of error code. Values are listed in MQTT error codes.
<error_code2>	Number	• SARA-R4 / SARA-N4 - Value of supplemental error code. The values are listed in MQTT supplimental error codes.

A Appendix: Error result codes

A.1 Mobile termination error result codes +CME ERROR

Numeric error code	Description
0	Phone failure
1	No connection to phone
2	Phone-adaptor link reserved
3	Operation not allowed
4	Operation not supported
5	PH-SIM PIN required
10	SIM not inserted
11	SIM PIN required
12	SIM PUK required
13	SIM failure
14	SIM busy
15	SIM wrong
16	Incorrect password
17	SIM PIN2 required
18	SIM PUK2 required
20	Memory full
21	Invalid index
22	Network not found
23	Memory failure
24	Text string too long
25	Invalid characters in text string
26	Dial string too long
27	Invalid characters in dial string
30	No network service
31	Network timeout
32	Network not allowed - emergency calls only
40	Network personalisation PIN required
41	Network personalisation PUK required
42	Network subset personalisation PIN required
43	Network subset personalisation PUK required
44	Service provider personalisation PIN required
45	Service provider personalisation PUK required
46	Corporate personalisation PIN required
47	Corporate personalisation PUK required
50	Incorrect parameters
51	Command implemented but currently disabled
52	Command aborted by user
53	Parameters are invalid
100	Unknown
103	Illegal MS
106	Illegal ME
107	GPRS services not allowed
108	GPRS and non GPRS services not allowed
111	PLMN not allowed
112	Location area not allowed
113	Roaming not allowed in this location area
114	GPRS services not allowed in this PLMN
115	No Suitable Cells In Location Area
122	Congestion

Numeric error code	Description
125	Not authorized for this CSG
126	Insufficient resources
132	Service option not supported
133	Requested service option not subscribed
134	Service option temporarily out of order
135	NS-api already used
140	Feature not supported
141	Semantic error in the TFT operation
142	Syntactical error in the TFT operation
143	Unknown PDP context
144	Semantic errors in packet filter(s)
145	Syntactical errors in packet filter(s)
146	PDP context without TFT already activated
148	Unspecified GPRS error
149	PDP authentication failure
150	Invalid mobile class
156	User Busy
159	Uplink Busy/ Flow Control
172	Semantically incorrect message
173	Mandatory information element error
174	Information element non-existent or not implemented
175	Conditional IE error
176	Protocol error, unspecified
254	Invalid error mapping
255	Internal error
300	ME failure
301	SMS service of ME reserved
302	Operation not allowed
303	Operation not supported
304	Invalid PDU mode parameter
305	Invalid text mode parameter
310	(U)SIM not inserted
311	(U)SIM PIN required
312	PH-(U)SIM PIN required
313	(U)SIM failure
314	(U)SIM busy
315	(U)SIM wrong
316	(U)SIM PUK required
317	(U)SIM PIN2 required
318	(U)SIM PUK2 required
320	Memory failure
321	Invalid memory index
322	Memory full
330	SMSC address unknown
331	No network service
332	Network timeout
340	No +CNMA acknowledgement expected
500	Unknown error
608	Voice call active
701	Incorrect security code
702	Max attempts reached
1001	Unassigned (unallocated) number
1003	No route to destination
1006	Channel unacceptable
1008	Operator determined barring

Numeric error code	Description
1016	Normal call clearing
1017	User busy
1018	No user responding
1019	User alerting, no answer
1021	Call rejected
1022	Number changed
1026	Non selected user clearing
1027	Destination out of order
1028	Invalid number format (incomplete number)
1029	Facility rejected
1030	Response to STATUS ENQUIRY
1031	Normal, unspecified
1034	No circuit/channel available
1038	Network out of order
1041	Temporary failure
1042	Switching equipment congestion
1043	Access information discarded
1044	requested circuit/channel not available
1047	Resources unavailable, unspecified
1049	Quality of service unavailable
1050	Requested facility not subscribed
1055	Incoming calls barred within the CUG
1057	Bearer capability not authorized
1058	Bearer capability not presently available
1063	Service or option not available, unspecified
1065	Bearer service not implemented
1068	ACM equal to or greater than ACMmax
1069	Requested facility not implemented
1070	Only restricted digital information bearer capability is available
1079	Service or option not implemented, unspecified
1081	Invalid transaction identifier value
1087	User not member of CUG
1088	Incompatible destination
1091	Invalid transit network selection
1095	Semantically incorrect message
1096	Invalid mandatory information
1097	Message type non-existent or not implemented
1098	Message type not compatible with protocol state
1099	Information element non-existent or not implemented
1100	Conditional IE error
1101	Message not compatible with protocol state
1102	Recovery on timer expiry
1111	Protocol error, unspecified
1127	Interworking, unspecified
1279	Number not allowed
1283	CCBS possible
1500	Wrong GPIO identifier
1501	Set GPIO default error
1502	Select GPIO mode error
1503	Read GPIO error
1504	Write GPIO error
1505	GPIO busy
1520	Wrong ADC identifier
1521	Read ADC error
1530	IPv4 only allowed

Numeric error code	Description
1531	IPv6 only allowed
1540	Wrong ringer identifier
1542	LLC or SNDCP failure
1543	Regular deactivation
1544	Reactivation requested
1545	Single address bearers only allowed
1546	Invalid transaction identifier value
1547	APN restriction val incompatible with PDP context
1548	PDP activation rejected
1549	unknown PDP address or PDP type
1550	GPRS generic operation error
1551	GPRS invalid APN
1552	GPRS authentication failure
1553	GPRS QoS parameters inconsistent
1554	GPRS network failure
1555	GPRS context busy
1556	CSD generic operation error
1557	CSD undefined profile
1558	CSD context busy
1559	PLMN scan not allowed
1600	FFS error
1560	PDP type IPv4 only allowed
1561	PDP type IPv6 only allowed
1612	FILE NOT FOUND
1613	Cannot open file
1620	Buffer full
1621	FFS initializing
1622	FFS already open file
1623	FFS not open file
1624	FFS file not found
1625	FFS file already created
1626	FFS illegal id
1627	FFS illegal file handle
1628	FFS illegal type
1629	FFS illegal mode
1630	FFS file range
1631	FFS operation not possible
1632	FFS write error
1633	FFS user id error
1634	FFS internal fatal error
1635	FFS memory resource error
1636	FFS maximum number of files exceeded
1637	FFS memory not available
1638	FFS invalid filename
1639	FFS streaming not enabled
1640	FFS operation not allowed on static file
1641	FFS memory table inconsistency
1642	FFS not a factory default file
1643	FFS requested memory temporary not available
1644	FFS operation not allowed for a directory
1645	FFS directory space not available
1646	FFS too many streaming files open
1647	FFS requested dynamic memory temporary not available
1648	FFS user provided a NULL parameter instead of a suitable buffer
1649	FFS timeout

Numeric error code	Description
1650	Command line too long
1660	Call barred - Fixed dialing numbers only
1700	GPS GPIO not configured
1701	GPS GPIO ownership error
1702	Invalid operation with GPS ON
1703	Invalid operation with GPS OFF
1704	Invalid GPS aiding mode
1705	Reserved GPS aiding mode
1706	GPS aiding mode already set
1707	Invalid GPS trace mode
1708	Parameter valid only in case of GPS OTA
1709	GPS trace invalid server
1710	Invalid TimeZone
1711	Invalid value
1712	Invalid parameter
1713	Invalid operation with LOC running / GPS Busy
1801	IBM busy / eCall already armed/active
1802	IBM feature off / eCall feature off
1803	Wrong IBM requested
1804	Audio resource not available
1805	ECALL restriction
1806	eCall invalid dial number
1900	No SAP Server Connection
1901	SAP Protocol Error
1902	SAP Connection failure
1903	SAP Server Disconnection
1904	SAP Other terminal using service
1910	USECMNG import timeout expired (no input for > 20 s)
1911	USECMNG import file size exceeds limit
1912	USECMNG no memory available
1913	USECMNG invalid certificate/key format
1914	USECMNG database full
1950	CDC-ECM is not available
1951	CDC-ECM is busy
1952	No DHCP Packets received from the DTE
2000	Command timeout
3000	Command aborted
4000	APN configuration mismatch
4001	IP type configuration mismatch

A.2 Message service error result codes +CMS ERROR

Numeric error code	Description
1	Unassigned (unallocated) number
5	Delta firmware unavailable on FOTA server
8	Operator determined barring
10	Call barred
17	Network failure
21	Short message transfer rejected
22	Memory capacity exceeded
27	Destination out of service
28	Unidentified subscriber
29	Facility rejected
30	Unknown Subscriber
38	Network out of order

Numeric error code	Description
41	Temporary failure
42	Congestion
47	Resources unavailable, unspecified
50	Requested facility not subscribed
69	Requested facility not implemented
81	Invalid short message reference value
95	Invalid message, unspecified
96	invalid mandatory information
97	Message type non-existent or not implemented
98	Message not compatible with short message protocol state
99	Information element non-existent or not implemented
111	Protocol error, unspecified
127	Interworking, unspecified
128	Telematic interworking not supported
129	Short message type 0 not supported
130	Cannot replace short message
143	Unspecified TP-PID error
144	Data coding scheme (alphabet) not supported
145	Message class not supported
159	Unspecified TP-DCS error
160	Command cannot be actioned
161	Command unsupported
175	Unspecified TP-Command error
176	TPDU not supported
192	SC busy
193	No SC subscription
194	SC system failure
195	Invalid SME address
196	Destination SME barred
197	SM Rejected-Duplicate SM
198	TP-VPF not supported
199	TP-VP not supported
208	SIM SMS storage full
209	No SMS storage capability in SIM
210	Error in MS
211	Memory Capacity Exceeded
212	SIM Application Toolkit Busy
213	SIM data download error
287	Network failure unspecified
290	Network no resource
296	Radio Resources not Aailable due to DUAL SIM operation
297	Out of service due to DUAL SIM operation
300	ME failure
301	SMS service of ME reserved
302	Operation not allowed
303	operation not supported
305	Invalid Text mode parameter
310	SIM not inserted
311	SIM PIN required
312	PH-SIM PIN required
313	SIM failure
314	SIM busy
315	SIM wrong
320	memory failure
321	invalid memory index

Numeric error code	Description
322	memory full
330	SMSC address unknown
331	no network service
332	network timeout
340	no +CNMA acknowledgement expected
500	unknown error
512	Relay Protocol Acknowledgement
513	SMS timer expired
514	SMS forwarding availability failed
515	SMS forwarding availability aborted
516	MS invalid TP-Message-Type-Indicator
517	MS no TP-Status-Report in Phase 1
518	MS no TP-Reject-Duplicate in phase 1
519	MS no TP-Replay-Path in Phase 1
520	MS no TP-User-Data-Header in Phase 1
521	MS missing TP-Validity-Period
522	MS invalid TP-Service-Centre-Time-Stamp
523	MS missing TP-Destination-Address
524	MS invalid TP-Destination-Address
525	MS missing Service-Centre-Address
526	MS invalid Service-Centre-Address
527	MS invalid alphabet
528	MS invalid TP-User-Data-length
529	MS missing TP-User-Data
530	MS TP-User-Data to long
531	MS no Command-Request in Phase 1
532	MS Cmd-Req invalid TP-Destination-Address
533	MS Cmd-Req invalid TP-User-Data-Length
534	MS Cmd-Req invalid TP-User-Data
535	MS Cmd-Req invalid TP-Command-Type
536	MN MNR creation failed
537	MS CMM creation failed
538	MS network connection lost
539	MS pending MO SM transfer
540	RP-Error OK
541	RP-Error OK no icon display
542	SMS-PP Unspecified
543	SMS rejected By SMS CONTROL
544	Service Centre Address(SCA) FDN failed
545	Destination Address(DA) FDN failed
546	BDN check failed
547	Unspecified SMS PP error
548	Undefined Result
548	No Route To Destination
549	Channel Unacceptable
555	No Circuit/Channel Available
556	Access Information Discarded
557	Requested Circuit/Channel Not Available By Other Side
558	Quality Of Service Unavailable
560	Bearer Capability Not Authorized
561	Bearer Capability Not Presently Available
562	Service or Option Not Available, Unspecified
563	Bearer Service Not Implemented
564	ACM Equal to or Greater Than ACMmax
565	Only Restricted Digital Information Bearer Capability Is Available

Numeric error code	Description
566	Service or Option Not Implemented, Unspecified
567	User Not Member of CUG
568	Incompatible By Destination
569	Invalid Transit Network Selection
571	Message Not Compatible With Protocol State
572	Recovery On Timer Expiry
576	Data Call Active
577	Speech Call Active
579	MOC Setup Rejected Due to Missing ACM Info
580	Temporary Forbidden Call Attempt
581	Called Party is Blacklisted
583	Temporary Forbidden Call Attempt No Service
584	Temporary Forbidden Call Attempt Limited Service
585	Client Temporary Barred
586	Dual Service Call Active
587	Atc Fclass Not Speech
590	Client Not Registrated
591	Active Client Gone
595	Rejected By Call Control
601	Invalid ALS Line
604	MM No Service (out of coverage)
605	MM Access Class Barred (RR_REL_IND During RR Conn. Establishment)
606	ME Busy -CM Service Request Already Pending
608	Rejected Due To SUP Timer Expiry
609	Rejected Due To USSD Busy
610	Rejected Due To SS Busy
612	SIM Toolkit Request Is Rejected, Because Another SIM Toolkit Request Is Pending
614	Rejected Because SIM Toolkit Request Is Not Yet Answered By The User
615	MN Setup SS Error
616	Call Controller Blocked (Other Call Command Pending)
618	Environment Parameter Not Set Correctly (Fclass/Cmod)
619	Other Blocking Call Present
620	Lower Layer Failure
621	The Authentication Proedure Failed
622	The Packet-Switched Registration Procedure Failed
623	CM Service Reject From The Network
624	The ABORT Message Was Received From The Network
625	Timer Expiry
626	IMSI Deatch Was Initiated
627	Normal RR Connection Release (2G)
628	Registration Failed
630	Failure Due To Handover
631	Link Establishment Failure
632	Random Access Failure
633	Radio Link Aborted
634	Lower Layer Failure in Layer 1
635	Immediate Assignment Reject
636	Failure Due To Paging
637	Abnormal Release Unspecified
638	Abnormal Release Channel Unacceptable
639	Abnormal Release Timer Expired
640	Abnormal Release No Act On Radio Path
641	Preemptive Release
642	UTRAN Configuration Unknown

Numeric error code	Description
643	Handover Impossible
644	Channel Mode Unacceptable
647	Lower Layer Failure From NW
649	Conditional IE Error
650	No Cell Allocation Available
653	Re Establishment Reject
654	Directed Sigconn Re Establishment
656	Release of RRC connection Witout Network Activity(3G) Lower Layer Failure Downlink
657	Lower Layer Failure Uplink
658	Cell Barred Due To Authentication Failure
659	Signalling Connection Release
660	CS Connection Release Triggered By MM
661	RRC Connection Establishment Failure
662	RRC Connection Establsihment Reject With Redirection
663	Resource Conflict
664	Layer Layer Failure in Layer 2
665	L2 Cause T200 Expiry N200 Plus 1 Times
669	RR Connection Release Due to BAND Change (2G)
670	Release of the RRC Connection Due to Out of Service in Cell_Fach (3G)
671	Release of the RRC Connection Due to Not Matching PLMN in Shared Networks(3G)
672	Error Happens While Call Is Already Disconnected / Late Error
674	SIM Toolkit Cannot Initiate A Call, Because MMI Is Not Registered
675	SIM Toolkit Call Setup Request Is Rejected Due User Did Not Accept
676	Proactive SIM Appl Terminated By User
677	SIM Toolkit Originated SIM Reset (Refresh Request)
680	Dial String/Number Incorrect

A.3 Firmware install final result codes

The +UFWINSTALL command issues a final result code providing the result of the FW install procedure. In case the FW install procedure fails, the error result code provides some indication about the error cause (syntax error or issue during the installation procedure).

A.3.1 SARA-R4 / SARA-N4 final result codes

No error codes are generated.

A.4 FOAT error result codes

See +UFWUPD command description.

A.4.1 SARA-R4 / SARA-N4 error result codes

No error codes are generated.

A.5 Internal TCP/UDP/IP stack class error codes

The following table lists all allowed error classes that can be provided by the internal TCP/UDP/IP stack through +USOER and +USOCTL (with <param_id>=1) AT commands.

Numeric error code	Description	Resulting from the following commands
0	No error	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
1	EPERM - Operation not permitted (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI

Numeric error code	Description	Resulting from the following commands
2	ENOENT - No such resource (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
4	EINTR - Interrupted system call (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
5	EIO - I/O error (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
9	EBADF - Bad file descriptor (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
10	ECHILD - No child processes (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
11	EWOULDBLOCK / EAGAIN - Current operation would block, try again	+USOWR
12	ENOMEM - Out of memory (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
14	EFAULT - Bad address (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
22	EINVAL - Invalid argument	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
32	EPIPE - Broken pipe (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
38	ENOSYS - Function not implemented	+USOSO, +USOGO
64	ENONET - Machine is not on the internet	+USOCR, +USOWR, +USOST, +USORD, +USORF, +USOLI
65	EEOF - End of file	+USOWR, +USOST, +USORD, +USORF
71	EPROTO - Protocol error	+USOWR, +USOST, +USORD, +USORF
77	EBADFD - File descriptor in bad state (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
78	EREMCHG - Remote address changed	+USOWR, +USOST, +USORD, +USORF, +USOCL
89	EDESTADDRREQ - Destination address required	+USOCO, +USOST
91	EPROTOTYPE - Wrong protocol type for socket	+USOCR
92	ENOPROTOOPT - Protocol not available	+USOCR
93	EPROTONOSUPPORT - Protocol not supported	+USOCR
94	ESOCKTNNOSUPPORT - Socket type not supported	+USOCR
95	EOPNOTSUPP - Operation not supported on transport endpoint	+USOWR, +USOST, +USORD, +USORF, +USOCL
96	EPFNOSUPPORT - Protocol family not supported	+USOCR
97	EAFNOSUPPORT - Address family not supported by protocol	+USOCR
98	EADDRINUSE - Address already in use	+USOLI
99	EADDRNOTAVAIL - Cannot assign requested address	+USOCR, +USOLI, +USOCO
100	ENETDOWN - Network is down	+USOCR, +USOLI, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOCL
101	ENETUNREACH - Network is unreachable	+USOCO, +USOST, +USORF
102	ENETRESET - Network dropped connection because of reset	+USOCR, +USOLI, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOCL
103	ECONNABORTED - Software caused connection abort	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI

Numeric error code	Description	Resulting from the following commands
104	ECONNRESET - Connection reset by peer	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
105	ENOBUFS - No buffer space available	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
106	EISCONN - Transport endpoint is already connected	+USOCO
107	ENOTCONN - Transport endpoint is not connected	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
108	ESHUTDOWN - Cannot send after transport endpoint shutdown	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
110	ETIMEDOUT - Connection timed out	+USOCO, +USOST, +USORD, +USORF
111	ECONNREFUSED - Connection refused	+USOCO
112	EHOSTDOWN - Host is down	+USOCL, +USOCO, +USOWR, +USOST, +USORD, +USORF
113	EHOSTUNREACH - No route to host	+USOCO, +USOWR, +USOST, +USORD, +USORF
115	EINPROGRESS - Operation now in progress	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
160	ENSRNODATA - DNS server returned answer with no data	+UDNSRN
161	ENSRFORMERR - DNS server claims query was misformatted	+UDNSRN
162	ENSRSERVFAIL - DNS server returned general failure	+UDNSRN
163	ENSRNOTFOUND - Domain name not found	+UDNSRN
164	ENSRNOTIMP - DNS server does not implement requested operation	+UDNSRN
165	ENSRREFUSED - DNS server refused query	+UDNSRN
166	ENSRBADQUERY - Misformatted DNS query	+UDNSRN
167	ENSRBADNAME - Misformatted domain name	+UDNSRN
168	ENSRBADFAMILY - Unsupported address family	+UDNSRN
169	ENSRBADRESP - Misformatted DNS reply	+UDNSRN
170	ENSRCONNREFUSED - Could not contact DNS servers	+UDNSRN
171	ENSRTIMEOUT - Timeout while contacting DNS servers	+UDNSRN
172	ENSROF - End of file	+UDNSRN
173	ENSRFILE - Error reading file	+UDNSRN
174	ENSRNOMEM - Out of memory	+UDNSRN
175	ENSRDESTRUCTION - Application terminated lookup	+UDNSRN
176	ENSRQUERYDOMAINTOOLONG - Domain name is too long	+UDNSRN
177	ENSRCNAMELOOP - Domain name is too long	+UDNSRN

A.6 Internet suite error classes

The following table lists all allowed error classes that can be provided by the <error_class> parameter for each AT error command (+UFTPER, +UHTTPER) for FTP and HTTP.

<error_class>	Description	<error_codes>	Resulting from the following commands
0	OK, no error occurred		All
1	FTP Protocol error class	See the Appendix A.6.1	+UFTPC, +UFTP, +UFTPER
3	HTTP Protocol error class	See the Appendix A.6.2	+UHTTP, +UHTTPC, +UHTTPER
4	Flash File System error class	See the Appendix A.6.3	+UFTPC, +UFTPER, +UHTTPC, +UHTTPER
5	DNS error class		+UFTPC, +UFTPER, +UHTTPC, +UHTTPER, +USMTPC, +USMTPER

<error_class>	Description	<error_codes>	Resulting from the following commands
6	Socket error class	BSD error codes standard	All
7	Dynamic Memory error	0	All
8	Wrong FTP API usage (e.g. missing/null parameters)	See the Appendix A.6.1	+UFTPC, +UFTP, +UFTPER
10	Wrong HTTP API usage (e.g. missing/null parameters)	See the Appendix A.6.2	+UHTTP, +UHTTPC, +UHTTPER
11	Syntax error in high layer Protocol (wrong/missing/ corrupted data)		+UFTPC, +UFTPER, +UHTTPC, +UHTTPER, +USMTPC, +USMTPER
12	Unspecified error	0	All
13	UMQTT error class	See the #unique_1055	+UMQTT, +UMQTTC, +UMQTTWTOPIC, +UMQTTWMSG
15	CoAP error class	See the #unique_1068	+UCOAP, +UCOAPC, +UCOAPER

A.6.1 FTP class error codes

The following table lists the available values of <error_code> parameter of the last FTP operation provided through +UFTPER AT command if <error_class>=1 or 8 (for more details see the AT+UFTP, AT+UFTPC commands description).

Numeric error code	Description
0	No error
1	User missing
2	Password missing
3	Account missing
4	Server missing
5	Directory name missing
6	File name missing
7	Null parameter
8	Unknown FTP command
9	Unknown file action
10	Wrong FTP state
11	Wrong parameter
12	PSD or CSD connection not established
13	No memory available for allocation
14	Reserved internal code
15	Length of given web server (address or hostname) too long or too short
16	Hostname of given web server invalid
17	Address of given web server is invalid
18	Username too long or too short
19	Password too long or too short
20	Account too long or too short
21	Operation not allowed because FTP client is busy
22	Not possible to connect to FTP server
23	Error occurred in FTP request
24	Reserved internal code
25	FFS filename pointer is null or its length is 0
26-30	Reserved internal code
31	Timeout elapsed while performing requested operation
32	Internal processing error
33	Not logged in
34	Login incorrect
35	File unavailable (not found or no access)
36	File not ready
37	Filename not allowed

Numeric error code	Description
38	Folder not found
39	Folder no access
40	Operation aborted by user
41	Permission denied
42	Cannot open FTP data channel
43	Socket invalid parameter
44	Invalid socket
45	No socket available
46	Cannot create socket
47	Cannot bind socket to network interface
48	Cannot resolve hostname
49	Cannot connect socket
50	Cannot get socket name
51	Cannot bind socket to port
52	Socket cannot listen
53	Socket cannot accept
54	Socket would block
55	Socket cannot write
56	Socket cannot read
57	Reserved internal code
58	No socket data to send
59	Socket cannot get available data
60	No socket data to read
61	Socket no response code found
62	Socket not connected
63	Cannot set secure socket
64	Socket cannot decode password
65	Socket cannot get size
66	FFS Invalid parameter
67	FFS invalid handle
68	FFS cannot open file
69	FFS cannot seek file
70	FFS cannot get file size
71	FFS cannot read
72	FFS bad offset
73	FFS cannot write
74	Direct link internal error
75	Failed to open extended passive mode
76	Failed to parse extended passive mode server reply
77	Internal error
78	Client IP protocol not supported - try passive mode
79	Data transfer error. The transferred (received/sent) data is not complete
226	Closing data connection; requested file action successful (for example, file transfer or file abort)
250	Requested file action okay, completed
350	Requested file action pending further information
421	Service not available, closing control connection. User limit reached Not authorized to make the connection Maximum connections reached Maximum connections exceeded
425	Cannot open data connection
426	Connection closed; transfer aborted. The command opens a data connection to perform an action, but that action is cancelled, and the data connection is closed

Numeric error code	Description
450	Requested file action not taken. File unavailable (e.g. file busy)
451	Requested action aborted: local error in processing
452	Requested action not taken. Insufficient storage space in system
500	Syntax error, command unrecognized, command line too long
501	Syntax error in parameters or arguments
502	Command not implemented
503	Bad sequence of commands
504	Command not implemented for that parameter
530	User not logged in
532	Need account for storing files
550	Requested action not taken. File unavailable, not found, not accessible
552	Requested file action aborted. Exceeded storage allocation
553	Requested action not taken. Filename not allowed

For all the errors not listed in the table see the RFC 959 [75] and RFC 2428 [76].

A.6.2 HTTP class error codes

The following table lists the available values of <error_code> parameter of the last HTTP operation provided through +UHTTPER AT command if <error_class>=3 or 10 (for more details see the AT+UHTTP and AT +UHTTPC commands description).

Numeric error code	Description
0	No error
1	Invalid profile ID
2	Invalid input
3	Server hostname too long
4	Invalid server hostname
5	Invalid server IP address
6	Invalid authorization method
7	Server missing
8	Username length exceeded
9	Password length exceeded
10	Internal error
11	Server connection error
12	Error occurred in HTTP request
13	Internal error
14	Internal error
15	Invalid POST data size
16	Empty FFS file name
17	Invalid FFS file length
18	Invalid content-type specified
19	Internal error
20	Internal error
21	Internal error
22	PSD or CSD connection not established
23	Server or proxy hostname lookup failed
24	User authentication failed on server
25	User authentication failed on proxy
26	Connection timed out
27	Request prepare timeout expired
28	Response receive timeout expired
29	Request send timeout expired
30	HTTP operation in progress
31	Invalid HTTP parameter TCP port not in range (1-65535)
32	Invalid HTTP parameter secure

Numeric error code	Description
33	Invalid HTTP parameter authentication username
34	Invalid HTTP parameter authentication password
35	Invalid HTTP parameter output filename
36	Invalid HTTP parameter output filename length
37	Invalid HTTP parameter server path
38	Invalid HTTP parameter server path length
39	Invalid HTTP parameter content filename length
40	Invalid custom content type string
41	Output file open error
42	Output file close error
43	Output file write error
44	Connection lost
45	Operation not allowed in current state
46 - 72	Internal error
73	Secure socket connect error

A.6.3 File system class error codes

SARA-R4 / SARA-N4
The following table lists the available values of <error_code> parameter of the last FTP or HTTP operation provided through +UFTPER and +UHTTPER.

Numeric error code	Description
2	Operation performed with success
3	Initialization in progress
4	File already opened
5	File not opened
6	File not found
7	File already created
8	Illegal id
9	Illegal file handle
10	Illegal type
11	Illegal mode
12	File range error
13	The operation is not possible
14	Write error
15	User id error
16	Internal fatal error
17	Memory resource error
18	Maximum number of files exceeded
19	Memory not available
20	Invalid filename
21	Streaming not enabled
22	Operation not allowed on static file
23	Memory table inconsistency
24	Not a factory default file
25	Requested memory temporary not available
26	Operation not allowed for a directory
27	Space in the directory space not available
28	Too many streaming files opened
29	Requested dynamic memory temporary not available
30	The user provided a NULL parameter instead of a suitable buffer

A.7 MQTT error codes

The following table lists the available values of <error_code> parameter of the last MQTT operation provided through +UMQTTER AT command (for more details see the AT+UMQTT and AT+UMQTTC commands description).

Numeric error code	Description
0	No error
5	Error setting initial Default MQTT values
10	Error creating new MQTT context in response to UMQTT
11	Error in memory allocation for UMQTT command's response
12	Error in UMQTT command number of arguments
13	Error in UMQTT command syntax
14	UMQTT command parameter Invalid Error
15	Length (or termination) Error in UMQTT parameter
16	Range Error in UMQTT command parameter
17	UMQTT context Invalid Error
18	UMQTT memory allocation failure Error
19	UMQTT Profile Restore From or Save To Fail Error
20	Error creating new MQTT context in response to UMQTTC
21	Error in memory allocation for UMQTTC command's response
22	Error in UMQTTC command number of arguments
23	Error in UMQTTC command syntax
24	UMQTTC command parameter Invalid Error
25	Length (or termination) Error in UMQTTC command specifier
26	Range Error in UMQTTC command specifier
27	UMQTTC context Invalid Error
28	No MQTT connection when attempting UMQTTC
29	Error in UMQTTC's parameter length (or termination)
30	Error in UMQTTC parameter range
40	Error in memory allocation for UMQTTER command's response
41	Error in UMQTTER command syntax
50	IP Address invalid error
51	IP Address conversion failed
60	Input parameter invalid Error
61	Error in response to get Device
70	Hex input invalid Error
71	Hex conversion failed Error
80	Attempt to display field(s) that exceed(s) the display size (suppressed)
100	Generic memory allocation failed Error
110	QAPI FS Statvfs failed Error
111	QAPI FS Mk Dir failed Error
112	QAPI FS Open failed Error
113	QAPI FS File Missing (only sometimes checked for explicitly
114	QAPI FS Stat failed Error
115	QAPI FS Read failed Error
116	QAPI FS Write failed Error
117	QAPI FS Close failed Error
118	QAPI FS Unlink failed Error
120	QAPI FS Restore file noexist Error
130	Failed allocation Error during Restore
150	QMI DMS Init failed Error
151	QMI DMS De-Init failed Error
160	QMI DMS send msg fail Error
165	QMI DMS Dev response fail Error
166	QMI DMS Dev no IMEI fail Error
167	QMI DMS Dev IMEI Invalid Error

Numeric error code	Description
200	No Unique Client ID specified Error
201	No Remote Server specified Error
202	No Local Client IP Address specified Error
240	Error encountered when setting MQTT Connect callback
241	Error encountered when setting MQTT Subscribe callback
242	Error encountered when setting MQTT Message callback
250	Error in the MQTT Connect callback's parameters
251	Error in the MQTT Subscribe callback's parameters
252	Error in the MQTT Message callback's parameters
350	Error returned when attempting an MQTT Connection
360	Publish parameter invalid Error
361	Error returned when attempting an MQTT Publish
370	Subscribe parameter invalid Error
371	Error returned when attempting an MQTT Subscribe
380	Unsubscribe parameter invalid Error
381	Error returned when attempting an MQTT Unsubscribe
390	Error returned when attempting an MQTT Disconnect
400	Error returned when attempting an MQTT Destroy
410	Error due to PING Failure
411	Error response to IPv4 PING attempt
412	Error response to IPv6 PING attempt
500	Device Info Init Error
501	Device Info Release Error
502	Device Info Get Error
600	DSS Handle Error
601	DSS Init Error
602	DSS Get Device Name Error
603	DSS allocation Fail Error
604	DSS Get IP Address Error
700	DNS Get Server Fail Error
701	DNS Add Server Fail Error
702	DNS Client Start Fail Error
703	DNS Client Stop Fail Error
704	DNS Name Resolution Fail Error
1000	Start Data Call Fail Error

A.7.1 MQTT supplimental error codes

The following table lists the available values of <suppl_error_code> parameter of the last MQTT operation provided through +UMQTTER AT command (for more details see the AT+UMQTT and AT+UMQTTC commands description).

Numeric error code	Description
0	No error
-1	General error (QAPI)
-2	Invalid parameter (QAPI)
-3	Memory allocation error (QAPI)
-4	Resource allocation error (QAPI)
-6	Operation busy (QAPI)
-7	Entry not found (QAPI)
-8	Feature not supported (QAPI)
-9	Operation timed out (QAPI)
-10	Out of bounds (QAPI)
-11	Bad Payload (QAPI)
-12	Entry already exists (QAPI)
-20001	Error in own certificate (QAPI MQTT)

Numeric error code	Description
-20002	Error with SSL connection (QAPI MQTT)
-20003	Handshake must be completed before the operation can be attempted (QAPI MQTT)
-20004	Received SSL warning alert message (QAPI MQTT)
-20005	Received SSL fatal alert message (QAPI MQTT)
-20006	Handshake in progress (QAPI MQTT)
-20007	Handshake successful (QAPI MQTT)
-20008	The SSL certificate of the peer is trusted, CN matches the host name, time is expired (QAPI MQTT)
-20009	The SSL certificate of the peer is trusted, CN does not match the host name, time is valid (QAPI MQTT)
-20010	The SSL certificate of the peer is not trusted (QAPI MQTT)
-20011	Connection drops when out of network buffers (QAPI MQTT)
-20012	Socket error (QAPI MQTT)
-20021	IP address is invalid (QAPI MQTT)
-20022	Failed to get the scope ID (QAPI MQTT)
-20023	Socket command timed out (QAPI MQTT)
-20024	Max server add (v4/v6) reached in server's list (QAPI MQTT)
-20025	MQTT Memory allocation failed (QAPI MQTT)
-20026	MQTT Bad parameter while invoking API (QAPI MQTT)
-20027	MQTT Connection is in bad state (QAPI MQTT)
-20028	MQTT Connection closed (QAPI MQTT)
-20029	MQTT Packet decode failed (QAPI MQTT)
-20030	MQTT Packet encode failed (QAPI MQTT)
-20031	MQTT Negative CONNACK received (QAPI MQTT)
-20032	MQTT no data (QAPI MQTT)
-20033	MQTT no zero ref count while disconnecting (QAPI MQTT)
-20034	MQTT Ping req msg creation failed (QAPI MQTT)
-20035	MQTT Puback msg creation failed (QAPI MQTT)
-20036	MQTT Pubcom msg creation failed (QAPI MQTT)
-20037	MQTT Publish msg creation failed (QAPI MQTT)
-20038	MQTT Pubrec msg creation failed (QAPI MQTT)
-20039	MQTT Pubrel msg creation failed (QAPI MQTT)
-20040	MQTT RX incomplete (QAPI MQTT)
-20041	MQTT Socket fatal error (QAPI MQTT)
-20042	MQTT TCP Bind error (QAPI MQTT)
-20043	MQTT TCP connection error (QAPI MQTT)
-20044	MQTT SSL connection failed (QAPI MQTT)
-20045	MQTT Subscribe msg creation failed (QAPI MQTT)
-20046	MQTT Subscribe unknown topic (QAPI MQTT)
-20047	MQTT Unsubscribe message creation failed (QAPI MQTT)
-20048	MQTT unexpected messaged received (QAPI MQTT)
-20049	MQTT Subscription failed (QAPI MQTT)
-20050	MQTT Restore failed (QAPI MQTT)
-150001	Operation is not permitted (QAPI FS)
-150002	Bad file descriptor (QAPI FS)
-150003	Permission denied (QAPI FS)
-150004	Attempt to cross the device (QAPI FS)
-150005	No such device (QAPI FS)
-150006	Not a directory (QAPI FS)
-150007	Is a directory (QAPI FS)
-150008	Too many open files (QAPI FS)
-150009	File or directory is already open (QAPI FS)
-150010	No space is left on the device (QAPI FS)
-150011	Seek is not permitted (QAPI FS)
-150012	File name is too long (QAPI FS)

Numeric error code	Description
-150013	Directory is not empty (QAPI FS)
-150014	Too many symbolic links were encountered (QAPI FS)
-150015	Illegal byte sequence (QAPI FS)
-150016	Stale remote file handle (QAPI FS)
-150017	Attempt to write beyond the quota (QAPI FS)
-150018	End of file (QAPI FS)
-150019	Invalid ID was passed by the kernel framework (QAPI FS)
-150020	Unknown error (QAPI FS)

B Appendix: AT Commands List

	AT command	Call control			
		A	D	S0	
SARA	R404M-00B	•	•	•	
	R410M-01B	•	•	•	
	R410M-02B	•	•	•	
	R412M-02B	•	•	•	
	R410M-52B	•	•	•	
	N410-02B				

AT command		File System						
		+UDELFILE	+UDWNBLOCK	+UDWNFILE	+ULSTFILE	+URDBLOCK	+URDFILE	
SARA	R404M-00B	•		•	•		•	
	R410M-01B	•		•	•		•	
	R410M-02B	•	•	•	•	•	•	
	R412M-02B	•	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	•	
	N410-02B	•	•	•	•	•	•	

	AT command	General commands													
		+CCID	+CGMI	+CGMM	+CGMR	+CGSN	+CIMI	+CSCS	+GMI	+GMM	+GMR	+GSN	A/	I	
SARA	R404M-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R410M-01B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R410M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R412M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	N410-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	

AT command		GPIO interface			
		+UGPIOC	+UGPIOR	+UGPIOW	
SARA	R404M-00B	•	•	•	
	R410M-01B	•	•	•	
	R410M-02B	•	•	•	
	R412M-02B	•	•	•	
	R410M-52B	•	•	•	
	N410-02B	•	•	•	

	AT command	I2C interface					
		+UI2CC	+UI2CO	+UI2CR	+UI2CREGR	+UI2CW	
SARA	R404M-00B						
	R410M-01B						
	R410M-02B	•	•	•	•	•	
	R412M-02B	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	
	N410-02B	•	•	•	•	•	

AT command		Internet suite										
		+UDNSRN	+UFTP	+UFTPC	+UFTPER	+UHTTP	+UHTTPAC	+UHTTPC	+UHTTPER	+USECMNG	+USECPRF	
SARA	R404M-00B		•	•	•	•	•	•	•			
	R410M-01B		•	•	•	•	•	•	•	•	•	
	R410M-02B		•	•	•	•	•	•	•	•	•	
	R412M-02B	•	•	•	•	•	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	•	•	•	•	•	
	N410-02B	•	•	•	•	•	•	•	•	•	•	

AT command		Localization features																
		+UGAOS	+UGGGA	+UGGLL	+UGGSA	+UGGSV	+UGIND	+UGPRF	+UGPS	+UGRMC	+UGSRV	+UGTMR	+UGUBX	+UGVTG	+UGZDA	+ULOC	+ULOCGNSS	+ULOCIND	
SARA	R404M-00B																		
	R410M-01B																		
	R410M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R412M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	N410-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

	AT command	Mobile equipment control and status									
		+CCLK	+CFUN	+CIND	+CMEE	+CMER	+CPWROFF	+CSGT	+CTZU	+UCIND	
SARA	R404M-00B	•	•	•	•	•	•		•	•	
	R410M-01B	•	•	•	•	•	•		•	•	
	R410M-02B	•	•	•	•	•	•		•	•	
	R412M-02B	•	•	•	•	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	•	•	•	•	
	N410-02B	•	•	•	•	•	•	•	•	•	

AT command		Network service																
		+CEDRXRDP	+CEDRXS	+CESQ	+CNUM	+COPS	+CREG	+CSCON	+CSQ	+PACSP	+UBANDMASK	+UCGED	+UMNOPROF	+URAT	+USVCDOMAIN	+VZWAPNE	+VZWRSRP	+VZWRSRQ	
SARA	R404M-00B			•	•	•			•					•		•	•	•	
	R410M-01B			•	•	•			•	•				•					
	R410M-02B	•	•	•	•	•	•		•	•	•	•	•	•					
	R412M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•				
	R410M-52B	•	•	•	•	•	•		•	•	•	•	•	•	•				
	N410-02B	•	•	•	•	•	•		•	•	•	•	•	•					

AT command		Packet switched data services																	
		+CEMODE	+CEREG	+CGACT	+CGATT	+CGCONTRDP	+CGDCONT	+CGDEL	+CGEREP	+CGPADDR	+CGPIAF	+CGREG	+UAUTHREQ	+UDCONF=75	+UDCONF=76	+UPSD	D*	H	
SARA	R404M-00B		•	•	•		•	•		•						•	•	•	
	R410M-01B		•	•	•		•	•		•						•	•	•	
	R410M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R412M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	N410-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

AT command		Security			
		+CLCK	+CPIN	+CPWD	
SARA	R404M-00B	•	•	•	
	R410M-01B	•	•	•	
	R410M-02B	•	•	•	
	R412M-02B	•	•	•	
	R410M-52B	•	•	•	
	N410-02B	•	•	•	

AT command		Serial interface																						
		&C	&D	&F	&K	&S	&V	+CMUX	+ICF	+IFC	+IPR	E	O	Q	S10	S12	S2	S3	S4	S5	S6	S7	S8	V
SARA	R404M-00B	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R410M-01B	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R410M-02B	•	•	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R412M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R410M-52B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	N410-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

AT command		Serial interface			
		X	N	IO	
SARA	R404M-00B	•	•	•	
	R410M-01B	•	•	•	
	R410M-02B	•	•	•	
	R412M-02B	•	•	•	
	R410M-52B	•	•	•	
	N410-02B	•	•	•	

	AT command	Short Messages Service																					
		+CMGD	+CMGF	+CMGL	+CMGR	+CMGS	+CMGW	+CMMS	+CMSS	+CNMA	+CNMI	+CPMS	+CRES	+CRTDCP	+CSAS	+CSCA	+CSMP	+CSMS	+CSODCP	+UCMGL	+UCMGR	+UCMGS	+UCMGW	
SARA	R404M-00B	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•						
	R410M-01B	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•						
	R410M-02B	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•		•	•	•	•	
	R412M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•		•	•	•	•	
	N410-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

AT command		SIM functionalities								
		+CLAN	+CRSM	+CSIM	+CUSATR	+CUSATW	+UBIP	+UCUSATA	+USIMSTAT	
SARA	R404M-00B		•							
	R410M-01B		•							
	R410M-02B	•	•	•	•	•	•	•	•	
	R412M-02B	•	•	•	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	•	•	•	
	N410-02B	•	•	•	•	•	•	•	•	

AT command		System features															
		+CPSMS	+UANTR	+UCPSMS	+UFOTACONF	+UFWINSTALL	+UFWUPD	+UHOSTDEV	+ULGASP	+ULWM2M=0	+ULWM2MSTAT	+UPSMR	+UPSV	+URINGCFG	+UTEMP	+UTEST	
SARA	R404M-00B	•	•			•	•			•	•					•	
	R410M-01B	•	•	•		•	•	•		•	•					•	
	R410M-02B	•	•	•		•	•	•		•	•					•	
	R412M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	•	•	•	•	•		•	•	•	•	
	N410-02B	•	•	•	•	•	•	•	•	•	•		•	•	•	•	

	AT command	Internet protocol transport layer																				
		+UDCONF=1	+UDCONF=2	+UDCONF=3	+UDCONF=5	+UDCONF=6	+UDCONF=7	+USOCL	+USOCLCFG	+USOCO	+USOCR	+USOCTL	+USODL	+USOER	+USOGO	+USOLI	+USORD	+USORF	+USOSEC	+USOSO	+USOST	+USOWR	
SARA	R404M-00B	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•		•	•	•	
	R410M-01B	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	
	R410M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R412M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	N410-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

	AT command	MQTT						
		+UMQTT	+UMQTTC	+UMQTTER	+UMQTTNV	+UMQTTWMSG	+UMQTTWTOPIC	
SARA	R404M-00B							
	R410M-01B							
	R410M-02B	•	•	•	•	•	•	
	R412M-02B	•	•	•	•	•	•	
	R410M-52B	•	•	•	•	•	•	
	N410-02B	•	•	•	•	•	•	

B.1 Parameters stored in profiles

The parameter settings of some commands can be stored in the profiles available in the memory module.

☞ SARA-R4 / SARA-N4
To partially display these profiles, see the AT&V command description. Not all the parameter setting are displayed through AT&V command.

☞ Some AT commands have a unique configuration for all the AT interfaces while for other AT commands it is possible to set a different configuration for each AT interface: the "AT interface configuration sharing" column in the next table provides this information.
Some AT command interfaces have a dynamic activation, which means they are not statically activated at boot time (MUX AT channel is activated when the MUX protocol is established, USB AT channel is activated if/when the USB cable is plugged-in, deactivated when it is removed). Since the activation reloads the AT command profile from NVM for the activated interface, the shared "AT interface configurations" could be overwritten. It is suggested to reconfigure them at the requested value if an AT command interface is dynamically activated.

The following table lists the AT commands which setting can be stored in the profiles with their parameters as well as the factory-programmed values.

AT command	Description	AT interface configuration sharing	Factory-programmed value / Remarks
&C	DCD status	No	1 (DCD enabled)
&D	DTR status	No	1 (DTR enabled)
&K	Flow control status	No	3 (RTS/CTS DTE flow control enabled)
&S	DSR override	No	1 (DSR line set to ON in data mode and to OFF in command mode)
+CMGF	Preferred message format	Yes	0 (format of messages in PDU mode) • SARA-R4 / SARA-N4 - The command settings is not persistent
+CNMI	New message indication	Yes	• 1 (discard indication and reject new received message URCs when MT-DTE link is reserved) • 0 (no SMS-DELIVER indications are routed to the TE) • 0 (no CBM indications to the DTE) • 0 (no SMS-STATUS-REPORTs are routed to the DTE) • 0 (MT buffer of URCs defined within this command is flushed to the DTE when >mode< 1...3 is entered) • SARA-R4 / SARA-N4 - The command settings is not persistent
+COPS	Operator selection	Yes	• 0 (autoregistration enabled) • 0 (operator expressed in long alphanumeric format) • FFFF (undefined PLMN to register when COPS=1) • SARA-R4 / SARA-N4 - The command settings is not persistent
+ICF	DTE-DCE character framing	No	• SARA-R4 / SARA-N4 - 3, 1 (framing format: 8 data 1 stop, no parity)
+IFC	DTE-DCE local flow control	No	2 (<DCE_by_DTE> on circuit 106 (CTS)), 2 (<DTE_by_DCE> on circuit 105 (RTS))
+IPR	Baud rate	No	• SARA-R4 / SARA-N4 - 115200 (115200 b/s) • SARA-R4 / SARA-N4 - The command settings is not persistent
+UPSV	Power Saving configuration	Yes	• SARA-R4 / SARA-N4 - 0 (power saving disabled)
E	Echo status	No	1 (echo enabled)
Q	Result code suppression	No	0 (DCE transmits result codes)
S0	Automatic answer	No	0 (automatic answering disabled)
S2	Escape character selection	No	43 (043 corresponds the '+' character)

AT command	Description	AT interface configuration sharing	Factory-programmed value / Remarks
S3	Command line termination character	No	13 (0x0d corresponds to the carriage return character)
S4	Response formatting character	No	10 (0x0a corresponds to the line feed character)
S5	Command line editing character	No	8 (008 corresponds to the backspace character)
S7	Connection completion timeout	No	60
V	DCE response format	No	1 (Verbose response text)
X	Result code selection and call progress monitoring control	No	4 (CONNECT <text> result code is given upon entering online data state; dial tone and busy detection are both enabled)

B.2 Parameters stored in non volatile memory

The following table lists the AT commands which setting can be stored in the non volatile memory with their parameters and the factory-programmed values.

AT command	Description	Factory-programmed value / Comment
+CCLK	Clock	04/01/01,00:00:00+00
+CEDRXS	eDRX setting	0 (use of eDRX disabled)
+CEMODE	UE modes of operation for EPS	• SARA-R4 / SARA-N4 - 2 (CS/PS mode 2 of operation; "data centric")
+CGDCONT	PDP context definition	• SARA-R4 / SARA-N4 - all contexts are undefined
+CPMS	Preferred message storage	• SARA-R4 / SARA-N4 - <mem1>, <mem2> and <mem3> are set to "ME"
+CPSMS	Power Save Mode	• SARA-R4 / SARA-N4 - 0 (PSM disabled)
+CSAS	Save settings	0 (profile 0 where to store the active message settings)
+CSGT	Set greeting text	Greeting text is empty
+CTZU	Automatic time zone update	• SARA-R4 / SARA-N4 - 0 (automatic time zone via NITZ disabled)
+UBIP	Bearer Independent Protocol status indication	0 (BIP status indication disabled) • SARA-R4 / SARA-N4 - The command setting is not stored in the NVM
+UCUSATA	Enable USAT terminal URCs	0 (+CUSATEND, +CUSATP and +UUSIMSTAT URC disabled)
+UDCONF=75	PDP IP configuration when roaming	• SARA-R4 / SARA-N4 - no context is defined
+UDCONF=76	Disable data when roaming	• SARA-R4 / SARA-N4 - no context is defined
+UFOTACONF	uFOTA configuration	1 (module registration to uFOTA server enabled), 604800 (7 days as timer for the periodic connection to the uFOTA server)
+UGGGA	Get GPS fix data	0 (NMEA $GGA messages disabled)
+UGGLL	Get geographic position	0 (NMEA $GLL messages disabled)
+UGGSA	Get satellite information	0 (NMEA $GSA messages disabled)
+UGGSV	Get number of GNSS satellites in view	0 (NMEA $GSV messages disabled)
+UGPIOC	GPIO functionality setting	• SARA-R4 / SARA-N4 - 255 (<gpio1>), 255 (<gpio2>), 255 (<gpio3>), 255 (<gpio4>), 255 (<gpio5>), 255 (<gpio6>)
+UGPRF	GNSS profile configuration	0 (No data flow on multiplexer, file and IP address), 0 (IP port not defined), "" (Server address string not defined)
+UGRMC	Get recommended minimum GNSS data	0 (NMEA $RMC messages disabled)
+UGSRV	Aiding server configuration	"cell-live1.services.u-blox.com" (primary MGA server), "cell-live2.services.u-blox.com" (secondary MGA server), 14 (Number of days for validation of Offline data), 4 (Number of weeks for validation of Offline data), 1 (Resolution of offline data for MGA), 65 (Desired GNSS for the (offline) aiding: GPS and GLONASS), 0 (AssistNow Online data are downloaded at GNSS receiver power up), 15 (all the desired data types for the (online) aiding are set)

AT command	Description	Factory-programmed value / Comment
+UGVTG	Get course over ground and ground speed	0 (NMEA $VTG messages disabled)
+UGZDA	Get GPS time and date	0 (NMEA $ZDA messages disabled)
+UHOSTDEV	LWM2M Host device information	HMAN0 (Host Identification), HMOD0 (Host manufacturer name), HSW0 (Host model identification), HUID0 (Host software version)
+ULGASP	Last gasp configuration	• SARA-R4 / SARA-N4 o <GPIO_mode>: 0 (disabled) o <text>: "" o <msg_format>: 0 (text) o <profile_id>: 1 o <IP_protocol>: 17 (UDP) o <IP_addr:PORT>: "" (empty) o <method>: 1 (use IP (TCP or UDP) connection) o <urc_enable>: 1 (URC enabled) o <nv_upd_freq>: 60 (NVM update frequency in seconds) o <tx_count>: 1 (number of times to transmit the Last Gasp message)
+ULOCGNSS	Configure GNSS sensor	• 15 (Local aiding, AssistNow online, AssistNow offline, AssistNow autonomous enabled), 0 (power saving disabled), 3 (Minimum number of satellites for navigation), 7 (Minimum satellite signal level for navigation), 0 (Disabled initial Fix must be 3D flag), 0 (Static Hold Mode), 0 (SBAS disabled), 0 (Jamming indicator disabled), 0 (Antenna settings unknown), 0 (Broadband jamming detection threshold: 0 dB), 0 (Continuous wave jamming detection threshold: 0 dB), 1 (GPS), 0, 0
+UPSD	Packet switched data	Empty profile
+URAT	Selection of Radio Access Technology	• SARA-R404M - 3 (LTE RAT) • SARA-R410M - 7 (LTE Cat.M1), 8 (LTE Cat.NB1) • SARA-N4 - 8 (LTE Cat.NB1)
+UPSMR	PSM indication	0 (PSM URC disabled)
+URINGCFG	RING line configuration	0 (RING line handling disabled)
+USIMSTAT	(U)SIM initialization status reporting	0 (URC +UUSIMSTAT disabled) • SARA-R4 / SARA-N4 - The command setting is not stored in the NVM
+USOCLCFG	Configure Dormant Close Socket Behavior	1 (TCP socket Graceful Dormant Close feature enabled)
+USVCDOMAIN	Configure the device service domain	2 (CS/PS combined)
+VZWAPNE	Edit Verizon wireless APN table	Verizon wireless APN table (APN list entry, APN class, Network identifier, APN type, APN bearer, APN status, APN inactivity timer) • 1,1,"IMS","ipv4v6","LTE","Enabled",0 • 2,2,"VZWADMIN","ipv4v6","LTE","Enabled",0 • 3,3,"VZWINTERNET","ipv4v6","LTE","Enabled",0 • 4,4,"VZWAPP","ipv4v6","LTE","Enabled",0 • 6,6,"ENTERPRISE","ipv4v6","LTE","Enabled",0 • 7,7,"THINGSPACE","ipv4v6","LTE","Enabled",0 Class 1 APN in table above may differ from the one here specified. Refer to +VZWAPNE for details.

B.3 Saving AT commands configuration

SARA-R4 / SARA-N4
Saving AT commands configuration is not supported.

B.4 Estimated command response time

After having sent a command to a u-blox cellular module, the time to obtain a resulting result code depends on the SIM and the network. It is possible to have an immediate response if the command does not interact with either the network or the SIM.

The following table reports the maximum time to get the result code for the AT commands. The commands are grouped by categories.

Category	Estimated maximum time to get response	Commands
Power off	< 40 s	+CPWROFF
Set module functionality	Up to 3 min	+CFUN
Call control	< 20 s	A, H
Dial	Up to 3 min	D
Network commands	Up to 3 min	+CGATT, +COPS
Security	Up to 3 min	+CLCK, +CPWD
Delete all SMSes	< 55 s	+CMGD
SMS acknowledgement to MT	< 150 s	+CNMA
SMS	Up to 3 min (<1 s for prompt ">")	+CPMS, +CMGL, +CMSS, +CMGS, +UCMGS, +UCMGL
SIM management	< 10 s	+CMGW, +UCMGW, +CMGR, +UCMGR, +CNUM, +CPIN, +CRES, +CRSM, +CSCA, +CSMP
PDP context activation	< 150 s	+CGACT
PDP context deactivation	< 40 s	+CGACT
GPIO commands	< 10 s	+UGPIOC, +UGPIOR, +UGPIOW
Internet suite (socket connect)	• SARA-R4 / SARA-N4 - < 120 s	+USOCO
Internet suite (socket connect with SSL)	• SARA-R4 / SARA-N4 - < 1 s	+USOSEC
Internet suite (socket write)	• SARA-R4 / SARA-N4 - < 120 s	+USOWR
Internet suite (UDP socket write)	• SARA-R4 / SARA-N4 - < 10 s	+USOST
Internet suite (socket closure)	• SARA-R4 / SARA-N4 - < 120 s	+USOCL
Internet suite	• SARA-R4 / SARA-N4 - < 1 s	+USODL, +USOLI, +USORD, +USORF
Resolve name/IP number through DNS	< 120 s (except URC)	+UDNSRN
GNSS commands	< 10 s (except +UGPS for which timeout is according to the performed operation)	+UGAOS, +UGGGA, +UGGLL, +UGGSA, +UGGSV, +UGPS, +UGRMC, +UGTMR, +UGUBX, +UGVTG, +UGZDA, +ULOC
Last gasp configuration	< 10 s	+ULGASP
MQTT command	< 60 s	+UMQTTC
Firmware update	• SARA-R4 / SARA-N4 - < 20 s	+UFWUPD

B.5 Multiple AT command interfaces

u-blox cellular modules support multiple AT command interfaces, that means a certain number of virtual or physical channels that work as described in Definitions.

Each interface maintains an own run-time AT commands configuration (AT command profile); this means that the AT command profile is different among the interfaces and therefore the AT commands configuration for the commands belonging to the profile can be different among the interfaces.

At the module start-up, since there is only a set of the profiles (not one for each interface), all the interfaces are configured in the same way (AT commands configuration for the commands in the profile is the same for all the interfaces). Subsequently, each interface can change its run-time AT profile (stored in RAM). The commands AT&W, AT&V manage this run-time AT commands configuration for the interface where they are issued.

The USB interface implements multiple AT command interfaces. Unlike what happens for the other physical interfaces (e.g. UART, SPI), the AT command interfaces that run on the USB interface only exists as long as the USB interface connects the module with the DTE. As a result, if the USB connection between the module and the DTE is interrupted (e.g. by USB cable removal), all the AT command interfaces running on it are destroyed. This has two main consequences:

- Any data connection (both circuit switched and packet switched) established over an AT command interface associated to the USB interface is released.
- As already explained in Appendix B.1, whenever the USB connection between the module and the DTE is re-established, the AT command interfaces running on it are created, and for each of these interfaces the AT command profile is reloaded from NVM and applied.

☞ The reload of the AT command profile from the NVM also results in the re-application of the +UPSV setting, which is a shared "AT interface configuration". This must be kept in mind, since the change could have impacts on the communication over the UART interface.

As mentioned in Definitions, generally there is not difference in the execution of an AT command among the interfaces. But, there are some exceptions due to interface restrictions. In particular, the differences relate to AT commands that configure the DCE-DTE interface.

Table 25 provides the major differences.

AT command	UART / AUX UART (where available)	Multiplexer	USB (where available)	SPI (where available)
&K	Effective	When it returns OK (the configuration is allowed), it is effective	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)
\Q	Effective	When it returns OK (the configuration is allowed), it is effective	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)
+ICF	Effective	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)
+IFC	Effective	When it returns OK (the configuration is allowed), it is effective	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)
+IPR	Effective	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)
+UPSV	Effective	Returns OK, but it changes UART setting	Returns OK, but it changes UART setting	Returns OK, but it changes UART setting

Table 25: Interface comparison

C Appendix: UDP Direct Link workflow

C.1 Data from the IP network to the external port

When a UDP data packet is received from the network, its payload is forwarded through the external port as soon as possible (according to the HW flow control, if any).

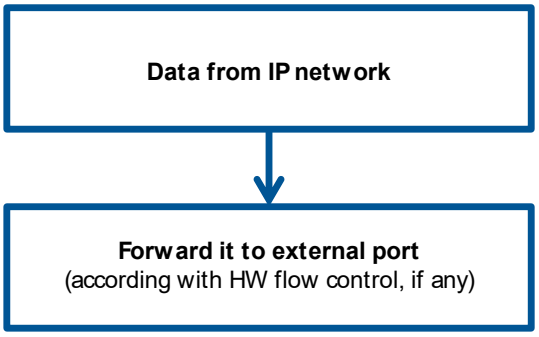

Figure 10: Workflow of data from the IP network to the external port

C.2 Data from the external port to the IP network

When some data comes from the external port, there are 2 parameters involved:

1. The UDP DL packet size (factory-programmed: 1024 bytes; valid range 100-1472)
2. The UDP DL sending timer delay (factory-programmed: 1000 ms; valid range 100-120000)

Both parameters are specific for each socket and could be modified by the user. These values are not saved into the NVM and if not specified, the factory-programmed values are used.

There are 3 different cases that may occur while receiving data from the external port in UDP DL mode:

1. The received data from the external port is equal to the UDP DL packet size: the received data is immediately sent to the network
2. The received data from the external port is more than the UDP DL packet size: the amount of data till UDP DL packet size is immediately sent to the network, the remaining data is saved into an intermediate buffer.
3. The received data from the external port is less than UDP DL packet size: the received data is saved into an intermediate buffer and sent to the network when the UDP DL sending timer expires. The timer is reset (it restarts the countdown) every time new data is received from the external port, this means that the data will be sent to the network after N ms (default 1000 ms) since the last received byte.

☞ The data sent from the serial port is not echoed to the sender.

☞ The configuration of UDP DL packet size and UDP DL sending timer are NOT saved in NVM.

The following diagram shows how the events of external data input and sending timer expire are handled.

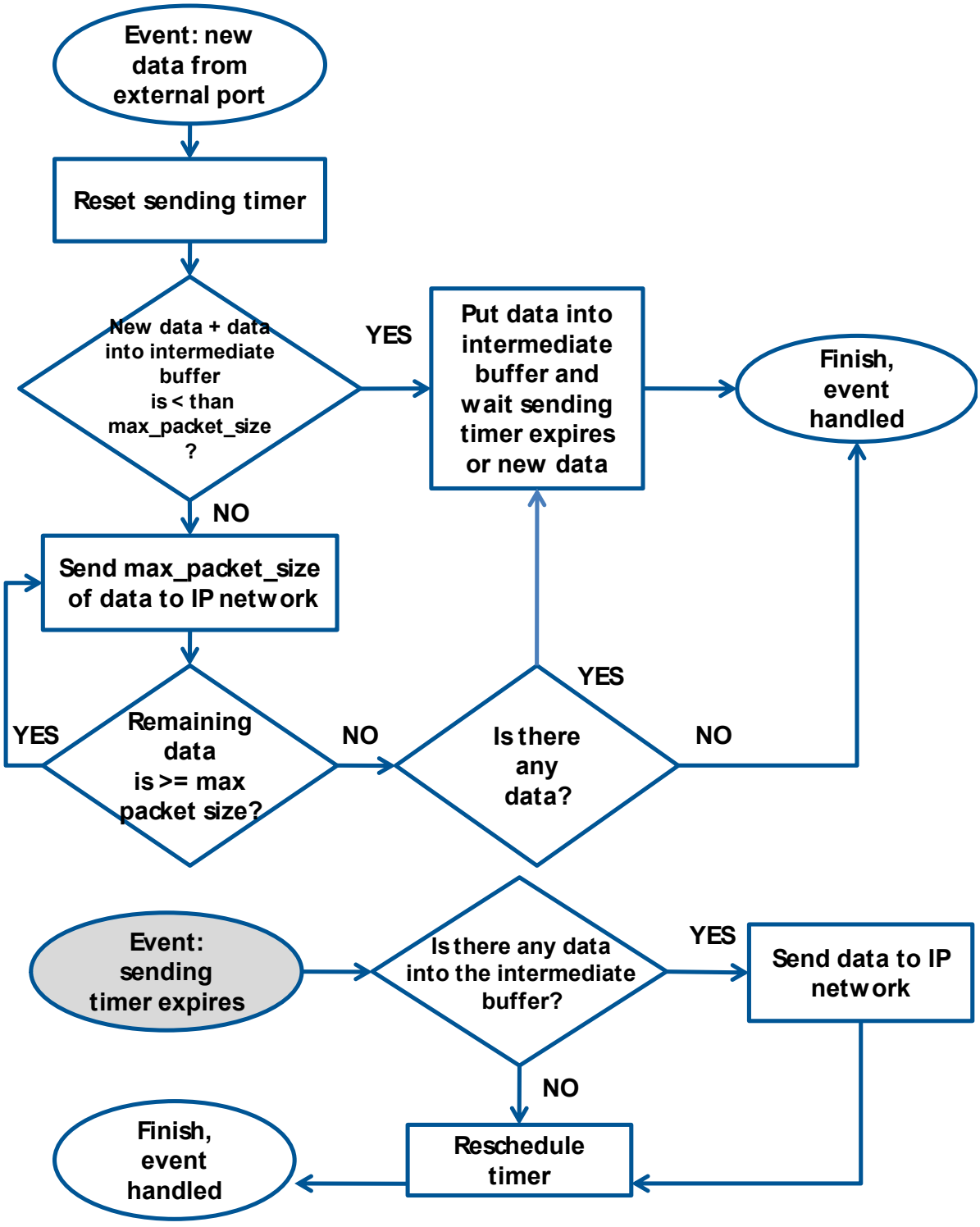

Figure 11: Workflow of data from the external port to the IP network

D Appendix: Glossary

2G	2nd Generation
3G	3rd Generation
3GPP	3rd Generation Partnership Project
ADC	Analog to Digital Converter
AIeC	Automatically Initiated eCall
ADN	Abbreviated Dialing Numbers
AMR	Adaptive Multi Rate
AP	Access Point
APN	Access Point Name
ASCII	American Standard Code for Information Interchange
AT	AT Command Interpreter Software Subsystem, or attention
BL	Black List
BSD	Berkley Standard Distribution
CB	Cell Broadcast
CBM	Cell Broadcast Message
CLI	Calling Line Identification
CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
COLP	Connected Line Identification Presentation
COLR	Connected Line Identification Restriction
CM	Connection Management
CPHS	Common PCN Handset Specification
CR	Carriage Return
CS	Circuit Switch
CSD	Circuit-Switched Data
CSG	Closed Subscriber Group
CTS	Clear To Send
CUG	Closed User Group
DA	Destination Address
DARP	Downlink Advanced Receiver Performance
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCM	Data Connection Management
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Server
DSR	DSC transponder response
DTE, TE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
DTR	Data Terminal Ready
DUT	Device Under Test
EARFCN	E-UTRAN Absolute Radio Frequency Channel Number
eCall	Emergency Call
EEP	EEPROM Emulation Parameters
EF	Elementary File
EF_{CGST}	Elementary File "Closed Subscriber Group Type"
EF_{HNBN}	Elementary File "Home Node B Number"
$EF_{PLMNwAcT}$	Elementary File "User controlled PLMN Selector with Access Technology"
eIM	eCall In-band Modem
EONS	Enhanced Operator Name from SIM-files EF_{OPL} and EF_{PNN}
EPD	Escape Prompt Delay
ETSI	European Telecommunications Standards Institute
E-UTRAN/EUTRAN	Evolved UTRAN
FDN	Fixed Dialling Number

FOAT	Firmware Over AT
FOTA	Firmware Over The Air
FS	File System
FTP	File Transfer Protocol
FW	Firmware
FWINSTALL	Firmware Install
GAS	Grouping information Alpha String
GERAN	GSM/EDGE Radio Access Network
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
HDLC	High Level Data Link Control
HNB	Home Node B
HPLMN	Home PLMN
HTTP	HyperText Transfer Protocol
I	Information
I^2C	Inter-Integrated Circuit
I^2S	Inter IC Sound or Integrated Interchip Sound
ICCID	Integrated Circuit Card ID
ICMP	Internet Control Message Protocol
ICP	Inter Processor Communication
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Station Identity
InBM	In-Band Modem (generic)
IP	Internet Protocol
IRA	International Reference Alphabet
IRC	Intermediate Result Code
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
IVS	In-Vehicle System (eCall related)
L3	Layer 3
LCP	Link Control Protocol
LF	Line Feed
LNS	Linux Network Subsystem
M2M	Machine-To-Machine
MCC	Mobile Country Code
ME	Mobile Equipment
MIeC	Manually Initiated eCall
MMI	Man Machine Interface
MN	Mobile Network Software Subsystem
MNC	Mobile Network Code
MNO	Mobile Network Operator
MO	Mobile Originated
MS	Mobile Station
MSD	Minimum Set of Data (eCall related)
MSIN	Mobile Subscriber Identification Number
MSISDN	Mobile Systems International Subscriber Identity Number
MSPR	Multi-Slot Power Reduction
MT	Mobile Terminated
MWI	Message Waiting Indication
NAA	Network Access Application
NAS	Non Access Stratum
NITZ	Network Identity and Time Zone
NVM	Non-Volatile Memory
ODIS	OMA-DM IMEI Sync

OLCM	On Line Commands Mode
PAD	Packet Assembler/Disassembler
P-CID	Physical Cell Id
PCN	Personal Communication Network
PDP	Packet Data Protocol
PDU	Protocol Data Unit
PIN	Personal Identification Number
PLMN	Public Land Mobile Network
PPP	Point-to-Point Protocol
PSAP	Public Safety Answering Point (eCall related)
PSD	Packet-Switched Data
PUK	Personal Unblocking Key
QoS	Quality of Service
RAM	Random Access Memory
RDI	Restricted Digital Information
RFU	Reserved for Future Use
RNDIS	Remote Network Driver Interface Specification
RI	Ring Indicator
RTC	Real Time Clock
RTP	Real-time Transport Protocol
RTS	Request To Send
Rx	Receiver
SAP	SIM Access Profile
SC	Service Centre
SI	SIM Application Part Software Subsystem
SIP	Session Initiation Protocol
SIM	Subscriber Identity Module
SMS	Short Message Service
SMSC	Short Message Service Center
SMTP	Simple Mail Transfer Protocol
SoR	Steering of Roaming
SDIO	Secure Digital Input Output
SES	Speech Enhancement System
STA	station
SSID	Service Set Identifier
TA	Terminal Adaptor
TCP	Transfer Control Protocol
TE	Terminal Equipment
TFT	Traffic Flow Template
TP	Transfer layer Protocol
Tx	Transmitter
TZ	Time Zone
UCS2	Universal Character Set
UDI	Unrestricted Digital Information
UDP	User Datagram Protocol
UI	Unnumbered Information
UICC	Universal Integrated Circuit Card
UIH	Unnumbered Information with header Check
URC	Unsolicited Result Code
USIM	UMTS Subscriber Identity Module
UTRAN	Universal Terrestrial Radio Access Network
UUS1	User-to-User Signalling Supplementary Service 1
WLAN	Wireless Local Area Network

Related documents

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8. 3GPP TS 23.040 - Technical realization of Short Message Service (SMS)
9. 3GPP TS 23.041 - Technical realization of Cell Broadcast Service (CBS)
10. 3GPP TS 23.060 - Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description
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12. 3GPP TS 24.008 - Mobile radio interface layer 3 specification
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32. 3GPP TS 22.082 - Call Forwarding (CF) supplementary services
33. 3GPP TS 22.083 - Call Waiting (CW) and Call Holding (HOLD)
34. 3GPP TS 22.081 - Line identification Supplementary Services- Stage 1
35. 3GPP TS 23.081 - Line identification supplementary services- Stage 2
36. 3GPP TS 22.086 - Advice of Charge (AoC) Supplementary Services
37. 3GPP TS 22.024 - Description of Charge Advice Information (CAI)
38. 3GPP TS 22.085 - Closed User Group (CUG) Supplementary Services
39. 3GPP TS 22.096 - Name identification supplementary services
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41. GSM 04.60 - Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol
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166. 3GPP TS 43.064 - General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2

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Revision history

Revision	Date	Name	Comments
R01	27-Jan-2017	jole	Initial release
R02	03-Apr-2017	jole	Removed +UPSV. Added +CPSMS. General document clean-up
R03	04-May-2017	jole	Added SARA-R410M
R04	24-May-2017	jole	Moved to Advance Information for SARA-R404M
R05	19-Jul-2017	jole	Extended document applicability to SARA-R410M-02B. Added +ULWM2M, +ULWM2MSTAT and +CNUM. Changed +CPSMS back to it's original 3GPP definition. Added FOAT file tag.
R06	30-Oct-2017	jole	Extended document applicability to SARA-R412M-02B. Added DTR and PPP behavior clarification. Updated max response time for +USOCL. New commands: +UCPSMS, +CCLK, +CTZU, +CEDRXS, +CEDRXRDP, +USECMNG, +USECPRF, +USOSEC and O.
R07	09-Feb-2018	jole	New commands: +CSCS, +UCGED, +PACSP, +UMNOPROF, +UBANDMASK, +UCMGR, +UCMGL, +UCMGS, +UCMGW, +USIMSTAT, +CSIM, +CLAN, +UBIP, +CUSATR, +CUSATW, +UCUSATA, +CEMODE, +UDCONF=75, +UDCONF=76, +UDWNBLOCK, +URDBLOCK, +USOCLCFG, +UGPS, +UGAOS, +UGSRV, +UGIND, +UGPRF, +UGUBX, +UGTMR, +UGZDA, +UGGGA, +UGGLL, +UGGSV, +UGRMC, +UGVTG, +UGGSA, +ULOC, +ULOCIND, +ULOCGNSS, +UI2CO, +UI2CW, +UI2CR, +UI2CREGR, +UI2CC. Modified commands: +CMUX, D, +COPS, +URAT, +CEDRXS, +CEDRXRDP, &D, S2, +IPR, D*, +CEREG, +CGACT, +CPSMS, +UCPSMS, GPIO introduction, File System Introduction, +USODL, +USOCTL, +USECMNG, +USECPRF, AT commands. Updated estimated response time information for these commands: +USOCL, +USOCO, +USOWR.
R08	27-Apr-2018	jole	New commands: +CREG, +UMNOPROF, +UPSD, +CGEREP, +CGREG, +UMQTT, +UMQTTWTOPIC, +UMQTTWMSG, +UMQTTNV, +UMQTTC, +UMQTTER. Modified commands: +COPS, \Q, +CGDCONT, +CEMODE, +UAUTHREQ, +UTEST, File System Introduction, Internet protocol transport layer, +USOGO, +USOCL, +USOCLCFG, +USOSEC, +USOCO, Internal TCP/UDP/IP stack class error codes, Parameters stored in profiles. Updated estimated response time information for these commands: +USOCL, +USOCO, +USOST, +USOSEC.
R09	15-Jun-2018	jole	Extended the document applicability to SARA-R410M-52B and SARA-N410-02B. New commands: +CSGT, +CRTDCP, +CSODCP, +UPSV, +UFOTACONF, +ULGASP, +UTEMP, +UDNSRN. Modified commands: +CMUX, +CFUN, +CSQ, +COPS, +UCGED, +UMNOPROF, <PDP_Type>, +CEREG, +UDCONF=76, +UFWINSTALL, +UTEST, +CPSMS, GPIO introduction, +USODL, SSL/TLS introduction, +USECMNG, +USECPRF, +UHTTP.
R10	03-Aug-2018	jole	New commands: +UHOSTDEV, +URINGCFG. Modified commands: +URAT, +UBANDMASK, +CEDRXS, +CPMS, &K, +IFC, +USIMSTAT, +UCUSATA, +CUSATR, +CUSATW, +UTEST, +UTEMP, +UFOTACONF, GPIO introduction, +USOSO, +USOCTL, +UDCONF=5, +UI2CR, +UMQTT, +UMQTTC. Review the command applicability for these commands: &K, +IFC.
R11	01-Dec-2018	lpah	Extended the document applicability to SARA-R404M-00B-01.
R12	20-Feb-2019	lpah	New commands: +CSCON, +USVCDOMAIN, +CGPIAF, +CGCONTRDP, +UPSMR. Modified commands: I, +CSCS, +CFUN, +CSQ, +COPS, +URAT, +CREG, +CEDRXS, +UMNOPROF, +CNMI, +CSODCP, +IPR, Primary and secondary PDP contexts, <PDP_Type>, +CEREG, +UDCONF=76, +UTEST, +ULWM2MSTAT, +UFOTACONF, +URINGCFG, Network status indication,

Revision	Date	Name	Comments
			+USOWR, +USORD, +USORF, +USECMNG, AT+USECMNG command example, +UHTTP, +ULOC, +UMQTT, +UMQTTC, +UMQTTER. Updated estimated response time information for these commands: +UFWUPD. Review the command applicability for these commands: +CSGT, +CTZU, +CEDRXS, +CEDRXRDP, +UCMGS, +CSODCP, +CRTDCP, +CRSM, +UPSV, +UTEMP, +ULGASP, +UFOTACONF, +URINGCFG, +UDNSRN, +UGPS, +UGIND, +UGPRF, +UGSRV, +UGAOS, +UGUBX, +UGTMR, +UGZDA, +UGGGA, +UGGLL, +UGGSV, +UGRMC, +UGVTG, +UGGSA, +ULOC, +ULOCIND, +ULOCGNSS, +UDCONF=8.

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