SARA-N2 / SARA-N3 series

Power-optimized NB-IoT (LTE Cat NB1 / LTE Cat NB2) modules

AT commands manual

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

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Preface

Applicable products

This document applies to the following products:

Name	Type number	Modem version	Application version	PCN reference
SARA-N200	SARA-N200-01B-00	V100R100C10B656	N.A.	UBX-17013509
	SARA-N200-02B-00	06.57	A07.03	UBX-18005015
	SARA-N200-02B-01	06.57	A09.06	UBX-18048558
	SARA-N200-02B-02	06.57	A10.08	UBX-19030865
SARA-N201	SARA-N201-01B-00	V100R100C10B656	N.A.	UBX-17013509
	SARA-N201-02B-00	06.57	A07.03	UBX-18005015
	SARA-N201-02B-01	06.57	A08.05	UBX-19030865
SARA-N210	SARA-N210-01B-00	V100R100C10B656	N.A.	UBX-17013509
	SARA-N210-02B-00	06.57	A07.03	UBX-18005015
	SARA-N210-02B-01	06.57	A09.06	UBX-18048558
	SARA-N210-02B-02	06.57	A10.08	UBX-19030865
SARA-N211	SARA-N211-02X-00	06.57	A07.03	UBX-18005015
	SARA-N211-02X-01	06.57	A09.06	UBX-18048558
	SARA-N211-02X-02	06.57	A10.08	UBX-19030865
SARA-N280	SARA-N280-01B-00	V100R100C10B656	N.A.	UBX-17013509
	SARA-N280-02B-00	06.57	A07.03	UBX-18005015
	SARA-N280-02B-01	06.57	A09.06	UBX-19030865
SARA-N310	SARA-N310-00X-00	18.13	A01.01	UBX-21017614
	SARA-N310-00X-01	18.13	A01.02	UBX-21039338

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 1.4
    - **NVM**: the command setting is saved in the non-volatile memory as specified in Chapter 1.4
    - **<command_name>**: the parameter values set with the command are volatile, but the whole profile can be stored in NVM with <command_name> AT command.
    - **OP**: the command setting can be overwritten by the Mobile Network Operator (MNO) profile set with the +UMNOPROF or +UMNOCONF AT commands (if supported)
    - **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 1.4 for the saving of settings, in Chapter 1.3.4 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.

- For some guidelines when developing applications for LTE Cat M1 technologies, see the SARA-R4 series application development guide [16] or the SARA-R5 series application development guide [12].
- For some guidelines when developing applications for NB-IoT technologies, see the SARA-N3 series application development guide [32] or the NB-IoT application development guide [29].
- For more examples of typical scenarios when developing application for LTE Cat 4, LTE Cat 1, UMTS/HSPA and GSM/GPRS technologies, see the AT commands examples application note [34].

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 email

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

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1 AT command settings

u-blox cellular modules provide at least one physical serial interface that is compliant to V.24 [190]. 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.

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

1.2 Operational mode of the AT interface

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 (PPP or DUN 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.
- **Direct link mode**: intermediate state where the DCE transfers data transparently over a connected TCP/UDP socket (e.g. by means of +USODL), after reporting the "CONNECT" string.
- **SMS mode**: AT commands for writing or sending SMSs lead the AT interface into an intermediate state indicated by the ">" (greater-than sign) where SMS text/PDU can be entered (DCD signal shall be in ON state during this operation). <Ctrl-Z> indicates that the SMS editing is completed, while <ESC> indicates aborting of the edited SMS.
- **Raw mode**: special AT commands lead the AT interface into intermediate state where raw data is being exchanged (e.g. during file transfer).
- **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:
  - o AT command port;
  - o 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.

☞ SARA-N3
For more details on PSD connection, see the +UPSD and +UPSDA AT commands description.

☞ SARA-N3
The online command mode and AT commands over an IP connection are not supported.

☞ SARA-N2

The data mode and AT commands over IP connection is not supported.

1.3 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.

1.3.1 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

1.3.2 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).

☞ SARA-N3
The command line is not case sensitive unless autobauding is enabled; in this case the prefix "AT" must be typed as "AT" (only uppercase); other combinations ("aT", "Ta" and at") 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.

1.3.2.1 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.

☞ SARA-N3
Not all the commands can be entered with other commands on the same command line: +CMGW, +CMGS, +UDWNFILE must be used by themselves.

1.3.3 Notes

SARA-N2

- The maximum length of the command line is 2048 characters.
- String parameter type limitations - The following characters are not allowed in the parameter string:
  - 0x00 (NUL)
  - 0x0D (CR)
  - 0x15 (NAK)
  - 0x22 (")
  - 0x2C (,)

SARA-N3

- The DTE must wait for the final result code of the previous command before entering new commands.
- The maximum length of the command line is 5120 characters.
- String parameter type limitations - The following characters are not allowed in the parameter string:
  - 0x00 (NUL)
  - 0x0D (CR)
  - 0x15 (NAK)
  - 0x22 (")
  - 0x2C (,)

1.3.4 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

☞ SARA-N3
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
NO CARRIER	3	Final	Connection terminated from the remote part or attempt to establish a connection failed
ERROR	4	Final	General failure. The +CMEE AT 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).
NOT SUPPORT	10	Final	Operation not supported
INVALID COMMAND LINE	11	Final	Invalid command line
CR	12	Final	Carriage return
SIM DROP	13	Final	SIM not inserted
Command aborted	3000	Final	Command execution aborted issuing a character to the DCE
DISCONNECT	14	Final	Data connection disconnected
ABORTED	18	Final	Aborted terminal

Table 1: Allowed result codes

☞ SARA-N2
The `DISCONNECT` result code is not supported.

☞ SARA-N2 / SARA-N3
The `ABORTED` result code is not supported.

☞ SARA-N3
These result codes are not supported: `CONNECT<data rate>` and `Command aborted`.

☞ SARA-N2

- The result code in verbose format is not supported.
- These result codes are not supported: `CONNECT`, `RING`, `NO CARRIER`, `NO DIALTONE`, `BUSY`, `NO ANSWER`, `CONNECT<data rate>`, `NOT SUPPORT`, `INVALID COMMAND LINE`, `CR`, `SIM DROP`.

As already stated in the Preface section (see the "Can be aborted" attribute), some AT commands can be aborted after having issued them.

☞ SARA-N3
The abortability is not supported.

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 +CMEE AT 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:

- SARA-N3 - Firmware update Over AT command: see the Appendix A.4
- SARA-N3 - DNS: see the Appendix A.5 and Appendix A.6
- SARA-N3 - TCP and UDP connections: see the Appendix A.6, Appendix A.7
- SARA-N3 - FTP: see the Appendix A.7.1
- SARA-N3 - HTTP: see the Appendix A.7.2
- SARA-N3 - MQTT: see the Appendix A.7.4
- SARA-N3 - MQTT-SN: see the Appendix A.7.5
- SARA-N3 - CoAP: see the Appendix A.7.6
- SARA-N3 - Ping: see the Appendix A.8

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

1.4 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.

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.

☞ SARA-N3
More details about loading, storing and updating profiles can be found in the command descriptions for: ATZ, AT&F, AT&W and AT&V.
Only one default profile is available, so AT&Y command is not supported.

☞ SARA-N2
The module does not store the AT commands setting in the personal profiles.

1.5 S-parameters

The S-parameters, as specified in ITU-T recommendation V250 [186], 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
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

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

1.6 +UDCONF AT command

The UDCONF AT commands constitute a group of u-blox proprietary AT commands that allow to configure some features beloging to i.e network services, internet suite, etc. They are indicated by the "+UDCONF=" string followed by an <op_code> (i.e. +UDCONF=20). The allowed <op_code> values depend on the module series.

The generic set command syntax is:

```
AT+UDCONF=<op_code>,<param1>,<param2>,....
```

while the generic read command syntax is

```
AT+UDCONF=<op_code>
```

The test command syntax is defined as follows:

```
+UDCONF: <op_code1>,(supported <op_code1_param1>),(supported <op_code1_param2>),..
+UDCONF: <op_code2>,(supported <op_code2_param1>),(supported <op_code2_param2>),..
+UDCONF: <op_code3>,(supported <op_code3_param1>),(supported <op_code3_param2>),..
OK
```

The test command syntax for <op_code>=110 (NVM RAM mode management) differs respect with the other <op_code> values:

```
+UDCONF: 110,"audio","+CLVL,+CRSL,+UMGC,+USGC,+UMSEL,+UMAFE,+USAFE,+UI2S,+USPM"
```

The string after the <at_group> parameter (i.e. "audio") lists the commands that are impacted by the corresponding "command class". The allowed values for the <at_group> parameter (i.e. AT+UDCONF=110, "audio") are provided by means of the corresponding read command.

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 the boot phase the module might not respond to 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.

☞ SARA-N2
At each module start up or reboot, the "u-blox" greeting text is issued followed by the "OK" final result code.

A complete start up including cellular network operation can only take place with a SIM card.

☞ SARA-N3
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

☞ SARA-N2
The auto-registration is not supported.

If the +COPS <mode> parameter in the profiles or in NVM is left to its factory-programmed value 0 or is set to 1, then 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 (also sometimes called "auto-COPS", not to be confused with automatic <mode>=0) will also be triggered 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.

☞ SARA-N3
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 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. If the automatic registration fails and the 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.

2.2 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 an 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 or can be enabled by another command. Generally the AT commands activate the URC on the present (virtual) AT interface on which they are enabled. If the AT commands settings are stored in the **personal profile**, the related URCs are enabled on all AT interface identifiers once set with AT&W (where supported). If the AT commands settings are stored to the **NVM**, at the module boot the related URCs are enabled on all the AT interfaces.

☞ There are cases where both the AT command setting and the AT interface identifier is stored to NVM, therefore the URC will be enabled only on a specific AT interface. These cases are documented in the related AT commands descriptions.

☞ For more details on the storing of AT command setting, see Storing of AT commands setting.

2.2.5.1 URCs presentation deferring

☞ SARA-N2
The URCs presentation deferring is not supported.

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 if 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); if 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	+CNMI AT command
+CIEV URCs	+CMER AT command
+CGEV URCs	+CGEREP AT command

For the above classes, it is possible to select the presentation strategy when the AT interface is busy, according to the 3GPP TS 27.007 [60]; 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 commands 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, then 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

☞ To ensure the DCE can transmit the buffered URCs, 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. Otherwise, the collision of the URCs with the subsequent AT command is possible.

☞ If multiple AT interfaces are available, it is best to use one of the AT interfaces to manage all the user-enabled URCs, while using the other ones to send AT commands and receive their responses.
The 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.

2.2.7 SARA-N2 Reset reasons

If the applications core reboots for any reason apart from either being power cycled or being externally reset, it will return the reason for the reboot before the greeting text.

Reboot reason	Description
REBOOT_CAUSE_SECURITY_RESET_UNKNOWN	Security core: unknown reboot
REBOOT_CAUSE_SECURITY_SYSRESETREQ	Codeloader reboot command or codeloder baud-rate change error
REBOOT_CAUSE_SECURITY_WATCHDOG	Security core: watchdog reboot
REBOOT_CAUSE_SECURITY_SELF	Security core: soft reboot or hardware error
REBOOT_CAUSE_SECURITY_ALTBOOT	Security core: ROM failure or hardware error
REBOOT_CAUSE_SECURITY_REGIONS_UPDATED	Security core: updated memory mapping
REBOOT_CAUSE_PROTOCOL_UNKNOWN	Protocol core: unknown reboot
REBOOT_CAUSE_PROTOCOL_SYSRESETREQ	Protocol core: self reboot with SYSRESETREQ internal line
REBOOT_CAUSE_PROTOCOL_WATCHDOG	Protocol core: watchdog reboot
REBOOT_CAUSE_PROTOCOL_MONITOR_REBOOT_REQ	Protocol core: start of custom reboot causes
REBOOT_CAUSE_APPLICATION_UNKNOWN	Application core: unknown reboot
REBOOT_CAUSE_APPLICATION_SYSRESETREQ	Application core: self reboot with SYSRESETREQ internal line
REBOOT_CAUSE_APPLICATION_WATCHDOG	Application core: watchdog reboot
REBOOT_CAUSE_APPLICATION_AT	Application core: AT interface reboot
REBOOT_CAUSE_UNKNOWN	Unknown reboot

Table 2: List of possible reboot reasons

3 General

3.1 Manufacturer identification +CGMI

+CGMI						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

3.1.1 Description

Text string identifying the manufacturer.

3.1.2 Syntax

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

3.1.3 Defined values

Parameter	Type	Description
<manufacturer>	String	Manufacturer name

3.2 Manufacturer identification +GMI

+GMI						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

3.2.1 Description

Text string identifying the manufacturer.

3.2.2 Syntax

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

3.2.3 Defined values

Parameter	Type	Description
<manufacturer>	String	Manufacturer name

3.3 Model identification +CGMM

+CGMM						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

3.3.1 Description

Text string identifying the model identification.

3.3.2 Syntax

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

3.3.3 Defined values

Parameter	Type	Description
<model>	String	Name of model

3.4 Model identification +GMM

+GMM						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

3.4.1 Description

Text string identifying the model identification.

3.4.2 Syntax

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

3.4.3 Defined values

Parameter	Type	Description
<model>	String	Name of model

3.5 Firmware version identification +CGMR

+CGMR						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

3.5.1 Description

Returns the firmware version of the module.

3.5.2 Syntax

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

3.5.3 Defined values

Parameter	Type	Description
<version>	String	Firmware version

3.6 Firmware version identification +GMR

+GMR						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

3.6.1 Description

Returns the firmware version of the module.

3.6.2 Syntax

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

3.6.3 Defined values

Parameter	Type	Description
<version>	String	Firmware version

3.7 Request product serial number identification +CGSN

+CGSN						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

3.7.1 Description

Returns the International Mobile station Equipment Identity (IMEI) number and related information to identify the MT that the TE is connected to.

3.7.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+CGSN[=<snt>]	[+CGSN:]<param_val> OK	AT+CGSN=0 357520070120767 OK
Serial number request			
Set	AT+CGSN[=0]	<sn> OK	AT+CGSN 357520070120767 OK
IMEI request			
Set	AT+CGSN=1	+CGSN: <imei> OK	AT+CGSN=1 +CGSN: "357520070120767" OK
IMEISV request			
Set	AT+CGSN=2	+CGSN: <imeisv> OK	AT+CGSN=2 +CGSN: "3575200701207601" OK
SVN request			
Set	AT+CGSN=3	+CGSN: <svn> OK	AT+CGSN=3 +CGSN: "01" OK

Type	Syntax	Response	Example
Full IMEI and SVN request			
Set	AT+CGSN=255	<imei_full> OK	AT+CGSN=255 35752007012076701 OK
Test	AT+CGSN=?	+CGSN: (list of supported <snt>s) OK	+CGSN: (0-3,255) OK

3.7.3 Defined values

Parameter	Type	Description
<snt>	Number	It indicates the requested serial number type. Depending on <snt> value, the <param_val> parameter in the information text response provides different information: • 0 (default value): MT serial number, typically the 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
<sn>	Number	MT serial number, typically the International Mobile station Equipment Identity (IMEI)
<imei>	String	International Mobile station Equipment Identity (IMEI). IMEI is composed of Type Allocation Code (TAC) (8 digits), Serial Number (SNR) (6 digits) and the Check Digit (CD) (1 digit).
<imeisv>	String	International Mobile station Equipment Identity and Software Version Number (IMEISV). The 16 digits of IMEISV are composed of Type Allocation Code (TAC) (8 digits), Serial Number (SNR) (6 digits) and the software version (SVN) (2 digits).
<svn>	String	Software Version Number (SVN) which is a part of IMEISV.
<imei_full	Number	International Mobile station Equipment Identity (IMEI), Check Digit and Software Version Number.
<param_val>	Number/ String	Type and supported content depend on related <snt> (details are given above)

3.7.4 Notes

SARA-N2 / SARA-N3

- <snt>=0 provides the 128-bit UUID of the UE.
- <snt>=255 is not supported.

SARA-N2

- The <snt> parameter is mandatory.
- The information text response to <snt>=1 or 2 returns with the "+CGSN:" prefix, e.g. "+CGSN: 357518080013535".

3.8 IMEI identification +GSN

+GSN						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

3.8.1 Description

The commands handling is the same of +CGSN.

3.8.2 Syntax

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

Type	Syntax	Response	Example
		OK	OK
Test	AT+GSN=?	OK	

3.8.3 Defined values

See +CGSN AT command.

3.9 Identification information I

I						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

3.9.1 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.

3.9.2 Syntax

Type	Syntax	Response	Example
Action	**Type number request** ATI[0]	<type_number> OK	ATI0 SARA-G350-00S-00 OK
	Module boot sequence version request ATI6	<module_boot_sequence_version> OK	ATI6 1 OK
	Modem and application version request ATI9	<modem_version>,<applications_version> OK	ATI9 29.90,A01.00 OK

3.9.3 Defined values

Parameter	Type	Description
<type_number>	String	Product type number
<module_boot_sequence_version>	Number	Module boot sequence version. Where not applicable the module provides "Undefined"
<modem_version>	String	Module modem version
<applications_version>	String	Module application version. Where not applicable the module provides "Undefined"

3.10 TE character set configuration +CSCS

+CSCS						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

3.10.1 Description

Selects the TE character set.

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

3.10.2 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", "PCCP936") OK

3.10.3 Defined values

Parameter	Type	Description
<chset>	String	Allowed characters set: • "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 • "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 • "PCCP936": Chinese character set Allowed values: • SARA-N3 - "GSM", "UCS2", "HEX", "PCCP936" (factory-programmed value)

3.11 International mobile subscriber identification +CIMI

+CIMI						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

3.11.1 Description

Request the IMSI (International Mobile Subscriber Identity).

3.11.2 Syntax

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

3.11.3 Defined values

Parameter	Type	Description
<IMSI>	Number	International Mobile Subscriber Identity

3.11.4 Notes

SARA-N2

- The IMSI may not be displayed for a few seconds after the module power-on.

3.12 Card identification +CCID

+CCID						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

3.12.1 Description

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

3.12.2 Syntax

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

3.12.3 Defined values

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

3.12.4 Notes

- The command needs of the SIM to correctly work.

3.13 List all available AT commands +CLAC

+CLAC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

3.13.1 Description

Causes the MT to return one or more lines of AT commands that are available for the DTE user. Each line contains one AT command.

3.13.2 Syntax

Type	Syntax	Response	Example
Action	AT+CLAC	<AT command 1> [<AT command 2> [...]] OK	
Test	AT+CLAC=?	OK	

3.13.3 Defined values

Parameter	Type	Description
<AT command>	String	AT command name

3.14 Set 3GPP release version +NVSETRELEASEVERSION

+NVSETRELEASEVERSION						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

3.14.1 Description

Switches the feature set between 3GPP release 13 and release 14.

☞ Reboot the module (e.g. by means of the AT+CFUN=16 command) to make the change effective.

3.14.2 Syntax

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

3.14.3 Defined values

Parameter	Type	Description
<release_version>	Number	Allowed values: • 0 (factory-programmed value): release 13 • 1: release 14

4 Mobile equipment control and status

4.1 Module switch off +CPWROFF

+CPWROFF						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 40 s	+CME Error

4.1.1 Description

Switches off the MT. During shutdown 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.

4.1.2 Syntax

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

4.1.3 Notes

SARA-N3

- The +UCPWROFF URC is not supported.

4.2 Set module functionality +CFUN

+CFUN						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	Up to 3 min	+CME Error

4.2.1 Description

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

☞ SARA-N3
If the AT+CFUN=16 (reset) command is issued, the rest of the command line, placed after that will be ignored.

4.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+CFUN=<fun>[,<rst>]	OK	AT+CFUN=1 OK
Read	AT+CFUN?	+CFUN: <power_mode> OK	+CFUN: 1 OK
Test	AT+CFUN=?	+CFUN: (list of supported <fun>'s), (list of supported <rst>'s) OK	+CFUN: (0,1,4,15,16,19),(0-1) OK
URC		+UUFASTSHUTDOWN: <value>	+UUFASTSHUTDOWN: 0

4.2.3 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 AT+CFUN=15, AT+CFUN=16 or AT+CPWROFF (where supported). • 10: fast and safe power-off, the command triggers a fast shutdown, without sending a detach request to the network, with storage of current settings in module's non-volatile memory. The "OK" final result code indicates the command request was successful, while the +UUFASTSHUTDOWN URC provides the status of the power-off process. • 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. Re-enable the SIM card by means of <fun>=0, 1, 4. Allowed values: • SARA-N3 - 0, 1, 16 • SARA-N2 - 0, 1
<rst>	Number	Reset mode: • 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	Power mode: • 0: MT is switched on with minimum functionality • 1: MT is switched on • 4: MT is in "airplane mode" • 5: MT is in "test mode" • 19: MT is in minimum functionality with SIM deactivated Allowed values: • SARA-N2 / SARA-N3 - 0, 1
<value>	Number	Allowed values: • 0: fast power-off ongoing • 1: fast power-off completed

4.2.4 Notes

SARA-N2

- The module enters the deep-sleep power mode whenever possible.
- <rst> parameter is ignored when issued in the set command.

SARA-N3

- <fun>=4 is not supported (<fun>=0 can be used instead).
- The <rst> parameter is not supported.

4.3 Indicator control +CIND

+CIND						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

4.3.1 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 [60].

4.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+CIND=[<ind>[,<ind>[,...]]]	OK	AT+CIND= OK
Read	AT+CIND?	+CIND: <ind>[,<ind>[,...]] OK	+CIND: 5,0,0,0,0,0,0,0,0,0,0,0 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

4.3.3 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 level. See mapping in the Notes 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
		• "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

Parameter	Type	Description
		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

4.3.4 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)

SARA-N2

- Only <descr>="battchg" is supported.

SARA-N3

- <descr>="sounder", "call", "callsetup", "callheld" and "simind" are not supported.

4.4 Mobile termination event reporting +CMER

+CMER						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

4.4.1 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.

4.4.2 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>	

4.4.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 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	Allowed values: • 0: no keypad event reporting
<disp>	Number	Allowed values: • 0: no display event reporting
<ind>	Number	Allowed values: • 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.
<bfr>	Number	Allowed values: • 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 level
		  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

Parameter	Type	Description
		• 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

4.4.4 Notes

SARA-N3

- <mode>=0, 1 and 2 are not supported.
- <mode>=3 implies that URCs are directly displayed on the DTE.
- <ind>=1 is not supported.
- <bfr> parameter is not supported.
- For more details on the <descr> parameter, see +CIND AT command description.

4.5 Clock +CCLK

+CCLK						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

4.5.1 Description

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

4.5.2 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	

4.5.3 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. • SARA-N2 - The factory-programmed value is "04/01/01,00:00:00+00" • SARA-N3 - The factory-programmed value is "17/01/01,12:40:43+20". Values prior to the factory-programmed value are not allowed.

4.5.4 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 AT 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.

SARA-N2

- Time setting is not permanently stored in NVM.
- The set command is not supported.

4.6 Alarm +CALA

+CALA						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

4.6.1 Description

Sets an alarm time in the MT. There can be an array of different types of alarms. If the setting fails, an error result code is returned. To set up a recurrent alarm for more days in the week, the <recurr> parameter is used. When an alarm time is reached, the alarm actions are executed:

- Sound alarm (if not silent and if the sound is supported)
- URC **+CALV: <n>** is displayed on DTE

4.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+CALA=<time>[,<n>[,<type>[,<text>[,<recurr>[,<silent>]]]]]	OK	AT+CALA="02/07/01,14:56:00+04",1,1,"Alarm" OK
Read	AT+CALA?	[+CALA: <time>,<n1>,<type>,<text>,<recurr>,<silent> [+CALA: <time>,<n2>,<type>,<text>,<recurr>,<silent> [...]]] OK	+CALA: "02/07/01,14:56:00+04",1,1,"Alarm","",1 OK
Test	AT+CALA=?	+CALA: (list of supported <n>s),(list of supported <type>s),<tlength>,<rlength>,(list of supported <silent>'s) OK	+CALA: (1-3),,255,13,(0-1) OK
URC		+CALV: <n>	

4.6.3 Defined values

Parameter	Type	Description
<time>	String	Format is "yy/MM/dd,hh:mm:ss+TZ". Characters indicate year, month, day, hour, minutes, seconds, time zone.
<n>, <n1>, <n2>	Number	Indicates the index of the alarm, the range is 1-3; the default value is 1.
<type>	Number	Type of the alarm
<text>	String	Text to be displayed when the alarm time is reached.
<tlength>	Number	Maximum length of <text>; the maximum length is 255.
<recurr>	String	Maximum string length is 13, it indicates the day of week for the alarm in one of the following formats: • "<1..7>[,<1..7>[...]]": sets a recurrent alarm for one or more days in the week. The digits 1 to 7 corresponds to the days in the week, Monday (1), ..., Sunday (7). Example: the string "1,2,3,4,5" may be used to set an alarm for some weekdays. • "0": sets a recurrent alarm for all days in the week and all following weeks • when the recurrent parameter is set, the time parameter format is "hh:mm:ss +TZ" (hour, minutes, seconds, time zone)
<rlength>	Number	Indicates the maximum length of <recurr>

Parameter	Type	Description
<silent>	Number	Indicates if the alarm is silent or not: • 0 (default value): the alarm will not be silent • 1: the alarm will be silent and the only result from the alarm is the +CALV URC

4.6.4 Notes

- The alarm is not by default configured.
- The <type> parameter is ignored.
- The <silent> parameter can only be set to 1 when sound is not supported, if the audio interface is available in the interested product version then the silent mode 0 or 1 can be set.
- The module can be switched off after setting the alarm, in which case the module switches on as soon as the alarm time is reached. The following is an example procedure using the alarm setting:
  - Set the RTC clock by AT command: AT+CCLK="06/12/29,11:00:00+00" (the time can be checked with the AT+CCLK read command)
  - Set the RTC alarm by AT command: AT+CALA="06/12/29,11:01:00+00",1,0,"","",0 (the alarm set can be checked by the AT+CALA read command)
  - Switch off the MT with AT+CPWROFF

  Output: the MT switches on as soon as the minute is expired and answers "+CALV: 1". Try to send "AT" on the hyper terminal, the MT replies properly.

SARA-N3

- The format of <time> parameter is "yy/MM/dd,hh:mm:ss".
- Alarm index <n> range goes from 1 to 15.
- The <type> parameter can only be set to 0.
- The <tlength> parameter range goes from 0 to 32 characters.
- The <rlength> parameter range goes from 0 to 16 characters.
- The <silent> parameter is not supported.
- Before entering the deep-sleep mode, an alarm with <n>=9, <type>=0, <text>="osi", is automatically created; any previoulsy created alarm with <n>=9 will be overwritten.

4.7 Delete alarm +CALD

+CALD						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.7.1 Description

Deletes an alarm in the MT.

4.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+CALD=<n>	OK	AT+CALD=1 OK
Test	AT+CALD=?	+CALD: (list of <n>s) OK	+CALD: (1-3) OK

4.7.3 Defined values

Parameter	Type	Description
<n>	Number	Indicates the index of the alarm; see the +CALA command description for the allowed range of indexes.

4.8 Set greeting text +CSGT

+CSGT						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

4.8.1 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.

☞ SARA-N3
Take care about restrictions related to the baud rate described in the Autobauding description.

4.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSGT=<mode>[,<text>]	OK	AT+CSGT=1,"Hello user" OK
Read	AT+CSGT?	+CSGT: <text>,<mode> OK	+CSGT: "Hello",0 OK
Test	AT+CSGT=?	+CSGT: (list of supported <mode>s), <ltext> OK	+CSGT: (0-1),49 OK

4.8.3 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.

4.9 Automatic time zone update +CTZU

+CTZU						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

4.9.1 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).

4.9.2 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: (0-2) OK

4.9.3 Defined values

Parameter	Type	Description
<on_off>	Number	Automatic time zone update: • 0: automatic time zone via NITZ disabled • 1: automatic time zone update via NITZ enabled; if the network supports the service, update the local time to the module (not only time zone) • 2: automatic time zone update via NITZ enabled; if the network supports the service, update the GMT time to the module (not only time zone) Allowed values: • SARA-N2 - 0, 1 (factory-programmed value) • SARA-N3 - 0, 1 (factory-programmed value), 2

4.10 Time zone reporting +CTZR

+CTZR						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	NVM	No	-	+CME Error

4.10.1 Description

Configures the time zone change event reporting. If the reporting is enabled, according to the <mode> parameter the MT returns:

- the **+CTZV** URC whenever the time zone changes and additionally the **+CTZDST** URC if the daylight saving time information is available
- the **+CTZE** URC
- the **+CTZEU** URC whenever the universal time reporting is available

4.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+CTZR=<mode>	OK	AT+CTZR=1 OK
Read	AT+CTZR?	+CTZR: <mode> OK	+CTZR: 0 OK
Test	AT+CTZR=?	+CTZR: (list of supported <mode>s) OK	+CTZR: (0-1) OK
URC		+CTZV: <tz>[,<time>]	+CTZV: +04,"12/12/31,23:46:33"
URC		+CTZE: <tz>,<dst>[,<time>]	+CTZE: +04,1,"12/12/31,23:46:33"
URC		+CTZEU: <tz>,<dst>[,<utime>]	+CTZEU: +04,1
URC		+CTZDST: <dst>	+CTZDST: 1

4.10.3 Defined values

Parameter	Type	Description
<mode>	Number	Enables the time zone reporting URCs: • 0: disable the time zone change event reporting • 1: enable the time zone reporting by +CTZV and +CTZDST URCs • 2: enable the time zone reporting by +CTZE URC • 3: enable the time zone reporting and universal time reporting by +CTZEU URC according to 3GPP TS 27.007 Release 13 Allowed values: • SARA-N3 - 0 (default and factory-programmed value), 1. The +CTZDST URC is not supported. • SARA-N2 - 0 (default value), 1, 2, 3. The +CTZDST URC is not supported.
<tz>	Number	Indicates the time zone. The range goes from -48 to +56.
<time>	String	Current local time in format "yy/MM/dd,hh:mm:ss". The characters indicate year, month, day, hour, minutes, seconds.

Parameter	Type	Description
<dst>	Number	Indicates the daylight saving time. The allowed values are: • 0: no adjustments • 1: +1 hour adjustment • 2: +2 hours adjustment
<utime>	String	Universal time in format "yyyy/MM/dd,hh:mm:ss". The characters indicate year, month, day, hour, minutes, seconds.

4.10.4 Notes

- The +CTZU AT command (automatic time zone setting) does not affect the time zone reporting.
- The time zone information is expressed in steps of 15 minutes.
- The reported <tz> reflects the <dst> offset: if time zone is +1 hour and the daylight saving time is +1 hour, the reported <tz> is +08.
- For the +CTZE URC, the local time <time> needs to be derived by the MT.

SARA-N2

- The command setting is not stored in the NVM.
- The format of the <time> parameter is "yy/MM/dd,hh:mm:ss".

4.11 Report mobile termination error +CMEE

+CMEE						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.11.1 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.

4.11.2 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

4.11.3 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

4.11.4 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

SARA-N2

- <n>=2 is not supported.

4.12 Extended error report +CEER

+CEER						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

4.12.1 Description

Causes the MT to return one or more lines of the information text response which offer an extended report of the reason for:

- the failure in the last unsuccessful call setup or in-call modification,
- the last call release,
- the last unsuccessful GPRS attach / EPS bearer establishment or unsuccessful PDP context activation,
- the last GPRS / EPS bearer detach or PDP context deactivation.

☞ SARA-N2
The last SM STATUS message sent to the network is not supported.

4.12.2 Syntax

Type	Syntax	Response	Example
Action	AT+CEER	+CEER: <report> OK	+CEER: "ILLEGAL ME" OK
Test	AT+CEER=?	OK	

4.12.3 Defined values

Parameter	Type	Description
<report>	String	The total number of characters, including line terminators, in the information text shall not exceed 2041 characters.

4.12.4 Notes

SARA-N2

- The GPRS attach/detach is not supported.

4.13 Reboot +NRB

+NRB						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.13.1 Description

Reboots the module. There is a short delay after the command issuing before the module reboot that will be notified by an IRC. No further AT commands will be processed.

4.13.2 Syntax

Type	Syntax	Response	Example
Action	AT+NRB		
IRC		REBOOTING	REBOOTING

4.14 UE statistics +NUESTATS

+NUESTATS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

4.14.1 Description

Returns the most recent operational statistics of the module. Depending on the <type> parameter the information text response provides different information as radio specific, cell, application core memory, block error rate or throughput information. All the data will be printed if <type>="ALL".

4.14.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Read	AT+NUESTATS[=<type>]	+NUESTATS: <type>,<param_name>,<value> OK	
Radio specific information			
Read	AT+NUESTATS[="RADIO"]	+NUESTATS: "RADIO",<param_name>,<value> [[..] [+NUESTATS: "RADIO",<param_name>,<value>]] OK	AT+NUESTATS="RADIO" +NUESTATS: "RADIO","Signal_power",-508 +NUESTATS: "RADIO","Total_power",-500 +NUESTATS: "RADIO","TX_power",-30 +NUESTATS: "RADIO","TX_time",2393 +NUESTATS: "RADIO","RX_time",28903 +NUESTATS: "RADIO","Cell_ID",25 +NUESTATS: "RADIO","ECL",1 +NUESTATS: "RADIO","SNR",20 +NUESTATS: "RADIO","EARFCN",30 +NUESTATS: "RADIO","PCI",11 +NUESTATS: "RADIO","RSRQ",0 OK
Cell information			
Read	AT+NUESTATS="CELL"	+NUESTATS: "CELL",<earfcn>,<physical_cell_id>,<primary_cell>,<rsrp>,<rsrq>,<rssi>,<snr> OK	AT+NUESTATS="CELL" +NUESTATS: "CELL",3569,69,1,23,-1073,-1145,5 OK
Block error rate information			
Read	AT+NUESTATS="BLER"	+NUESTATS: "BLER",<param_name>,<value> [[..] [+NUESTATS: "BLER",<param_name>,<value>]] OK	AT+NUESTATS="BLER" +NUESTATS: "BLER","RLC_UL_BLER",10 +NUESTATS: "BLER","RLC_DL_BLER",5 +NUESTATS: "BLER","MAC_UL_BLER",8 +NUESTATS: "BLER","MAC_DL_BLER",3

Type	Syntax	Response	Example
			+NUESTATS: "BLER","Total_TX_bytes",1080 +NUESTATS: "BLER","Total_RX_bytes",900 +NUESTATS: "BLER","Total_TX_blocks",80 +NUESTATS: "BLER","Total_RX_blocks",80 +NUESTATS: "BLER","Total_RTX_blocks",100 +NUESTATS: "BLER","Total_ACK/NACK_RX",100 OK
Throughput information			
Read	AT+NUESTATS="THP"	+NUESTATS: "THP",<param_name>,<value> [[..] [+NUESTATS: "THP",<param_name>,<value>]] OK	AT+NUESTATS="THP" +NUESTATS: "THP","RLC_UL",100 +NUESTATS: "THP","RLC_DL",98 +NUESTATS: "THP","MAC_UL",103 +NUESTATS: "THP","MAC_DL",100 OK
Application core memory information			
Read	AT+NUESTATS="APPSMEM"	+NUESTATS: "APPSMEM",<param_name>:<value> [[..] [+NUESTATS: "APPSMEM",<param_name>:<value>]] OK	AT+NUESTATS="APPSMEM" +NUESTATS: "APPSMEM","Current_Allocated":8240 +NUESTATS: "APPSMEM","Total_Free":198 +NUESTATS: "APPSMEM","Max_Free":8496 +NUESTATS: "APPSMEM","Num_Allocs":300 +NUESTATS: "APPSMEM","Num_Frees":240 OK
Test	AT+NUESTATS=?	+NUESTATS: (list of supported <type>s) OK	+NUESTATS: ("RADIO","CELL","BLER","THP","APPSMEM","ALL") OK

4.14.3 Defined values

UE statistics <type>

Parameter	Type	Description
<type>	String	Type of data to be displayed. Allowed values: • "RADIO" (default value): radio specific information • "CELL": per-cell information for the top 8 cells • "BLER": block error rate information • "APPSMEM": application core dynamic memory usage • "THP": throughput information • "ALL": all information
<param_name>	String	Alphabetical names for the specific information, provided with their numeric values for each <type>.
<type>="RADIO"		
<value>	Number	Allowed values: • <power>: NB-IoT signal power expressed in tenth of dBm

Parameter	Type	Description
		• <tot_power>: total power within receive bandwidth expressed in tenth of dBm • <tx_power>: TX power expressed in tenth of dBm • <tx_time>: elapsed TX time since last power on event expressed in milliseconds • <rx_time>: elapsed RX time since last power on event expressed in milliseconds • <cell_ID>: physical ID of the cell providing service to the module • <ECL>: last ECL value • <snr>: last SNR value expressed in tenth of dB • <earfcn>: last EARFCN value • <pci>: last PCI value • <rsrq>: o SARA-N2 - last RSRQ value is expressed in tenth of dB o SARA-N3 - last RSRQ value is expressed as follows: - 0: less than -19.5 dB - 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
<type>="BLER"		
<value>	Number	Allowed values: • <rlc_ul_bler>: uplink block error rate of Radio Link Control (RLC) layer, expressed in percentage • <rlc_dl_bler>: downlink block error rate of Radio Link Control (RLC) layer, expressed in percentage • <mac_ul_bler>: uplink block error rate of physical layer, expressed in percentage • <mac_dl_bler>: downlink block error rate of physical layer, expressed in percentage • <total_tx_bytes>: total transmitted bytes, when transmission occurs on Narrowband Physical Uplink Shared Channel (NPUSCH) • <total_rx_bytes>: total received bytes, when Narrowband Physical Downlink Shared Channel (NPDSCH) is successfully received • <total_tx_blocks>: total transmitted transport blocks, updated when UL grant received and transmission occurs on Narrowband Physical Uplink Shared Channel (NPUSCH) • <total_rx_blocks>: total received transport blocks updated, when Narrowband Physical Downlink Shared Channel (NPDSCH) is successfully received • <total_rtx_blocks>: retransmitted transport blocks • <total_ack/nack_rx>: total ack received/ total harq nack (at lower layers before L2) received
<type>="CELL"		
<earfcn>	Number	Absolute radio-frequency channel number. The allowed range is 0-65535
<physical_cell_id>	Number	Physical ID of the cell
<primary_cell>	Number	The current serving cell is indicated by 1
<rsrp>	Number	Reference Signal Received Power (RSRP): • SARA-N2 - the RSRP value is expressed in tenth of dBm • SARA-N3 - the RSRP value is expressed as follows: o 0: less than -140 dBm o 1..96: from -140 dBm to -45 dBm with 1 dBm steps o 97: -44 dBm or greater o 255: not known or not detectable
<rsrq>	Number	Reference Signal Received Quality (RSRQ): • SARA-N2 - last RSRQ value is expressed in tenth of dB • SARA-N3 - last RSRQ value is expressed as follows: o 0: less than -19.5 dB o 1..33: from -19.5 dB to -3.5 dB with 0.5 dB steps o 34: -3 dB or greater o 255: not known or not detectable
<rssi>	Number	Received Signal Strength Indicator (RSSI) as defined in 3GPP TS 25.133 [118]: • 0: less than -100 dBm • 1..75: from -100 to -25 dBm with 1 dBm steps • 76: -25 dBm or greater

Parameter	Type	Description
		• 255: not known or not detectable
<snr>	Number	Signal to noise ratio expressed in tenth of dB
<type>="THP"		
<value>	Number	Allowed values: • <rlc_ul>: uplink throughput of Radio Link Control (RLC) layer, expressed in b/s • <rlc_dl>: downlink throughput of Radio Link Control (RLC) layer, expressed in b/s • <mac_ul>: uplink throughput of physical layer, expressed in b/s • <mac_dl>: downlink throughput of physical layer, expressed in b/s
<type>="APPSMEM"		
<value>	Number	Application core dynamic memory usage in kBs. Allowed values: • <allocated>: current allocated memory • <free>: total free memory • <max_free>: maximum free memory • <num_allocs>: number of allocs • <num_frees>: number of frees

4.14.4 Notes

SARA-N3

- <type>="APPSMEM" is not supported.
- <type>="CELL" returns information of up to 5 cells.

SARA-N2

- The <total_rtx_blocks> parameter is not updated and set to zero.
- The read and test command response is returned with "NUESTATS" prefix.

4.15 Configure UE behavior +NCONFIG

+NCONFIG						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

4.15.1 Description

Configures customizable aspects of the UE (e.g Auto Attach). It takes a function and a value that controls operation of that function.

☞ The changes are effective after the module reboot by means of the +NRB AT command.

☞ The "NAS_SIM_POWER_SAVING_ENABLE" feature shall remain always enabled.

4.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+NCONFIG=<function>,<value>	OK	AT+NCONFIG="AUTOCONNECT", "TRUE" OK
Read	AT+NCONFIG?	+NCONFIG: <function>,<value> [[..] +NCONFIG: <function>,<value>] OK	+NCONFIG: "AUTOCONNECT", "TRUE" +NCONFIG: "CR_0354_0338_SCRAMBLING","TRUE" +NCONFIG: "CR_0859_SI_AVOID", "TRUE" +NCONFIG: "COMBINE_ATTACH", "FALSE" +NCONFIG: "CELL_RESELECTION", "TRUE"

Type	Syntax	Response	Example
			+NCONFIG: "ENABLE_BIP","FALSE" +NCONFIG: "NAS_SIM_POWER_SAVING_ENABLE","TRUE" +NCONFIG: "RLF_UPDATE","FALSE" OK
Test	AT+NCONFIG=?	+NCONFIG: (<function>,(list of supported <value>s)) [[..] +NCONFIG: (<function>,(list of supported <value>s)) OK	+NCONFIG: ("AUTOCONNECT",("FALSE","TRUE")) +NCONFIG: ("CR_0354_0338_SCRAMBLING",("FALSE","TRUE")) +NCONFIG: ("CR_0859_SI_AVOID",("FALSE","TRUE")) +NCONFIG: ("COMBINE_ATTACH",("FALSE","TRUE")) +NCONFIG: ("CELL_RESELECTION",("FALSE","TRUE")) +NCONFIG: ("ENABLE_BIP",("FALSE","TRUE")) +NCONFIG: ("NAS_SIM_POWER_SAVING_ENABLE",("FALSE","TRUE")) +NCONFIG: ("RLF_UPDATE",("FALSE","TRUE")) OK

4.15.3 Defined values

Parameter	Type	Description
<function>	String	• "AUTOCONNECT": control if the platform will automatically attempt to connect to the network after power-on or reboot. When enabled, will set +CFUN=1 and read the PLMN from the SIM. It will use the APN provided by the network. The factory-programmed value is "TRUE". • "CR_0354_0338_SCRAMBLING": enable/disable the scrambling. See the 3GPP TS 36.211 [143], CR-0354 and CR-0338. The factory-programmed value is "TRUE". • "CR_0859_SI_AVOID": enable/disable the scheduling of conflicted NSIB. See the 3GPP TS 36.213 [131], CR-0859. The factory-programmed value is "TRUE". • "COMBINE_ATTACH": enable/disable combined EPS/IMSI attach. The factory-programmed value is "FALSE". • "CELL_RESELECTION": enable support for RRC cell reselection. The factory-programmed value is "FALSE". • "ENABLE_BIP": enable/disable BIP (Bearer Independent Protocol), where BIP is the interface between SIM/USIM and the ME which provides access to the data bearers supported by the ME. The factory-programmed value is "FALSE". • "NAS_SIM_POWER_SAVING_ENABLE": enable/disable the feature to powering SIM until PSM, when enabled; the SIM is only powered when it is accessed. The factory-programmed value is "TRUE". • "RLF_UPDATE": enable/disable the feature to send TAU at the event of Radio Link Failure. The factory-programmed value is "FALSE".
<value>	String	• "TRUE" • "FALSE"

4.15.4 Notes

SARA-N2

- The <function>="RLF_UPDATE" parameter is not supported by SARA-N200-02B-00, SARA-N201-02B-00, SARA-N210-02B-00, SARA-N211-02X-00, SARA-N280-02B-00.

5 Network service

5.1 Network parameters definition

Parameter	Type	Description	Commands
<MCC>	Number	Mobile Country Code. The range is 0-999 (3 digits).	+COPS
<MNC>	Number	Mobile Network Code. The range is 0-999 (1 to 3 digits).	+COPS
<LAC>	Number	Location Area Code, The range is 0x0-0xFFFF (2 octets)	+COPS
<CI>	Number	Cell identity. • SARA-N2 - The range is 0-0x1F7.	+COPS, +NEARFCN
<RxLev>	Number	Received Signal Strength Indicator (RSSI) index as defined in 3GPP TS 45.008 [75]: • 0: less than -110 dBm • 1..62: from -110 to less than -48 dBm with 1 dBm steps • 63: -48 dBm or greater	+COPS
<RAC>	Number	Routing Area Code, range 0h-FFh (1 octet); see the 3GPP TS 44.018 [146]	+COPS
<scrambling_code>	Number	Scrambling code.	+COPS
<dl_frequency>	Number	Downlink frequency. The range is 0-16383.	+COPS
<ul_frequency>	Number	Uplink frequency. The range is 0-16383.	+COPS
<arfcn>	Number	Absolute Radio Frequency Channel Number (ARFCN).	+COPS
<rscp_lev>	Number	Received Signal Code Power expressed in dBm levels: • 0: less than -115 dBm • 1..90: from -115 dBm to less than -25 dBm with 1 dBm steps • 91: -25 dBm	+COPS
<ecn0_lev>	Number	Energy per Chip/Noise ratio expressed in dB levels: • 0: less than -24 dB • 1..48: from -24 dB to less than 0 dB with 0.5 dB steps • 49: 0 dB	+COPS
<PhysCellID>	Number	Physical cell ID. The range is 0-503.	+COPS
<TAC>	Number	Tracking area code.	+COPS
<dl_EARFCN>	Number	Downlink E-UTRAN absolute radio frequency channel number in decimal format.	+COPS
<ul_EARFCN>	Number	Uplink E-UTRAN absolute radio frequency channel number in decimal format.	+COPS
<RSRP>	Number	Reference Signal Received Power (RSRP) as defined in 3GPP TS 36.133 [117]: • 0: less than -140 dBm • 1..96: from -140 dBm to less than -44 dBm with 1 dBm steps • 97: -44 dBm or greater	+COPS
<RSRQ>	Number		+COPS
<BSIC>	Number	Base Station Identify Code (BSIC) in hexadecimal format, the range is 0x0-0x3F (6 bits).	+COPS
<Requested_eDRX_cycle>	String	Requested eDRX cycle value to be allocated to the UE. Half byte in a 4 bit format: the eDRX cycle value refers to bit 4 to 1 of octet 3 of the extended DRX parameters information element. For the coding and the value range, see the extended DRX parameters information element in 3GPP TS 24.008 table 10.5.5.32/3GPP TS 24.008 [69].	+CEDRXS, +CEDRXRDP, +NPTWEDRXS

Parameter	Type	Description	Commands
		• SARA-N3 - The factory-programmed value is 2 ("0010").	
<Assigned_eDRX_cycle>	String	Assigned eDRX cycle value. Half byte in a 4 bit format: the eDRX cycle value refers to bit 4 to 1 of octet 3 of the extended DRX parameters information element. For the coding and the value range, see the extended DRX parameters information element in 3GPP TS 24.008 table 10 .5.5.32/3GPP TS 24.008 [69].	+CEDRXS, +CEDRXRDP, +NPTWEDRXS
<Requested_paging_time_window>	String	Requested paging time window value to be allocated to the UE. Half byte in a 4 bit format: the paging time window (PTW) refers to bit 8 to 5 of octet 3 of the extended DRX parameters information element. For the coding and the value range, see the extended DRX parameters information element in 3GPP TS 24.008 table 10 .5.5.32/3GPP TS 24.008 [69]. • SARA-N3 - The factory-programmed value is 3 ("0011").	+CEDRXS, +NPTWEDRXS
<Assigned_paging_time_window>	String	Assigned paging time window value. Half byte in a 4 bit format: the paging time window (PTW) refers to bit 8 to 5 of octet 3 of the extended DRX parameters information element. For the coding and the value range, see the extended DRX parameters information element in 3GPP TS 24.008 table 10.5.5.32/3GPP TS 24.008 [69].	+CEDRXS, +CEDRXRDP, +NPTWEDRXS

5.2 Signal quality +CSQ

+CSQ						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

5.2.1 Description

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

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.

☞ SARA-N3
Set the module to full functionality with the AT+CFUN=1 command before to read the signal strength.

5.2.2 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

5.2.3 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 and LTE RATs. For more details on the RSSI values mapping in LTE RAT, see Notes. • the Received Signal Code Power (RSCP) in UMTS RAT.

Parameter	Type	Description
		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 [140] • In 2G RAT EGPRS packet transfer mode indicates the Mean Bit Error Probability (BEP) of a radio block. 3GPP TS 45.008 [140] 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 [118] 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 [117] 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.

5.2.4 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-N2 / SARA-N3

- Only LTE RAT is supported.
- Table 4 maps the <signal_power> parameter value to the RSSI:

<signal_power>	RSSI of the network
0	RSSI of the network <= -113 dBm
1	-111 dBm
2-30	-109 dBm <= RSSI of the network <= -53 dBm
31	-51 dBm <= RSSI of the network
99	Not detectable

Table 4: <signal_power> parameter mapping to RSSI

SARA-N2

- The <qual> parameter is not supported, and will be always set to 99.

5.3 Extended signal quality +CESQ

+CESQ						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	+CME Error

5.3.1 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.

☞ SARA-N3
Set the module to full functionality with the AT+CFUN=1 command before to read the signal strength.

5.3.2 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

5.3.3 Defined values

Parameter	Type	Description
<rxlev>	Number	Received Signal Strength Indication (RSSI). • SARA-N3 - The allowed range is 0-31 and 99; for more details, see +CSQ AT command.
<ber>	Number	Bit Error Rate (BER): • 0..7: as RXQUAL values in the table in 3GPP TS 45.008 [140], subclause 8.2.4 • 99: not known or not detectable ☞ SARA-N3 For more details, see also +CSQ AT command.
<rscp>	Number	Received Signal Code Power (RSCP): • 0: less than -120 dBm • 1..95: from -120 dBm to -26 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 [118] 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
<rsrq>	Number	Reference Signal Received Quality (RSRQ): • 0: less than -19.5 dB • 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: less than -140 dBm • 1..96: from -140 dBm to -45 dBm with 1 dBm steps • 97: -44 dBm or greater • 255: not known or not detectable

5.3.4 Notes

SARA-N3

- The <rscp> and <ecn0> parameters are not supported.

5.4 Operator selection +COPS

+COPS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	Yes	Up to 3 min	+CME Error

5.4.1 SARA-N3 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.

☞ 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 Cat M1, NB-IoT 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 [102], 3GPP TS 34.121-2 [103], 3GPP TS 36.521-2 [124] and 3GPP TS 36.523-2 [125], 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 set value can be checked with the read command 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.
- **<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 [97]), 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 LTE, hence no PLMN list will be returned at the end of the PLMN scan attempt.

☞ 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 if 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.

5.4.2 SARA-N3 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

5.4.3 SARA-N3 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: • 0: GSM • 3: GSM/GPRS with EDGE availability • 7: LTE • 8: EC-GSM-IoT (A/Gb mode) • 9: E-UTRAN (NB-S1 mode) Allowed values: • SARA-N3 - 9

5.4.4 SARA-N2 Description

Forces an attempt to select and register with the NB-IoT network operator. Through <mode> parameter the network selection can automatically be performed or forced by this 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 [102], 3GPP TS 34.121-2 [103], 3GPP TS 36.521-2 [124] and 3GPP TS 36.523-2 [125], 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?.

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 [97]), 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 LTE, hence no PLMN list will be returned at the end of the PLMN scan attempt.

☞ 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 if overlapping registration and deregistration requests are not handled by the network, and could result in an unpredictable registration state.

5.4.5 SARA-N2 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>] OK	+COPS: 0,0,"vodafone IT" OK
Test	AT+COPS=?	+COPS: [(<stat>, long <oper>, short <oper>, numeric <oper>[,<AcT>])],,(list of supported <mode>s),(list of supported <format>s) OK	+COPS: (1,,,"00101"),,(0-2),(2) OK

5.4.6 SARA-N2 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
<format>	Number	• 2: numeric <oper>
<oper>	String	Given in format <format> this field may be up to 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

5.4.7 Notes

SARA-N3

- The <AcT> parameter is not supported in set command.
- The estimated command response time can be up to 20 minutes.
- The AT command settings are not stored in the NVM/profile.

SARA-N2

- The AT command settings are not stored in the NVM/profile.
- The <oper> parameter is not issued in the information text response to the read command if <mode>=2.
- The test command returns the configured values.

5.5 Display operator name +UDOPN

+UDOPN						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	Up to 1 s	+CME Error

5.5.1 Description

Displays the network name accordingly to the selected <type>:

- If the requested information is not available (e.g. no SIM-files EF_{OPL} and EF_{PNN}), the command displays the network name which is most similar to the requested <type>
- If the requested name is the Service Provider Name (<type>= 7), a null string is displayed if not available
- If EONS names are not available, NITZ names are displayed, if any
- If no NITZ name is available, CPHS names are used
- If no CPHS name is available, ROM PLMN names are displayed
- If no ROM PLMN name matches to the current network, its numeric format (i.e. <type>=0) is returned

☞ The maximum expected response time could request about 1 s if the data are read by the SIM.

5.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDOPN=<type>	+UDOPN: <type>[,<name>[,<display_condition>]] OK	AT+UDOPN=4 +UDOPN: 4,"Main Network" OK
			AT+UDOPN=7 +UDOPN: 7,"SERVICE-PROVIDER",1 OK
			AT+UDOPN=7 +UDOPN: 7,"" OK
Test	AT+UDOPN=?	+UDOPN: (list of supported <type>s) OK	+UDOPN: (0-9) OK

5.5.3 Defined values

Parameter	Type	Description
<type>	Number	Network name format: • 0: numeric format of MCC/MNC network (three BCD digit country code and two/three BCD digit network code) • 1: short name in ROM • 2: long name in ROM • 3: short network operator name (CPHS) • 4: long network operator name (CPHS) • 5: short NITZ name • 6: full NITZ name • 7: service provider name • 8: EONS short operator name • 9: EONS long operator name • 11: short network operator name • 12: long network operator name • 13: numeric format of network MCC/MNC even in limited service Allowed values: • SARA-N3 - 7
<name>	String	• MCC/MNC code for <type>= 0 or 13 • Corresponding network name for <type>= 1, 2, 3, 4, 5, 6, 8, 9, 11 or 12

Parameter	Type	Description
		• Service provider name followed by <display_condition> for <type>=7
<display_condition>	Number	Display condition as stored on SIM for the service provider name in respect to the registered PLMN (see 3GPP TS 51.011 [73] for more details).

5.6 Coverage enhancement status +CRCES

+CRCES						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

5.6.1 Description

Returns the coverage enhancement status of the MT. The DTE can consider the coverage enhancement status prior to deciding to transmit data. Depending on the coverage enhancement status the DTE can refrain from transmitting data.

5.6.2 Syntax

Type	Syntax	Response	Example
Action	AT+CRCES	+CRCES: <AcT>,<CE_level>,<CC> OK	+CRCES: 3,1,0 OK
Test	AT+CRCES=?	+CRCES: (list of supported <AcT>s), (list of supported <CE_level>s),(list of supported <CC>s) OK	+CRCES: (1),(0-4),(0) OK

5.6.3 Defined values

Parameter	Type	Description
<AcT>	Number	Access technology of the serving cell. Allowed values: • 1: E-UTRAN • 3: E-UTRAN (NB-S1 mode). The 3GPP TS 36.331 [120] specifies the System Information blocks which give the information about whether the serving cell supports NB-IoT, which corresponds to E-UTRAN (NB-S1 mode). Allowed values: • SARA-N3 - 3
<CE_level>	Number	Coverage enhancement (CE) level of the MT in the serving cell. For more details about the Coverage Enhancement levels, see the 3GPP TS 36.331 [120]. • 0 (default value): no coverage enhancement in the serving cell • 1: coverage enhancement level 0 • 2: coverage enhancement level 1 • 3: coverage enhancement level 2 • 4: coverage enhancement level 3
<CC>	Number	Coverage class (CC) of the MT in the serving cell. For more details on coverage classes, see the 3GPP TS 43.064 [147]. Allowed values: • 0 (default value): no coverage class in the serving cell

5.7 Network registration status +CREG

+CREG						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	-	+CME Error

5.7.1 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.
- +CREG: <stat>,[<lac>],[<ci>],[<AcTStatus>][,<cause_type>,<reject_cause>] if <n>=3 and the MT registration status (<stat>) changes. The <cause_type> and the <reject_cause> parameters are returned only if the MT is not registered, but it is currently searching a new operator to register to (<stat>=2) or if the registration is denied (<stat>=3).

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 or <n>=3 and the MT is registered with the network. The <cause_type>, <reject_cause> parameters are returned only if <n>=3 and the MT is not registered, but it is currently searching a new operator to register to (<stat>=2) or if the registration is denied (<stat>=3).

☞ 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, where supported, apply to the registration status and location information for those services.

5.7.2 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>][,<cause_type>,<reject_cause>]]]	+CREG: 1,"4E54","44A5"

5.7.3 Defined values

Parameter	Type	Description
<n>	Number	Network registration URC configuration. Allowed values: • 0 (default value and factory-programmed value): network registration URC disabled • 1: network registration URC enabled • 2: network registration and location information URC enabled • 3: network registration and reject cause URC enabled
<stat>	Number	Network registration status. Allowed values: • 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 • 6: registered for "SMS only", home network (applicable only when <AcTStatus> indicates E-UTRAN)

Parameter	Type	Description
		• 7: registered for "SMS only", roaming (applicable only when <AcTStatus> indicates E-UTRAN) • 8: attached for emergency bearer services only (see 3GPP TS 24.008 [69] and 3GPP TS 24.301 [104] that specify the condition when the MS is considered as attached for emergency bearer services) • 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/GPRS with EDGE availability • 4: UTRAN with HSDPA availability • 5: UTRAN with HSUPA availability • 6: UTRAN with HSDPA and HSUPA availability • 7: E-UTRAN • 8: EC-GSM-IoT (A/Gb mode) • 9: E-UTRAN (NB-S1 mode) • 255: the current <AcTStatus> value is invalid Allowed values: • SARA-N3 - 9
<cause_type>	Number	<reject_cause> type. Allowed values: • 0: indicates that <reject_cause> contains an EMM cause value, see 3GPP TS 24.30 1 [104] Annex A
<reject_cause>	Number	Cause of the failed registration. The value is of type as defined by <cause_type>

5.7.4 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 (or 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
- 8: the MT is attached for emergency bearer services only.
- 9: in LTE, the MT is registered only for the SMS circuit-switched service on the HPLMN (or on one of the equivalent HPLMN's). CS fallback is not supported for voice services, therefore if the device is configured as "voice centric" (see +CEMODE) and does not support VoLTE, it will disable LTE and reselect 3G or 2G RAT if supported.
- 10: in LTE, the MT is registered only for the SMS circuit-switched service on a VPLMN, in national or international roaming. CS fallback is not supported for voice services, therefore if the device is configured as "voice centric" (see +CEMODE) and does not support VoLTE, it will disable LTE and reselect 3G or 2G RAT if supported.

SARA-N3

- The PIN insertion is not mandatory before the command execution.
- <n>=3 is not supported.
- The <AcTStatus> parameter is not returned in the URC.
- <stat>=6, 7, 8, 9, 10 are not supported.

5.8 Preferred operator list +CPOL

+CPOL						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 10 s	+CME Error

5.8.1 Description

Edits the user preferred list of networks in the active application on the UICC (GSM or USIM) or preferred list of networks in the SIM card.

☞ SARA-N3
The set command writes an entry in the SIM list of preferred operators ($EF_{PLMNsel}$), when the SIM card is present or when the UICC is present with an active GSM application.

The read command returns all used entries from the SIM list of preferred PLMNs and the Access Technologies for each PLMN in the list where provided.

If a new PLMN is added in a different format than the one previously set, the <format> parameter always switches to the last used.

5.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPOL=[<index>][,<format>[,<oper>[,<GSM_AcT>,<GSM_Compact_AcT>,<UTRAN_AcT>[,<E-UTRAN_AcT>]]]]	OK	AT+CPOL=2,0,"I WIND",1,0,1 OK
Read	AT+CPOL?	+CPOL: <index1>,<format>,<oper1>[,<GSM_AcT1>,<GSM_Compact_AcT1>,<UTRAN_AcT1>[,<E-UTRAN_AcT>]] [+CPOL: <index2>,<format>,<oper2>[,<GSM_AcT2>,<GSM_Compact_AcT2>,<UTRAN_AcT2>[,<E-UTRAN_AcT>]]...] OK	+CPOL: 1,0,"F SFR",1,0,1 +CPOL: 2,0,"TIM I",1,0,1 OK
Test	AT+CPOL=?	+CPOL: (list of supported<index>s),(list of supported <format>s) OK	+CPOL: (1-30),(0-2) OK

5.8.3 Defined values

Parameter	Type	Description
<index> / <indexn>	Number	Represents the order number of operator in the SIM preferred operator list. The parameter range depends on the number of entries in SIM card (i.e. its size), but can be further limited by the module capabilities of the module.
<format>	Number	See also +COPS command description: • 0: long format alphanumeric <oper> • 1: short format alphanumeric <oper> • 2 (default value): numeric <oper>
<oper> / <opern>	String	See also +COPS command description Format indicated by <format>
<GSM_AcT>	Number	GSM access technology. Allowed values: • 0: access technology not selected • 1: access technology selected
<GSM_Compact_AcT>	Number	GSM compact access technology. Allowed values: • 0: access technology not selected • 1: access technology selected
<UTRAN_AcT>	Number	UTRA access technology. Allowed values: • 0: access technology not selected • 1: access technology selected
<E-UTRAN_AcT>	Number	E-UTRAN access technology. Allowed values: • 0: access technology not selected • 1: access technology selected

5.8.4 Notes

SARA-N3

- The <GSM_AcT>, <GSM_Compact_AcT>, <UTRAN_AcT> and <E-UTRAN_AcT> parameters are not supported.
- The <format>=0 and 1 are not supported.

5.9 Select band +UBANDSEL

+UBANDSEL						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM / OP	No	-	+CME Error

5.9.1 Description

Allows switching from the automatic band selection to the selected ones. The set command allows to select:

- SARA-N3 - up to 4 bands.

☞ SARA-N3
To make the setting effective, the module must be deregistered and registered again. (see Notes for the procedure to enter the detach state).

☞ The MT will camp on a cell, if suitable, belonging to one of the selected band; the OK final result code is not related to the result of the camping on the new cell.

☞ 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 [102], 3GPP TS 34.121-2 [103], 3GPP TS 36.521-2 [124] and 3GPP TS 36.523-2 [125], 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.

☞ See the corresponding module data sheet for the bands supported by each module.

5.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+UBANDSEL=<band_1>[,<band_2>[,...]]	OK	AT+UBANDSEL=900 OK
Read	AT+UBANDSEL?	+UBANDSEL: <band_1>[,<band_2>[,...]] OK	+UBANDSEL: 850,900,1800,1900 OK
Test	AT+UBANDSEL=?	+UBANDSEL: (list of supported <band_x>) OK	+UBANDSEL: (0,850,900,1800,1900) OK

5.9.3 Defined values

Parameter	Type	Description
<band_x>	Number	Allowed values: • 0: restore the factory-programmed configuration of the module • 700: selection of 700 MHz band (3G and 4G band 12, band 13, band 17, band 28) • 800: selection of 800 MHz band (3G and 4G band 6, band 19, band 20) • 850: selection of 850 MHz band (3G and 4G band 5) • 900: selection of 900 MHz band (3G and 4G band 8) • 1500: selection of 1500 MHz band (3G and 4G band 11) • 1700: selection of 1700 MHz band (3G and 4G band 4) • 1800: selection of 1800 MHz band (3G and 4G band 3) • 1900: selection of 1900 MHz band (3G and 4G band 2) • 2100: selection of 2100 MHz band (3G and 4G band 1) • 2600: selection of 2600 MHz band (3G and 4G band 7)

5.9.4 Notes

SARA-N3

- Issue the AT+COPS=2 AT command to detach the module from the network.

5.10 Smart jamming detection +UJAD

+UJAD						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	NVM	No	-	+CME Error

5.10.1 Description

The feature consists of detecting, at the application level, an anomalous source of interference or jammer installed in the cellular network and signalling it to the client. The jamming detection shall only be checked when the module is trying to attach and register to the network. The jamming condition occurs when the module fails to attach and an interference is detected (i.e. the band scan reveals radio channels with power levels equal to or higher than a predefined threshold).

The jamming condition is cleared when the above mentioned statement does not hold.

It is recommended to activate the feature while in full cellular functionality (i.e. +CFUN: 1) and in normal service (i.e. if the module is detached via AT+COPS=2, the smart jamming detection algorithm does not start).

If jamming detection is activated, an unsolicited indication is issued when the jamming condition is entered or released.

☞ The maximum time to receive the +UJAD URC is 3 minutes.

☞ The read command returns the <active> value, if and only if jamming detection has been previously enabled.

5.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+UJAD=<op_code>	OK	AT+UJAD=1 OK
Read	AT+UJAD?	+UJAD: <op_code>[,<active>] OK	**If jamming detection disabled:** +UJAD: 0 OK **If jamming detection enabled:** +UJAD: 1,0 OK
Test	AT+UJAD=?	+UJAD: (list of supported <op_code>s) OK	+UJAD: (0-1) OK
URC		+UJAD: <active>	+UJAD: 1

5.10.3 Defined values

Parameter	Type	Description
<op_code>	Number	Jamming detection operation mode. Allowed values: • 0 (default and factory-programmed value): smart jamming detection disabled • 1: smart jamming detection enabled; the +UJAD URC may be generated
<active>	Number	Jamming detection status: • 0: jamming not detected • 1: jamming detected • 2: jamming unknown

5.10.4 Notes

- An error result code is provided when attempting to enable/disable the smart jamming detection when it is already enabled/disabled.

5.11 MNO configuration +UMNOCONF

+UMNOCONF						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	Up to 3 min	+CME Error

5.11.1 Description

Configures the module to automatically comply with the requirements of the Mobile Network Operators.

When the <MNO> parameter is set to China Telecom (CTCC) a manual reboot is required, then it:

- applies the configuration implied by the selected <MNO> value
- triggers the corresponding self-registration

The <reg_time> parameter (only applicable for China Unicom) defines the time to trigger the self-registration.

☞ SARA-N2
Set a valid IP address (by means of the +UCOAPS AT command) before selecting <MNO>=6 or 7.

☞ 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 [102], 3GPP TS 34.121-2 [103], 3GPP TS 36.521-2 [124] and 3GPP TS 36.523-2 [125], 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.

5.11.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMNOCONF=<MNO>[,<reg_time>]	OK	AT+UMNOCONF=6 OK
Read	AT+UMNOCONF?	+UMNOCONF: <MNO>[,<reg_time>] OK	+UMNOCONF: 7,2 OK

5.11.3 Defined values

Parameter	Type	Description
<MNO>	Number	Mobile Network Operator (MNO) configuration. Allowed values: • 0 (default and factory-programmed value): self-registration is disabled • 6: CTCC. The corresponding self-registration is enabled • 7: CUCC. The corresponding self-registration is enabled • 11: CMCC. The corresponding self-registration is enabled
<reg_time>	Number	Configures the registration time value. Allowed values: • 0 (default value): 30 days • 1-10: 1-10 minutes The parameter is mandatory if <MNO>=7 (China Unicom). If the <MNO> parameter is set to different values an error result code will be issued if the <reg_time> parameter is not omitted.

5.11.4 Notes

SARA-N2

- The <reg_time> parameter is not supported by SARA-N200-02B-00, SARA-N201-02B-00, SARA-N210-02B-00, SARA-N211-02X-00, SARA-N280-02B-00.
- <MNO>=11 is not supported.

5.12 Signalling connection status +CSCON

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

5.12.1 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 date. The terminal may think it is "Connected" yet cannot currently use a base station due to a change in the link quality.

☞ SARA-N2
The command setting is not stored in NVM.

☞ SARA-N3
The information text response of the read command always returns the URC configuration and the signaling connection status (corresponding to <n> and <mode> parameters). The state information (<state> parameter) is returned only when module is in connected state and <n>=2 or <n>=3. The radio access technology (<access> parameter) is returned only when module is in connected state and <n>=3

5.12.2 Syntax

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

5.12.3 Defined values

Parameter	Type	Description
<n>	Number	URC configuration: • 0: +CSCON URC disabled • 1: URC +CSCON: <mode> enabled • 2: URC +CSCON: <mode>[,<state>] enabled • 3: URC +CSCON: <mode>[,<state>[,<access>]] enabled Allowed values: • SARA-N3 - 0 (default and factory-programmed value), 1, 2, 3 • SARA-N2 - 0 (default value), 1
<mode>	Number	Indicates the signaling connection status: • 0: idle • 1: connected
<state>	Number	Allowed values: • 0: UTRAN URA_PCH • 1: UTRAN Cell_PCH • 2: UTRAN Cell_FACH • 3: UTRAN Cell_DCH • 4: GERAN CS connected • 5: GERAN PS connected • 6: GERAN CS and PS connected

Parameter	Type	Description
		• 7: E-UTRAN connected
<access>	Number	Indicates the radio access technology: • 4: E-UTRAN FDD

5.12.4 Notes

SARA-N3

- Only <state>=7 is supported.

5.13 Supported bands configuration +NBAND

+NBAND						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

5.13.1 Description

Defines the set of bands to be used.

5.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+NBAND=<n>[,<n>[,<n>[...]]]	OK	AT+NBAND=8,20 OK
Read	AT+NBAND?	+NBAND: <n>[,<n>[,<n>[...]]] OK	+NBAND: 8,20 OK
Test	AT+NBAND=?	+NBAND: (<n>[,<n>[,<n>[...]]]) OK	+NBAND: (8,20) OK

5.13.3 Defined values

Parameter	Type	Description
<n>	Number	LTE band expressed as a decimal number. The allowed values depends on the product and can assume these values: 5, 8, 20 and 28. See the data sheet for the LTE bands supported by each product.

5.14 Specify search frequencies+NEARFCN

+NEARFCN						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

5.14.1 Description

Locks the module to a specific EUTRA Absolute Radio Frequency Channel Number (EARFCN) and optionally the desired Physical Cell ID (PCI).

If the specified PCI is not present, the UE will enter out of service mode.

☞ Setting the <earfcn> parameter to 0, will remove the EARFCN restriction and any associated PCI lock.

5.14.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+NEARFCN=<search_mode>,<param1>[,<param2>[,...]]	OK	
Locks the module to a specific EUTRA			

Type	Syntax	Response	Example
Set	AT+NEARFCN=<search_mode>,<earfcn>,<CI>	OK	AT+NEARFCN=0,10,"ABCD" OK
Test	AT+NEARFCN=?	OK	OK

5.14.3 Defined values

Parameter	Type	Description
<search_mode>	Number	Specifies the type of search and defines the supplied parameters. Allowed value: • 0: single point EARFCN search
<earfcn>	Number	Indicates the EARFCN to search; the range is 0-65535. Setting the parameter to 0, will remove the EARFCN restriction and any associated PCI lock.
<CI>	String	See <CI>

5.15 Clear stored EARFCN +NCSEARFCN

+NCSEARFCN						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	+CME Error

5.15.1 Description

Clears the stored EARFCN.

☞ Put the MT to minimum functionality (by means of AT+CFUN=0) before issuing the command.

5.15.2 Syntax

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

5.15.3 Notes

SARA-N2

- The command is not supported by SARA-N200-02B-00, SARA-N201-02B-00, SARA-N210-02B-00, SARA-N211-02X-00, SARA-N280-02B-00.

5.16 Radio Policy Manager (RPM) activation +URPM

+URPM						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	NVM / OP	No	-	+CME Error

5.16.1 Description

Activates or deactivates the Radio Policy Manager (RPM) feature.

Generally a UE aggressively retries the registration procedure until it is successful and behaves similarly if the PDP context activation procedure fails. This behavior may cause signaling overload and consequently a prolonged network outage. To avoid these scenarios and provide a more efficient access to the network, the RPM feature controls the number of network accesses per service type over a fixed amount of time. For more details on the RPM feature, see GSMA Connection Efficiency [159].

Some network rejection error causes require specific behaviors which the RPM feature does not alter (see the 3GPP TS 24.008 [69]).

5.16.2 Syntax

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

5.16.3 Defined values

Parameter	Type	Description
<mode>	Number	Indicates the action to perform: • 0 (factory-programmed value): RPM feature deactivated • 1: RPM feature activated The factory-programmed value depends on the series module: • SARA-N3 - 0

5.17 Radio Policy Manager (RPM) configuration +URPMCONF

+URPMCONF						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

5.17.1 Description

Configures the Radio Policy Manager (RPM) related parameters.

The parameters are grouped in different sets:

- **Current RPM configuration**: the parameters can only be read
- **Default RPM parameter setting stored in the module**: the parameters can only be read

5.17.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+URPMCONF=<op_code>,.....	OK	
PLMN SIM card based check configuration			
• SARA-N3			
Read	AT+URPMCONF?	+URPMCONF: 0,<PLMN>,<PLMN>,<PLMN>,<PLMN>,<PLMN> +URPMCONF: 1,<RPM_active>,<SIM_RPM_setting>,<N1>,<T1>,<F1>,<F2>,<F3>,<F4>,<LR1>,<LR2>,<LR3> +URPMCONF: 2,<RPM_enabled_flag_m>,<N1_m>,<T1_m>,<F1_m>,<F2_m>,<F3_m>,<F4_m> OK	+URPMCONF: 0,"222.88","","123.456","987.65","222.10" +URPMCONF: 1,0,0,0,0,0,0,0,0,0,0,0 +URPMCONF: 2,1,20,60,60,30,60,30 OK
Test	AT+URPMCONF=?	+URPMCONF: (list of the supported <op_code>s) OK	+URPMCONF: (0) OK

5.17.3 Defined values

Parameter	Type	Description
<op_code>	Number	Type of operation:

Parameter	Type	Description
		• 0: PLMN SIM card based check configuration • 1: current RPM configuration
<PLMN>	String	PLMN in MCC.MNC format. "FFF.FF" indicates empty PLMN; the range goes from 000.00 to 999.999. The factory-programmed value is empty.
<RPM_active>	Number	Indicates the action to perform: • 0: RPM feature is currently not active • 1: RPM feature is currently active
<SIM_RPM_setting>	Number	Indicates whether the inserted SIM card contains RPM parameter setting: • 0: the inserted SIM card does not contain the RPM parameter setting • 1: the inserted SIM card contains the RPM parameter setting
<N1>,<T1>,<F1>,<F2>,<F3>,<F4>,<LR1>,<LR2>,<LR3>	Number	See the Radio Policy Manager Requirements [159].
<RPM_enabled_flag_m>,<N1_m>,<T1_m>,<F1_m>,<F2_m>,<F3_m>,<F4_m>	Number	Default RPM parameter setting stored in the module. See the Radio Policy Manager Requirements [159].

5.18 eDRX setting +CEDRXS

+CEDRXS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM / OP	No	-	+CME Error

5.18.1 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 cycle and paging time window values for each specified type of radio access technology.

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.

The read command returns the requested eDRX cycle and paging time window values. See the +CEDRXP URC and the +CEDRXRDP AT command to see if eDRX is enabled by the network and retrieve the values assigned by the network.

The parameters are omitted in the information text response to the read command when the eDRX is not enabled on any RAT.

☞ SARA-N2 / SARA-N3
The set command is applied runtime if the parameters are changed with respect to the previously saved values.

5.18.2 Syntax

Type	Syntax	Response	Example
Set	AT+CEDRXS=[<mode>[,<AcT_type>[,<Requested_eDRX_cycle>[,<Requested_paging_time_window>]]]]	OK	AT+CEDRXS=1,4,"0101","0101" OK
Read	AT+CEDRXS?	+CEDRXS: [<AcT_type>,<Requested_eDRX_cycle>,<Requested_paging_time_window> [...] [+CEDRXS: <AcT_type>,<Requested_eDRX_cycle>,	+CEDRXS: 4,"0101","0001" OK

Type	Syntax	Response	Example
		<Requested_paging_time_window>]] OK	
Test	AT+CEDRXS=?	+CEDRXS: (list of supported <mode>s),(list of supported <AcT_type>s),(list of supported <Requested_eDRX_cycle>s),(list of supported <Requested_paging_time_window>s) OK	+CEDRXS: (0-3),(3,4,5),("0000"-"1111"),("0000"-"1111") OK
URC		+CEDRXP: <AcT_type>[,<Requested_eDRX_cycle>[,<Assigned_eDRX_cycle>[,<Assigned_paging_time_window>]]]	+CEDRXP: 4,"1010","1001","1101"

5.18.3 Defined values

Parameter	Type	Description
<mode>	Number	Indication to disable or enable the use of eDRX in the UE. Allowed values: • 0 (default and factory-programmed value): use of eDRX disabled • 1: use of eDRX enabled • 2: enable the use of eDRX and enable the +CEDRXP 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: • 2: GPRS/eGPRS • 4: E-UTRAN (WB-S1 mode) • 5: E-UTRAN (NB-S1 mode) Allowed values: • SARA-N2 - 5 • SARA-N3 - 5 (default value)
<Requested_eDRX_cycle>	String	See <Requested_eDRX_cycle>.
<Assigned_eDRX_cycle>	String	See <Assigned_eDRX_cycle>.
<Requested_paging_time_window>	String	See <Requested_paging_time_window>.
<Assigned_paging_time_window>	String	See <Assigned_paging_time_window>.

5.18.4 Notes

SARA-N2

- The PIN insertion is not mandatory. The command setting is not stored in the NVM.
- The <mode> and <AcT_type> parameters are mandatory in set command.
- The <Requested_paging_time_window> parameter cannot be set by means of the set command and it is not supported in the read and in the test command. Use the +NPTWEDRXS AT command to set the <Requested_paging_time_window> parameter. Use the +CEDRXP URC, the +CEDRXRDP AT command, the +NPTWEDRXS AT command or the +NPTWEDRXP URC to retrieve the <Requested_eDRX_cycle>, the <Assigned_eDRX_cycle_value> and the <Assigned_paging_time_window>.

SARA-N3

- The PIN insertion is not mandatory before the command execution.

5.19 eDRX read dynamic parameters +CEDRXRDP

+CEDRXRDP						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

5.19.1 Description

Provides the information if eDRX is enabled by the network or not. If the eDRX is enabled by the network, the command also provides the requested eDRX cycle value to be allocated to the UE (<Requested_eDRX_cycle>), the assigned eDRX cycle value (<Assigned_eDRX_cycle>) and the assigned paging time window value (<Assigned_paging_time_window>) for the latest valid radio access technology (<AcT_type>). If the eDRX is disabled, the +CEDRXRDP: 0 information text response is returned.

5.19.2 Syntax

Type	Syntax	Response	Example
Action	AT+CEDRXRDP	+CEDRXRDP: <AcT_type>[, <Requested_eDRX_cycle>, <Assigned_eDRX_cycle_value>, <Assigned_paging_time_window>] OK	+CEDRXRDP: 5,"0010","1110","0101" OK
Test	AT+CEDRXRDP=?	OK	

5.19.3 Defined values

Parameter	Type	Description
<AcT_type>	Number	Indicates the type of radio access technology: • 0: use of eDRX disabled • 2: GSM (A/Gb mode) • 4: E-UTRAN (WB-S1 mode) • 5: E-UTRAN (NB-S1 mode) Allowed values: • SARA-N2 / SARA-N3 - 0, 5
<Requested_eDRX_cycle>	String	See <Requested_eDRX_cycle>.
<Assigned_eDRX_cycle>	String	See <Assigned_eDRX_cycle>.
<Assigned_paging_time_window>	String	See <Assigned_paging_time_window>.

5.20 Paging time window value and eDRX setting +NPTWEDRXS

+NPTWEDRXS						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

5.20.1 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 cycle and paging time window values for each specified type of radio access technology.

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

The read command returns the requested values. See the +NPTWEDRXP URC, the +CEDRXP URC and the +CEDRXRDP AT command to see if eDRX is enabled by the network and get the values assigned values, if eDRX is enabled by the network.

☞ <Assigned_eDRX_cycle> and <Assigned_paging_time_window> are not issued in the read command if they are not set by the network.

5.20.2 Syntax

Type	Syntax	Response	Example
Set	AT+NPTWEDRXS=<mode>[,<AcT_type>[,<Requested_paging_time_window>[,<Requested_eDRX_cycle>]]]	OK	AT+NPTWEDRXS=1,5,"1110","0101" OK
Read	AT+NPTWEDRXS?	[+NPTWEDRXS: <AcT_type>, <Requested_paging_time_window>, <Requested_eDRX_cycle> [...] [+NPTWEDRXS: <AcT_type>, <Requested_paging_time_window>, <Requested_eDRX_cycle>]] OK	+NPTWEDRXS: 5,"1110","0101" OK
Test	AT+NPTWEDRXS=?	+NPTWEDRXS: (list of supported <mode>s),(list of supported <AcT_type>s),(list of supported <Requested_paging_time_window>s),(list of supported <Requested_eDRX_cycle>s) OK	+NPTWEDRXS: (0-3),(5),("0000"-"1111"),("0000"-"1111") OK
URC		+NPTWEDRXP: <AcT_type>[,<Requested_paging_time_window>[,<Requested_eDRX_cycle>[,<Assigned_eDRX_cycle>[,<Assigned_paging_time_window>]]]]	+NPTWEDRXP: 5,"1010","1001","1101","1011"

5.20.3 Defined values

Parameter	Type	Description
<mode>	Number	Indication to disable or enable the use of eDRX in the UE. Allowed values: • 0 (default value): use of eDRX disabled • 1: use of requested paging time window and eDRX enabled • 2: enable the use of requested paging time window and eDRX and enable the +NPTWEDRXP URC • 3: disable the use of requested paging time window and eDRX and reset all parameters to factory-programmed values
<AcT_type>	Number	Indicates the type of access technology. Allowed values: • 5 (default value): E-UTRAN (NB-S1 mode)
<Requested_paging_time_window>	String	See <Requested_paging_time_window>.
<Requested_eDRX_cycle>	String	See <Requested_eDRX_cycle>.
<Assigned_eDRX_cycle>	String	See <Assigned_eDRX_cycle>.
<Assigned_paging_time_window>	String	See <Assigned_paging_time_window>.

5.20.4 Notes

- If <mode>=0 and the other parameters are omitted, then the <Requested_Paging_time_window> or <Requested_eDRX_cycle> parameters are set to invalid values like 0x00.

5.21 Power class configuration +NPOWERCLASS

+NPOWERCLASS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

5.21.1 Description

Configures the mapping for band and power class. The read command list all mapping of bands and power class.

☞ See the corresponding data sheet for the bands supported by each module.

☞ SARA-N3
Power class configuration for a specified band is not supported, so configured power class will be applied to the camped band internally.

5.21.2 SARA-N2 Syntax

Type	Syntax	Response	Example
Set	AT+NPOWERCLASS=<band>,<power_class>	OK	AT+NPOWERCLASS=8,5 OK
Read	AT+NPOWERCLASS?	+NPOWERCLASS: <band>,<power_class> [[...] [+NPOWERCLASS: <band>,<power_class>]] OK	+NPOWERCLASS: 8,5 OK
Test	AT+NPOWERCLASS=?	+NPOWERCLASS: (list of supported <band>s),(list of supported <power_class>es) OK	+NPOWERCLASS: (5,8,20,28),(3,5) OK

5.21.3 SARA-N3 Syntax

Type	Syntax	Response	Example
Set	AT+NPOWERCLASS=<power_class>	OK	AT+NPOWERCLASS=5 OK
Read	AT+NPOWERCLASS?	+NPOWERCLASS: <power_class> OK	+NPOWERCLASS: 5 OK
Test	AT+NPOWERCLASS=?	+NPOWERCLASS: (list of supported <power_class>es) OK	+NPOWERCLASS: (3,5,6) OK

5.21.4 Defined values

Parameter	Type	Description
<band>	Number	Band expressed as a decimal number. Only the bands supported by the interested module are allowed.
<power_class>	Number	Power class expressed as a decimal number. For details see the 3GPP TS 36.101 [112] subclause 6.2.2F. The allowed values are: • SARA-N3 - 3, 5, 6. The factory-programmed value is 3. • SARA-N2 - 3, 5. The factory-programmed value is 3.

5.22 CIoT parameter configuration +CFGCIOT

+CFGCIOT						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

5.22.1 Description

Configures and queries the Cellular IoT (CIoT) parameters.

5.22.2 Syntax

Type	Syntax	Response	Example
Set	AT+CFGCIOT=<nonip>[,<cpciot>[,<upciot>[,<erwopdn>[,<sms_wocomb_att>[,<apn_rate_control>[,<epco>[,<cpbackoff>[,<roam>[,<nasrai>]]]]]]]]]	OK	AT+CFGCIOT=1,1,1 OK
Read	AT+CFGCIOT?	+CFGCIOT: <nonip>,<cpciot>,<upciot>,<erwopdn>,<sms_wocomb_att>,<apn_rate_control>,<epco>,<cpbackoff>,<roam>,<nasrai> OK	+CFGCIOT: 1,1,2,1,1,0,1,0,1,1 OK
Test	AT+CFGCIOT=?	+CFGCIOT: (list of supported <nonip>s),(list of supported <cpciot>s),(list of supported <upciot>s),(list of supported <erwopdn>s),(list of supported <sms_wocomb_att>s),(list of supported <apn_rate_control>s),(list of supported <epco>s),(list of supported <cpbackoff>s),(list of supported <roam>s),(list of supported <nasrai>s) OK	+CFGCIOT: (0,1),(0,1),(0-3),(0-2),(0,1),(0,1),(0,1),(0,1),(0,1),(0,1) OK

5.22.3 Defined values

Parameter	Type	Description
<nonip>	Number	Disables or enables the use of NonIP. Allowed values: • 0: use of NonIP disabled • 1 (factory-programmed value): use of NonIP enabled
<cpciot>	Number	Disables or enables the use of Control Plane (CP) CIoT. Allowed values: • 0: disable the use of CP CIoT (because NB-IoT must support CP CIoT, so configuring this value will be ignored) • 1 (factory-programmed value): enable the use of CP CIoT
<upciot>	Number	Configures whether the User Plane (UP) CIoT feature is supported and preferred. Allowed values: • 0: do not support S1uData and UP CIoT • 1: support S1uData, not support UP CIoT • 2 (factory-programmed value): supports but does not optimize UP CIoT (CP mode is preferred for PDN services that can use both CP and UP) • 3: supports and optimizes UP CIoT (preferred UP method for PDN business that can use both CP and UP) ☞ About: <upciot>=2 and <upciot>=3 is the preference for UP CIoT, which affects: • the EMM indicates prefer in the Additionupdatetypeie which way • for the PDN business where CP and UP can be used, RABM takes precedence over which way
<erwopdn>	Number	Configures whether the ERwoPDN is supported and preferred. Allowed values: • 0: do not support ERwoPDN

Parameter	Type	Description
		• 1 (factory-programmed value): supports but does not optimize ERwoPDN (attach process necessarily carries PDN) • 2: support and optimize ERwoPDN (when attach process can not carry PDN, do not carry PDN)
<sms_wocomb_att>	Number	Configures whether the SmsWithoutCombinedAttach is supported. Allowed values: • 0: do not support SmsWithoutCombinedAttach • 1 (factory-programmed value): support SmsWithoutCombinedAttach
<apn_rate_control>	Number	Configures whether the APN rate control is supported. Allowed values: • 0 (factory-programmed value): do not support APN rate control • 1: support APN rate control
<epco>	Number	Configures whether the ePCO is supported. Allowed values: • 0: do not support ePCO • 1 (factory-programmed value): support ePCO ☞ For NB-IoT, the ePCO must be used in accordance with the Protocol, but the actual test found that some vendor protocol versions are older and do not support ePCO, so add the configuration entry.
<cpbackoff>	Number	Configures whether the control plane back-off is supported. Allowed values: • 0 (factory-programmed value): CP back-off not supported • 1: CP back-off supported
<roam>	Number	Configures whether the roam is supported. Allowed values: • 0: roam not supported • 1 (factory-programmed value): roam supported
<nasrai>	Number	Configures whether the NAS RAI is supported. Allowed values: • 0 (factory-programmed value): NAS RAI not supported • 1: NAS RAI supported

5.23 CIoT optimization configuration +CCIOTOPT

+CCIOTOPT						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM / OP	No	-	+CME Error

5.23.1 Description

Configures and queries which Cellular IoT (CIoT) EPS optimizations the UE indicates as supported and preferred in the ATTACH and TRACKING AREA UPDATE requests. The command also allows reporting of the CIoT EPS optimizations that are supported by the network.

The set command enables the +CCIOTOPTI URC, that is issued to indicate the supported CIoT EPS optimizations by the network.

5.23.2 Syntax

Type	Syntax	Response	Example
Set	AT+CCIOTOPT=<n>[,<supported_UE_opt>[,<preferred_UE_opt>]]	OK	AT+CCIOTOPT=1,2,1 OK
Read	AT+CCIOTOPT?	+CCIOTOPT: <n>,<supported_UE_opt>,<preferred_UE_opt> OK	+CCIOTOPT: 0,3,1 OK
Test	AT+CCIOTOPT=?	+CCIOTOPT: (list of supported <n>s),(list of supported <supported_UE_opt>s),(list of supported <preferred_UE_opt>s) OK	+CCIOTOPT: (0,1,3),(0-3),(0-2) OK
URC		+CCIOTOPTI: <supported_Network_opt>	+CCIOTOPTI: 1

5.23.3 Defined values

Parameter	Type	Description
<n>	Number	Enables or disables reporting of the +CCIOTOPTI URC. • 0: disable reporting • 1: enable reporting • 3: disable reporting and reset the parameters for CIoT EPS optimization to the factory-programmed values Allowed values: • SARA-N3 - 0 (factory-programmed value), 1, 3
<supported_UE_opt>	Number	Indicates the UE's support for CIoT EPS optimizations: • 0: no support. Neither control plane nor user plane optimizations are supported • 1: support for control plane CIoT EPS optimization • 2: support for user plane CIoT EPS optimization • 3 (factory-programmed value): support for both control plane CIoT EPS optimization and user plane CIoT EPS optimization Allowed values: • SARA-N3 - 1, 3 (factory-programmed value). Since NB-IoT must support CP CIoT the parameter configuration to 0 or 2 will be ignored.
<preferred_UE_opt>	Number	Indicates the UE's preference for CIoT EPS optimizations. Allowed values: • 0: no preference • 1: preference for control plane CIoT EPS optimization • 2: preference for user plane CIoT EPS optimization (it takes effect only if the support for user plane CIoT is configured) • SARA-N3 - The factory-programmed value is 1.
<supported_Network_opt>	Number	Indicates the network support for CIoT EPS optimizations. Allowed values: • 0: no support • 1: support for control plane CIoT EPS optimization • 2: support for user plane CIoT EPS optimization • 3: support for both control plane CIoT EPS optimization and user plane CIoT EPS optimization

5.23.4 Notes

SARA-N3

- The <preferred_UE_opt>=0 (no preference) is not supported.

5.24 RSRP offset setting +NVSETRSRPOFFSET

+NVSETRSRPOFFSET						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

5.24.1 Description

Configures and queries the Reference Signal Received Power (RSRP) offset.

5.24.2 Syntax

Type	Syntax	Response	Example
Set	AT+NVSETRSRPOFFSET=<offset>	OK	AT+NVSETRSRPOFFSET=50 OK
Read	AT+NVSETRSRPOFFSET?	+NVSETRSRPOFFSET: <offset> OK	+NVSETRSRPOFFSET: 70 OK
Test	AT+NVSETRSRPOFFSET=?	+NVSETRSRPOFFSET: (list of supported <offset>s) OK	+NVSETRSRPOFFSET: (0-100) OK

5.24.3 Defined values

Parameter	Type	Description
<offset>	Number	RSRP offset value: the range goes from 0 (corresponding to an RSRP offset of -50) to 100 (corresponding to an RSRP offset of 50). The factory-programmed value is 50.

5.25 RRC connection release waiting time setting +NVSETRRCRLSTIMER10

+NVSETRRCRLSTIMER10						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	NVM	No	-	+CME Error

5.25.1 Description

Configures and reads the RRC connection release waiting time.

5.25.2 Syntax

Type	Syntax	Response	Example
Set	AT+NVSETRRCRLSTIMER10=<value>	OK	AT+NVSETRRCRLSTIMER10=1 OK
Read	AT+NVSETRRCRLSTIMER10?	+NVSETRRCRLSTIMER10: <value> OK	+NVSETRRCRLSTIMER10: 1 OK
Test	AT+NVSETRRCRLSTIMER10=?	+NVSETRRCRLSTIMER10: (list of supported <value>s) OK	+NVSETRRCRLSTIMER10: (0-1) OK

5.25.3 Defined values

Parameter	Type	Description
<value>	Number	Indicates the timer value in seconds. Allowed values: • 0 (default and factory-programmed value): 1 s • 1: 10 s

5.26 Coverage enhancement levels setting +UECLS

+UECLS						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	NVM	No	-	+CME Error

5.26.1 Description

Configures and queries the coverage enhancement level of the MT.

5.26.2 Syntax

Type	Syntax	Response	Example
Set	AT+UECLS=<CE_level>	OK	AT+UECLS=1 OK
Read	AT+UECLS?	+UECLS: <CE_level> OK	+UECLS: 1 OK
Test	AT+UECLS=?	+UECLS: list of supported <CE_level>s) OK	+UECLS: (0-3) OK

5.26.3 Defined values

Parameter	Type	Description
<CE_level>	Number	Coverage enhancement (CE) level of the MT in the serving cell. For more details about the Coverage enhancement levels, see the 3GPP TS 36.331 [120]. Allowed values: • 0 (default and factory-programmed value): no coverage enhancement in the serving cell • 1: coverage enhancement level 0 • 2: coverage enhancement level 1 • 3: coverage enhancement level 2

6 Device lock

6.1 Enter PIN +CPIN

+CPIN						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

6.1.1 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.

6.1.2 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	

6.1.3 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

6.1.4 Notes

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

Command	Response
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 +CPWD AT command for details). Example:

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

SARA-N3

- After changing PIN (by means of +CPWD), the module requires to insert the PIN if the PIN1 request is active and the PIN has not been yet inserted.

6.2 PIN operator +NPIN

+NPIN						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

6.2.1 Description

Allows the user to change, verify, enable, disable or unlock the PIN. A URC is issued at each successful operation.

If the PIN is enabled, the PIN insertion is mandatory to set the MT to the full functionality (by means of AT +CFUN=1).

☞ SIM PIN, SIM PUK refer to the PIN of the selected application on the UICC. For example, in a UTRAN context, the selected application on the currently selected UICC should be a USIM and the SIM PIN then represents the PIN of the selected USIM. See 3GPP TS 31.101 [108] for further details on application selection on the UICC.

6.2.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+NPIN=<command>,<parameter1>[,<parameter2>]	OK	AT+NPIN=0,29563248 OK
PIN verification			
Set	AT+NPIN=0,<pin>	OK	AT+NPIN=0,"56783140" OK
PIN change			
Set	AT+NPIN=1,<old_pin>,<new_pin>	OK	AT+NPIN=1,"56783140","67519023" OK
PIN enabling			
Set	AT+NPIN=2,<pin>	OK	AT+NPIN=2,"56783140" OK
PIN disabling			
Set	AT+NPIN=3,<pin>	OK	AT+NPIN=3,"56783140" OK
PIN unlock			
Set	AT+NPIN=4,<puk>,<pin>	OK	AT+NPIN=4,"98204815","56783140" OK
URC		+NPIN: <npin_result>	+NPIN: "OK"

6.2.3 Defined values

Parameter	Type	Description
<command>	Number	Operation to be applied on the PIN. Allowed values: • 0: PIN verification • 1: PIN change • 2: PIN enabling • 3: PIN disabling • 4: PIN unlock
<pin>, <old_pin>, <new_pin>	String	Personal Identification Number. The parameter length goes from 4 to 8 characters.

Parameter	Type	Description
<puk>	String	Personal Unblocking Key. The parameter length goes from 4 to 8 characters.
<npin_result>	String	Result types regarding the PIN operation. The operation result is provided by means of the corresponding URC: • "OK" • "ERROR PIN disabled" • "ERROR PIN blocked" • "ERROR wrong PIN <pin_retries_remaining>" • "ERROR wrong format" • "ERROR"
<pin_retries_remaining>	Number	Remaining PIN retries. If no retries are left, then the PIN will be blocked.

6.2.4 Notes

- Power on the MT (by means of AT+CFUN=1) before issuing the command.

6.3 Read remaining SIM PIN attempts +UPINCNT

+UPINCNT						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

6.3.1 Description

Reads the remaining attempts for SIM PIN, SIM PIN2, SIM PUK, SIM PUK2 and some <lock_type>s.

6.3.2 Syntax

Type	Syntax	Response	Example
Action	AT+UPINCNT	+UPINCNT: <PIN_attempts>,<PIN2_attempts>,<PUK_attempts>,<PUK2_attempts> OK	+UPINCNT: 3,3,10,10 OK
Set	AT+UPINCNT=<lock_type>	+UPINCNT: <lock_type>,<Attempts_left>,<Timer_Penalty> OK	AT+UPINCNT=1 +UPINCNT: 1,3,0 OK
Test	AT+UPINCNT=?	[+UPINCNT: (list of supported <lock_type>s)] OK	OK

6.3.3 Defined values

Parameter	Type	Description
<PIN_attempts>	Number	Number of remaining attempts to enter PIN
<PIN2_attempts>	Number	Number of remaining attempts to enter PIN2
<PUK_attempts>	Number	Number of remaining attempts to enter PUK
<PUK2_attempts>	Number	Number of remaining attempts to enter PUK2
<lock_type>	Number	Allowed values: • 1: request number of remaining attempts to enter for PIN 1 • 2: request number of remaining attempts to enter for PIN 2 • 3: request number of remaining attempts to enter for PUK 1 • 4: request number of remaining attempts to enter for PUK 2 • 5: request number of remaining attempts to enter for Network Operator Lock • 6: request number of remaining attempts to enter for Network-Subset Lock • 7: request number of remaining attempts to enter for Service Provider Lock • 8: request number of remaining attempts to enter for Corporate lock • 9: request number of remaining attempts to enter for IMSI lock

Parameter	Type	Description
<Attempts_left>	Number	Number of attempts left before blocked (0 means blocked, or not used)
<Timer_Penalty>	Number	Provides the time in minutes to wait before the possible next tries

6.3.4 Notes

- The PIN insertion is not mandatory in the action command and in the set command for <PIN_attempts>= 1, 2, 3, 4.

SARA-N3

- The set command is not supported.
- The information text response to the test command is not provided.

6.4 Facility lock +CLCK

+CLCK						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 3 min	+CME Error

6.4.1 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.

6.4.2 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

6.4.3 Defined values

Parameter	Type	Description
<fac>	String	Facility values. Allowed values (for the applicability to the module see Table 5): • "SC": SIM (PIN enabled/disabled) • "PN": Network Personalisation (see the 3GPP TS 22.022 [77]) • "PU": network sUbset Personalisation (see the 3GPP TS 22.022 [77]) • "PP": service Provider Personalisation (see the 3GPP TS 22.022 [77]) • "PC": Corporate Personalisation (see the 3GPP TS 22.022 [77]) • "PS": SIM/USIM Personalisation (see the 3GPP TS 22.022 [77]) • "FD": SIM fixed dialling phonebook feature

Parameter	Type	Description
		o SARA-N3 - PIN2 is required if the PIN2 authentication has not been done during the current session • "AO": BAR (Bar All Outgoing Calls) • "OI": BOIC (Bar Outgoing International Calls) • "OX": BOIC-exHC(Bar Outgoing International Calls except to Home Country) • "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 [60]) • "PF": Lock Phone to the very First inserted SIM/UICC card (see the 3GPP TS 27.007 [60]) • "NT": Barr incoming calls from numbers Not stored to TA memory (see the 3GPP TS 27.007 [60]) • "NM": Barr incoming calls from numbers Not stored to MT memory (see 3GPP TS 27.007 [60]) • "NS": Barr incoming calls from numbers Not stored to SIM/UICC memory (see the 3GPP TS 27.007 [60]) • "NA": Barr incoming calls from numbers Not stored in any memory (see the 3GPP TS 27.007 [60])
<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

6.4.4 Notes

Module series	SC	PN	PU	PP	PC	PS	FD	AO	OI	OX	AI	IR	AB	AG	AC	CS	PF	NT	NM	NS	NA
SARA-N3	x						x														

Table 5: Lock applicability (<fac> allowed values)

6.5 Change password +CPWD

+CPWD						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 3 min	+CME Error

6.5.1 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.

6.5.2 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

6.5.3 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)

6.5.4 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.

SARA-N3

- Only <fac>="SC" and "P2" are supported.

7 Short Messages Service

7.1 Introduction

For a complete overview of SMS, see 3GPP TS 23.040 [65] and 3GPP TS 27.005 [71].

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

7.1.1 Class 0 SMS

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

- SARA-N3 - all incoming SMSes stored in <mem3> (preferred memory for storing the received SMS, see +CPMS) with increasing index.
- SARA-N2 - not stored.

7.1.2 <index> parameter range

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

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

- SARA-N3
  - Values between 1 and 100: SMS stored in ME.
  - Values between 1 and n: SMS stored in SIM (n depends on SIM card used).
- SARA-N2 - SMS storage is not supported.

BM (Broadcast Message):

- SARA-N2 / SARA-N3 - Broadcast Message storage is not supported.

SR (Status Report):

- SARA-N2 / SARA-N3 - Status Report storage is not supported.

7.1.3 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.

7.2 Select message service +CSMS

+CSMS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CMS Error

7.2.1 Description

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

☞ SARA-N2

The command setting is stored in the NVM following the procedure in the Saving AT commands configuration section.

☞ SARA-N3
The command setting is stored in the profile following the procedure in the Saving AT commands configuration section.

☞ SARA-N2
The +CMT URC is issued on the reception of the SMS messages. For more details, see the +CMGC AT command.

7.2.2 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

7.2.3 Defined values

Parameter	Type	Description
<service>	Number	Allowed values: • 0: see 3GPP TS 23.040 [65] and 3GPP TS 23.041 [66]; syntax of AT commands is compatible with 3GPP TS 27.005 [71] phase 2; phase 2+ features may be supported if no new command syntax is required • 1: see 3GPP TS 23.040 [65] and 3GPP TS 23.041 [66]; syntax of AT commands is compatible with 3GPP TS 27.005 [71] phase 2+ ☞ SARA-N2 / SARA-N3 The factory-programmed value is 0.
<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

7.3 Preferred message storage +CPMS

+CPMS						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	partial	Yes	NVM	No	Up to 3 min	+CMS Error

7.3.1 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.

7.3.2 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 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

7.3.3 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>

7.3.4 Notes

- SARA-N3 - the factory-programmed value is "SM", "SM" and "ME".

SARA-N3

- The parameters setting is stored in the personal profile following the procedure described in the Saving AT commands configuration section.

7.4 Preferred message format +CMGF

+CMGF						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	Profile	No	-	+CMS Error

7.4.1 Description

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

7.4.2 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

7.4.3 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

7.5 Show text mode parameters +CSDH

+CSDH						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CMS Error

7.5.1 Description

Controls whether detailed SMS header information is shown in text mode (see the AT+CMGF=1 command).

This affects the responses of the +CMGR, +CMGL, +CSMP, +CSCA AT commands and the +CMT, +CMTI, +CDS, +CDSI, +CBM, +CBMI (see +CNMI) URCs.

7.5.2 Syntax

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

7.5.3 Defined values

Parameter	Type	Description
<show>	Number	Allowed values: • 0 (default): do not show detailed SMS header information • 1: show detailed SMS header information

7.6 New message indication +CNMI

+CNMI						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	Profile	No	-	+CMS Error

7.6.1 Description

Selects the procedure to indicate the reception of a new SMS if 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 [64].

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).

7.6.2 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: <oa>,[<alpha>],<scts>[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>]<CR><LF><data>	+CMT: "+393475234652",,"14/11/21,11:58:23+01" 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>	

7.6.3 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 • 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: 0391214301000381 66F6000004E374F80D: 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 [65] TP-User-Data in text mode responses; format:

Parameter	Type	Description
		• if <dcs> indicates that 3GPP TS 23.038 [64] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS command in 3GPP TS 27.007 [60]): 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: 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 [66] CBM Content of Message in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [64] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS in 3GPP TS 27.007 [60]): 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 [66]
<pages>	Number	CBM Page Parameter bits 0-3 in integer format as described in 3GPP TS 23.041 [66]
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [65])
<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: • 0: octet, unspecified • 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

7.6.4 Notes

SARA-N3

- <mode> = 3 is not supported.
- The <bfr> parameter is not supported.
- <bm>=1 and 3 are not supported.
- <ds>=2 is not supported.
- The +UCMT URC is not supported.
- 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

7.7 Read message +CMGR

+CMGR						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	<10 s	+CMS Error

7.7.1 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 AT+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.

7.7.2 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",,"07/04/05,18:02:28+08",145,4,0,0,"+393492000466",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	

Type	Syntax	Response	Example
		+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 0791934329002000040C91932309826614000080703280452180 18D4F29CFE06B5CBF379F87C4EBF41E434082E7FDBC3 OK
Test	AT+CMGR=?	OK	

7.7.3 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 [69]. 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 [65])
<pid>	Number	TP-Protocol-Identifier (default 0); see the 3GPP TS 23.040 [65]
<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 [69]); 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 0391214301000381 66F6000004E374F80D: 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 [65] TP-User-Data in text mode responses; format:
		• if <dcs> indicates that 3GPP TS 23.038 [64] 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 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: 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 [66] CBM Content of Message in text mode responses; format:
		• if <dcs> indicates that 3GPP TS 23.038 [64] 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

Parameter	Type	Description
		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 [65] • 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 [65]); 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
<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 [65] TP-Message-Number in integer format
<cdata>	String	TP-Command-Data in text mode responses
<sn>	Number	CBM serial number
<mid>	Number	CBM message identifier
<page>	Number	3GPP TS 23.041 [66] CBM Page Parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [66] 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)

<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

7.7.4 Notes

SARA-N2

- Only PDU mode (+CMGF: 0) is supported.

SARA-N3

- The <alpha> and <scts> parameters are not supported.

7.8 New message acknowledgement to MT +CNMA

+CNMA						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	< 150 s	+CMS Error

7.8.1 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 [70] 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 +CMS ERROR: <err> error result code 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.

7.8.2 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

7.8.3 Defined values

Parameter	Type	Description
<n>	Number	Allowed values: • 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 [65] TP-FCS value set to 'FF' (unspecified error cause))
<length>	Number	PDU's length in octets without the Service Center's address

7.8.4 Notes

SARA-N2

- Only PDU mode is supported.
- <n>=0 is not supported.
- +CNMI is not supported.
- The <length> range goes from 0 to 232.

7.9 List message +CMGL

+CMGL						
Modules	SARA-N3					
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

7.9.1 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".

7.9.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGL[=<stat>]	**Command successful and SMS-DELIVERs:**	AT+CMGL

Type	Syntax	Response	Example
		+CMGL: <index>,<stat>,<oa>,[<alpha>],[<scts>][,<tooa>,<length>] <data> [+CMGL: <index>,<stat>,<oa>,[<alpha>],[<scts>][,<tooa>,<length>]<data>[...]] OK	+CMGL: 303,"REC READ","+39340 1234999",,"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): AT+CMGL[=<stat>]	**Command successful:** +CMGL: <index>,<stat>,[<alpha>],<length> <pdu> [+CMGL: <index>,<stat>,[<alpha>],<length>] <pdu> [...]	AT+CMGL=1 +CMGL: 305,1,,57 079193432900 1185440ED0D637396C7EBBCB0 000909092708024802A050 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

7.9.3 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

Parameter	Type	Description
		• 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 [69]. 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 0391214301000381 66F6000004E374F80D: 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 [65]; format:
		• if DCS indicates that 3GPP TS 23.038 [64] 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 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: 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 [66] CBM Content of Message in text mode responses; format:
		• if DCS indicates that 3GPP TS 23.038 [64] 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
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [65])
<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 [66] CBM Page Parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [66] 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

7.10 Send message +CMGS

+CMGS						
Modules	All products					
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

7.10.1 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.

☞ SARA-N2
The +CMT URC is issued on the reception of the SMS messages. For more details, see the +CMGC AT command.

7.10.2 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> > 039121430100038166F6000004E374F80D<Ctrl-Z> +CMGS: 2 OK
Test	AT+CMGS=?	OK	

7.10.3 Defined values

Parameter	Type	Description
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<text>	String	SMS String
<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 [65] RP-User-Data element of RP-ACK PDU; the format is same as for <PDU> in case of SMS

7.10.4 Notes

SARA-N2

- Only the PDU mode is supported.

- The <ackpdu> parameter is not issued in the information text response to the set command.
- The <length> range goes from 7 to 220.

SARA-N3

- Long short messages are not supported.
- The <toda> parameter can only be set to 161, 145 or 129.

7.11 Write message to memory +CMGW

+CMGW						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	<10 s	+CMS Error

7.11.1 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.

7.11.2 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> > 039121430100038166F600000 4E374F80D<Ctrl-Z> +CMGW: 303 OK
Test	AT+CMGW=?	OK	

7.11.3 Defined values

Parameter	Type	Description
<da>	String	TP-Destination-Address Address-Value field (see the 3GPP TS 23.040 [65]); 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 [65]); 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 <tooa>
<tooa>	Number	TP-Originating-Address Type-of-Address octet (see the 3GPP TS 24.011 [70]); see the <toda> parameter for the default value
<toda>	Number	TP-Destination-Address Type-of-Address octet (see the 3GPP TS 24.011 [70]); 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

Parameter	Type	Description
<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: 03912143010003816 6F6000004E374F80D 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)

7.11.4 Notes

SARA-N3

- Long messages are not supported.
- The <toda> parameter can only be set to 161, 145 or 129.
- In PDU mode set the <stat> parameter to 0 or 1 to write the MT message.

7.12 Send message from storage +CMSS

+CMSS						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	Up to 3 min	+CMS Error

7.12.1 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.

7.12.2 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	

7.12.3 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

7.13 Set text mode parameters +CSMP

+CSMP						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	+CSAS	No	< 10 s	+CMS Error

7.13.1 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 [64] and the 3GPP TS 23.040 [65].

☞ SARA-N3
The command setting is stored in the profile following the procedure in the Saving AT commands configuration section.

7.13.2 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	

7.13.3 Defined values

Parameter	Type	Description
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [65])
<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 [65]

<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 [65]); 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 [65]
<dcs>	Number	Data Coding Scheme. The default value is 0

7.13.4 Notes

SARA-N3

- The <fo> parameter can only be set to 17.
- The <dcs> parameter can only be set to 0, 4 or 8.

7.14 Delete message +CMGD

+CMGD						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 55 s	+CMS Error

7.14.1 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>.

☞ 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.

☞ SARA-N3
When deleting a message from an empty location, the module returns the "OK" final result code.

7.14.2 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

7.14.3 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

7.14.4 Notes

SARA-N3

- The "MT" memory entries cannot be deleted.

7.15 Service center address +CSCA

+CSCA						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	+CSAS	No	< 10 s	+CMS Error

7.15.1 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-N2

The command setting is stored in the NVM following the procedure described in the Saving AT commands configuration section.

☞ SARA-N3
The command setting is stored in the profile following the procedure in the Saving AT commands configuration section.

7.15.2 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	

7.15.3 Defined values

Parameter	Type	Description
<sca>	String	Service center address. ☞ SARA-N2 / SARA-N3 The factory-programmed value is an empty string.
<tosca>	String	Type of address of <sca> (for more details refer to 3GPP TS 24.008 [69]); the default value is 145 when string includes '+', otherwise the default is 129. ☞ SARA-N2 / SARA-N3 The factory-programmed value is 0 (undefined).

7.15.4 Notes

SARA-N2 / SARA-N3

- The <tosca> parameter is an octet in integer format.

7.16 Send SMS command +CMGC

+CMGC						
Modules	SARA-N2					
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

7.16.1 Description

Sends a command 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 network supports) the <ackpdu> parameter 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 PDU is preceded by a ">" (Greater-Than sign) character, and this indicates that the interface is in "PDU enter" mode. The DCD signal shall be in ON state while the PDU is entered.

☞ The +CMT URC is issued on the reception of the SMS messages.

7.16.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGC=<fo>,<ct>[,<pid>[,<mn>[,<da>[,<toda>]]]]<CR> > text is entered<Ctrl-Z/ESC>	+CMGC: <mr>[,<scts>] OK	AT+CMGC=17,0<CR> > This is the text<Ctrl-Z> +CMGC: 20 OK

Type	Syntax	Response	Example
	PDU mode (+CMGF=0): AT+CMGC=<length><CR> > <PDU> is given<Ctrl-Z/ESC>	+CMGC: <mr>[,<ackpdu>] OK	AT+CMGC=13<CR> > 039121430100038166F6000004E374F80D<Ctrl-Z> +CMGC: 2 OK
Test	AT+CMGC=?	OK	
URC		+CMT: [<alpha>], <length><CR><LF><pdu>	

7.16.3 Defined values

Parameter	Type	Description
<mr>	Number	Message reference
<length>	Number	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 [65] RP-User-Data element of RP-ACK PDU; format is same as for <PDU> in case of SMS.
<alpha>	String	Alphanumeric representation of destination or originating address. See the 3GPP TS 27.005 [71].
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [65])
<ct>	Number	TP-Command-Type (default value: 0)
<pid>	Number	TP-Protocol-Identifier (default value: 0); see the 3GPP TS 23.040 [65]
<mn>	Number	See the 3GPP TS 23.040 [65] TP-Message-Number in integer format
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet

7.16.4 Notes

SARA-N2

- The text mode is not supported.
- The <ackpdu> parameter is not returned in the response to the set command.
- The range of <length> parameter goes from 8 to 220.

7.17 Sending of originating data via the control plane +CSODCP

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

7.17.1 Description

Transmits data via the 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 [104] 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

7.17.2 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),(0-2),(0,1) OK

7.17.3 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: each 8-bit octet of the <cpdata> 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). The <cpdata> format is specified in 3GPP TS 24.301 [104] subclause 9.9.4.24. When there is no data to transmit, the <cpdata> shall be an empty string (""). This parameter shall not be subject to conventional character conversion as per the +CSCS AT command.
<RAI>	Number	Indicates the value of the release assistance indication (see the 3GPP TS 24.301 [104] subclause 9.9.4.25). Allowed values: • 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

7.17.4 Notes

SARA-N2

- Only one message will be buffered at a time.

7.18 Terminating data reporting via control plane +CRTDCP

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

7.18.1 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.

7.18.2 Syntax

Type	Syntax	Response	Example
Set	AT+CRTDCP=<reporting>	OK	AT+CRTDCP=1 OK
Read	AT+CRTDCP?	+CRTDCP: <reporting> OK	+CRTDCP: 1 OK

Type	Syntax	Response	Example
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: 0,1,"ab"

7.18.3 Defined values

Parameter	Type	Description
<reporting>	Number	Allowed values: • 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 [104] subclause 9.9.4.24)

8 V24 control and V25ter

8.1 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).

8.2 Flow control &K

&K						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

8.2.1 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

☞ SARA-N3
Enable the "Hardware flow control (RTS, CTS)" functionality (by means of the +UGPIOC AT command, <gpio_mode>=26) before enabling the HW flow control.

8.2.2 Syntax

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

8.2.3 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

8.2.4 Notes

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

SARA-N3

- <value>=4,5 and 6 are not supported.
- The default and factory-programmed value for <value> is 0.

8.3 DTE-DCE character framing +ICF

+ICF						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	Profile	No	-	+CME Error

8.3.1 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

8.3.2 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

8.3.3 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

8.3.4 Notes

SARA-N3

- The PIN insertion is not mandatory before the command execution.
- <format>=0 is not supported.
- The default and factory-programmed values are <format>= 3 and <parity>= 1.

8.4 UART data rate configuration +IPR

+IPR						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

8.4.1 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.

SARA-N3
When supported, the autobauding feature allows baud rate recognition by the DCE when it operates in command mode.

SARA-N3
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.

8.4.2 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

8.4.3 Defined values

Parameter	Type	Description
<rate>	Number	Allowed baud rates expressed in b/s (0, if present, means autobauding): • SARA-N3 - 0 (default and factory-programmed value), 2400, 4800, 9600, 19200, 38400, 57600

8.4.4 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.

8.4.5 Autobauding description

SARA-N3

The following notes related to autobauding must be reminded:

- At the module power on the autobauding can be by default enabled (necessary to program the stored AT profile with the baud rate parameter set to 0) or set with the AT+IPR=0 command if the DCE started with a fixed rate
- Autobauding values which can be discovered are the same of the fixing case i.e. 2400, 4800, 9600, 19200, 38400, 57600 b/s. AT commands provided with a baud rate other than values declared, cannot be properly acquired and recognized by the module
- To synchronize the UART interface, issue the first AT command with the "AT" string in uppercase
- Characters different than AT are ignored during the baud rate detection since the hardware detection sequence is triggered on the "AT" sequence. "At" or "aT" sequences are invalid too, both of the detection characters must be capital
- Power saving is exited at the 'A' character of the autobauding sequence; the power save state is re-entered again when the power saving timeout is elapsed, regardless if the baud detection is complete or not. The 'T' character does not reset the power saving timer; as a result if the detection completion character is sent outside power save condition, it does not force to stay out of power saving state for the number of frames of power saving timer
- The autobauding result can be unpredictable with spurious characters if the power saving is entered and the flow control is disabled (AT&K0). If the hardware flow control is present, the DTE can be synchronized with the power saving cycle through the module CTS line i.e. the delivery of the "AT" sequence during the module awake can be granted by the DTE and the power saving can be exited in the proper way. It is recommended to disable the power saving if no hardware flow control is used
- If the automatic baud rate detection is active, the greeting text or URCs before baud rate detection are not sent. The greeting text is sent at the specified baud rate only when the baud rate setting in the profile is other than autobauding
- <rate>=0 does not affect the +ICF AT command (character framing configuration).

8.5 Return to on-line data state O

O						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

8.5.1 Description

Causes the DCE to return to online data state and issue a CONNECT intermediate result code on DTE.

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.

☞ SARA-N3
It is the complementary command to the escape sequence, or to the other actions that cause the DCE to switch from online data state to online command state.

8.5.2 Syntax

Type	Syntax	Response	Example
Action	ATO	<response>	ATO CONNECT

8.5.3 Defined values

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

8.5.4 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).

8.6 Escape character S2

S2						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

8.6.1 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. "+++".

8.6.2 Syntax

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

8.6.3 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 '+').

8.7 Command line termination character S3

S3						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	Profile	No	-	+CME Error

8.7.1 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.

8.7.2 Syntax

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

8.7.3 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)).

8.7.4 Notes

SARA-N3

- The PIN insertion is not mandatory before the command execution.
- The <value> parameter range goes from 0 to 31.

8.8 Response formatting character S4

S4						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	Profile	No	-	+CME Error

8.8.1 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.

8.8.2 Syntax

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

8.8.3 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)).

8.8.4 Notes

SARA-N3

- The PIN insertion is not mandatory before the command execution.
- The <value> parameter range goes from 0 to 31.

8.9 Command line editing character S5

S5						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	Profile	No	-	+CME Error

8.9.1 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.

8.9.2 Syntax

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

8.9.3 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)).

8.9.4 Notes

SARA-N3

- The PIN insertion is not mandatory before the command execution.
- The <value> parameter range goes from 0 to 31.

8.10 Command echo E

E						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

8.10.1 Description

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

8.10.2 Syntax

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

8.10.3 Defined values

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

8.11 Result code suppression Q

Q						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

8.11.1 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.

8.11.2 Syntax

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

8.11.3 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

8.12 DCE response format V

V						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

8.12.1 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.

8.12.2 Syntax

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

8.12.3 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

8.13 Reset to default configuration Z

Z						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

8.13.1 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.

☞ SARA-N3
For more details on the settings stored in the profiles, see the Appendix B.1.

8.13.2 Syntax

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

8.13.3 Defined values

Parameter	Type	Description
<value>	Number	Profile index, optional parameter. Allowed values: • SARA-N3 - 0 (default value)

8.14 Set to factory defined configuration &F

&F						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

8.14.1 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-programmed profile. The other DCE settings are applied after the response has been sent.

☞ SARA-N3
For more details on the settings stored in the profiles, see the Parameters stored in profiles.

8.14.2 Syntax

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

8.14.3 Defined values

Parameter	Type	Description
<value>	Number	Only 0 allowed

8.15 Store current configuration &W

&W						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

8.15.1 Description

Stores into one of the two RAM profile mirrors the current AT configuration of the DCE interface in which the command is issued. The profile is selected according to the AT command parameter value. For more details on the AT command configuration saved in the profiles, refer to Appendix B.1.

The profile is updated with the RAM mirror only when the module is switched off using the +CPWROFF AT command.

8.15.2 Syntax

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

8.15.3 Defined values

Parameter	Type	Description
<value>	Number	• 0 (default value): selects profile 0 • 1: selects profile 1

8.15.4 Notes

SARA-N3

- Only <value>= 0 (default profile 0) is supported.

8.16 Display current configuration &V

&V						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

8.16.1 Description

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

☞ SARA-N3
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.

8.16.2 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	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,

Type	Syntax	Response	Example
		OK	+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 1: &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 OK

8.16.3 Notes

SARA-N3

- Only the ACTIVE PROFILE is displayed. The AT command does not show STORED PROFILE 0 or STORED PROFILE 1.

8.17 Configure AT UART baud rate +NATSPEED

+NATSPEED						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

8.17.1 Description

Configures the baud rate at which the DCE accepts AT commands on the UART interface.

8.17.2 Syntax

Type	Syntax	Response	Example
Set	AT+NATSPEED=<baud_rate>[,<timeout>[,<store>[,<sync_mode>[,<stop_bits>]]]]	OK	AT+NATSPEED=9600,3,1,2,1 OK
Read	AT+NATSPEED?	+NATSPEED: <baud_rate>,<sync_mode>,<stop_bits> OK	+NATSPEED: 9600,2,1 OK
Test	AT+NATSPEED=?	+NATSPEED: (list of supported <baud rate>s),(list of supported <timeout>s),(list of supported <store>s),(list of supported <sync_mode>s),(list of supported <stop_bits>s) OK	+NATSPEED: (4800,9600,57600,115200),(0-30),(0,1),(0-3),(1,2) OK

8.17.3 Defined values

Parameter	Type	Description
<baud_rate>	Number	Requested AT UART baud rate expressed in b/s: • The factory-programmed value is 9600. • Allowed <baud_rate> values are 4800, 9600, 57600, 115200.
<timeout>	Number	Indicates the time to wait for communication before switching back to the original speed: • Range: 0-30 s. • The default value is 3 s. • If <timeout>=0 the default value will be used
<store>	Number	Enable the <baud_rate>, <sync_mode> and <stop_bits> parameters storing in NVM:

Parameter	Type	Description
		• 0 (default value): do not store to NVM • 1: store to NVM
<sync_mode>	Number	The low power UART synchronizes to each start bit that it detects and uses this to configure its optimum sampling point for each subsequent bit in a data word. The <sync_mode> parameter allows this sampling point to be modified when needed: • 0: no sampling offset • 1: sample later • 2 (factory-programmed and default value): sample earlier • 3: sample even earlier
<stop_bits>	Number	Low power UART stop-bits. Allowed values: • 1 (factory-programmed and default value): 1 stop bit • 2: 2 stop bits

8.17.4 Notes

SARA-N2

- Setting the <baud_rate> greater than the fastest speed (9600 b/s) supported by the Low Power UART will disable Deep Sleep Low Power Operation.

9 SIM management

9.1 Generic SIM access +CSIM

+CSIM						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

9.1.1 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.

9.1.2 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

9.1.3 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 [73] and ETSI TS 102 221 [152]
<response>	String	Response to the command passed on by the SIM to the MT (3GPP TS 51.011 [73] and ETSI TS 102 221 [152])

9.2 Restricted SIM access +CRSM

+CRSM						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	< 10 s	+CME Error

9.2.1 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.

9.2.2 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

9.2.3 Defined values

Parameter	Type	Description
<command>	Number	Allowed values: • 176: read binary • 178: read record • 192: get response • 214: update binary • 220: update record • 242: status • 203: retrieve data • 219: set data
<fileid>	Number	Identifies an elementary datafile on SIM. Mandatory for each command except STATUS (e.g. 28423: meaning IMSI file (6F07)). For a complete description of Elementary Files (EF), see 3GPP TS 31.102 [74].
<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 [73] and ETSI TS 102 221 [152].
<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 [152] (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 [152].
<sw1>, <sw2>	Number	Contains SIM information about the execution of the actual command and can be (more details in 3GPP TS 51.011 [73] and ETSI TS 102 221 [152]). Status words examples for 2G SIM cards: • 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 • 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 Status words examples for 3G SIM cards: • 0x90 0x00: normal ending of the command

Parameter	Type	Description
		• 0x91 0xXX: length XX of the response data • 0x63 0xCX: command successful but after using an internal retry routine X times • 0x62 0x00: no information given, state of non volatile memory unchanged • 0x64 0x00: no information given, state of non-volatile memory unchanged • 0x65 0x00: no information given, state of non-volatile memory changed • 0x65 0x81: memory problem • 0x67 0x00: wrong length • 0x69 0x85: conditions of use not satisfied • 0x69 0x86: command not allowed (no EF selected) • 0x69 0x82: security status not satisfied • 0x62 0x81: part of returned data may be corrupted • 0x6A 0x81: function not supported • 0x6A 0x82: file not found • 0x6A 0x83: record not found • 0x6B 0x00: wrong parameter(s) P1, P2 • 0x6D 0x00: instruction code not supported or invalid • 0x6E 0x00: instruction code not supported or invalid • 0x6F 0x00: technical problem, no precise diagnosis
<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 [73] and the ETSI TS 102 221 [152]). 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.

9.2.4 Notes

SARA-N3

- <command>=203 and 219 are not supported.

9.3 Open logical channel +CCHO

+CCHO						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

9.3.1 Description

Causes the MT to return <sessionid> to allow the TE to identify a channel that is being allocated by the currently selected UICC, which is attached to ME. The currently selected UICC will open a new logical channel, select the application identified by the <dfname> received with this command and return a session Id as the response. The ME shall restrict the communication between the TE and the UICC to this logical channel.

When the maximum number of logical channels have been opened (normally 3, 2 when the IMS client is active), the command provides an error result code.

☞ SARA-N3
The <sessionid> is to be used when sending commands with +CGLA AT command.

9.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+CCHO=<dfname>	+CCHO: <sessionid> OK	AT+CCHO="A000000087100 4FF49FF0589" +CCHO: 11791 OK
Test	AT+CCHO=?	OK	

9.3.3 Defined values

Parameter	Type	Description
<dfname>	Number	DF name, coded on 1 to 16 bytes, identifying the UICC application.
<sessionid>	Number	Session Id to be used to target a specific application on the smart card using logical channel mechanism.

9.4 Close logical channel +CCHC

+CCHC						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

9.4.1 Description

Asks the ME to close a communication session with the active UICC. The ME shall close the previously opened logical channel. The TE will no longer be able to send commands on this logical channel. The UICC will close the logical channel when receiving this command.

9.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+CCHC=<sessionid>	+CCHC OK	AT+CCHC=11791 +CCHC OK
Test	AT+CCHC=?	OK	

9.4.3 Defined values

Parameter	Type	Description
<sessionid>	Number	Session Id to be used to target a specific application on the smart card using logical channel mechanism.

9.5 Generic UICC logical channel access +CGLA

+CGLA						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

9.5.1 Description

Transmits to the MT the <command> that shall be sent as it is to the selected UICC. In the same manner the UICC <response> shall be sent back by the MT to the TA as it is.

The command allows a direct control of the currently selected UICC by an application on the TE. The TE shall then take care of processing UICC information within the frame specified by GSM/UMTS networks.

Although the command allows the TE to take control over the UICC-MT interface, there are some functions of the UICC-MT interface that logically do not need to be accessed from outside the TA/MT. Moreover, for security reason the GSM network authentication should not be handled outside the TA/MT.

☞ SARA-N3
The +CGLA allows the TE to take more control over the UICC-MT interface. The locking and unlocking of the interface may be done by a special <command> value or automatically by TA/MT (by interpreting <command> parameter). If the TE application does not use the unlock command (or does not send a <command> causing automatic unlock) in a certain timeout value, the MT may release the locking.

9.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGLA=<sessionid>,<length>,<command>	+CGLA: <length>,<response> OK	
Test	AT+CGLA=?	OK	

9.5.3 Defined values

Parameter	Type	Description
<sessionid>	Number	Identifier of the session to be used to send the APDU commands to the UICC. It is mandatory to send the commands to the UICC when targeting applications on the smart card using a logical channel other than the default channel (channel "0").
<length>	Number	Length of the characters that are sent to TE in <command> or <response> (two times the actual length of the command or response)
<command>	String	Command passed on by the MT to the UICC in the format as described in 3GPP TS 31.101 [108] (hexadecimal character format; see +CSCS AT command)
<response>	String	Response to the command passed on by the UICC to the MT in the format as described in 3GPP TS 31.101 [108] (hexadecimal character format; see +CSCS AT command)

9.6 Reads EF files on (U)SIM +CRSML

+CRSML						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

9.6.1 Description

Reads some linear fixed EF files records stored on the (U)SIM.

9.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+CRSML=<fileid>,<start_record>,<count>	+CRSML: <sw1>,<sw2>,<response> OK	AT+CRSML=28474,1,1 +CRSML: 144,0,"989301770020594178F2" OK
Test	AT+CRSML=?	OK	OK

9.6.3 Defined values

Parameter	Type	Description
<fileid>	Number	Identifies an elementary data file on SIM. Mandatory for each command except STATUS (e.g. 28423: meaning IMSI file (6F07)). For a complete description of Elementary Files (EF), see 3GPP TS 31.102 [74].
<start_record>	Number	Indicates the starting index of record.
<count>	Number	Indicates the required number of records.
<sw1>, <sw2>	Number	Contains SIM information about the execution of the actual command and can be (more details in 3GPP TS 51.011 [73] and ETSI TS 102 221 [152]). Status words examples for 2G SIM cards: • 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

Parameter	Type	Description
		• 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 • 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 Status words examples for 3G SIM cards: • 0x90 0x00: normal ending of the command • 0x91 0xXX: length XX of the response data • 0x63 0xCX: command successful but after using an internal retry routine X times • 0x62 0x00: no information given, state of non volatile memory unchanged • 0x64 0x00: no information given, state of non-volatile memory unchanged • 0x65 0x00: no information given, state of non-volatile memory changed • 0x65 0x81: memory problem • 0x67 0x00: wrong length • 0x69 0x85: conditions of use not satisfied • 0x69 0x86: command not allowed (no EF selected) • 0x69 0x82: security status not satisfied • 0x62 0x81: part of returned data may be corrupted • 0x6A 0x81: function not supported • 0x6A 0x82: file not found • 0x6A 0x83: record not found • 0x6B 0x00: wrong parameter(s) P1, P2 • 0x6D 0x00: instruction code not supported or invalid • 0x6E 0x00: instruction code not supported or invalid • 0x6F 0x00: technical problem, no precise diagnosis
<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 [73] and the ETSI TS 102 221 [152]). 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.

10 Packet switched data services

10.1 PDP contexts and parameter definition

10.1.1 Primary and secondary PDP contexts

☞ SARA-N2 / SARA-N3
Primary and secondary PDP contexts are not supported.

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 [67].

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.

10.1.2 Multiple PDP contexts

☞ SARA-N2 / SARA-N3
The section does not apply to this module series.

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 an internal PDP context is supported. This IP instance supports up to 7 sockets;
- The sum of active external and internal PDP contexts cannot exceed the maximum number of active PDP contexts indicated in the <cid> parameter description;
- Using external PDP contexts via dial-up, it is usually possible to have at most 3 PPP instances simultaneously active.

10.1.3 Parameter definition

10.1.3.1 <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:

- SARA-N2 - 99 characters (the maximum length of coded APN is 100 octets, see 3GPP TS 23.003 [126], subclause 9.1)
- SARA-N3 - 50 characters

10.1.3.2 <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-N2	10	1
SARA-N3	7	1

☞ SARA-N2
The 7th <cid> is by default reserved to Bearer Independent Protocol (BIP). To define the <cid>=7 through AT+CGDCONT, disable the BIP flag by means of the +NCONFIG AT command (<function>="ENABLE_BIP" set to FALSE) and reboot the module.

☞ SARA-N3
The <cid> range goes from 1 to 7.

10.1.3.3 <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"

10.1.3.4 <PDP_type>

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

- "IP": 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 [104])
- "IPV6": Internet Protocol, version 6 (see RFC 2460 [161])

☞ SARA-N2
<PDP_type>="IPV4V6" and "IPV6" are not supported.

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

10.2 PPP LCP handshake behavior

SARA-N2
PPP is not supported.

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 behavior of module series differ between them.

SARA-N3
The data call can be initiated also by the +CGDATA AT command setting "PPP" as <L2P> protocol.

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.

SARA-N3
By default the module starts PPP in silent mode, waiting the first LCP packet coming from the TE. If a valid LCP packet is received the module continues the LCP handshake by its side, otherwise it remains in wait state. If the module is in wait state, it is possible to make it switch back to the AT command mode toggling the DTR line.

It is possible to disable the PPP silent mode by means of the +UDCONF=0 command. When the silent mode is disabled, the module will start sending the LCP configuration packets (up to 10 retries every 6 s) just after the CONNECT intermediate result code. If no valid LCP response packet is received from the TE, the module will act like in silent mode.

10.3 PDP context definition +CGDCONT

+CGDCONT						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	NVM / OP	No	-	+CME Error

10.3.1 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 [67] 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.

The information text response to the read command provides the configuration of all the PDP context / EPS bearers that have already been defined. The test command returns a different row for each <PDP_type> value supported by the module.

SARA-N3
PDP type and APN are ignored for the automatic attach procedure when an initial PDP context activation is enabled by means of +CIPCA AT command. So the PDP type and APN can be configured through +CFGDFTPDN AT command.

10.3.2 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**

Type	Syntax	Response	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: <cid>,<PDP_type>,<APN>,<PDP_addr>,<d_comp>,<h_comp>[,<IPv4AddrAlloc>,<emergency_indication>[,<P-CSCF_discovery>,<IM_CN_Signalling_Flag_Ind>[,<NSLPI>]]]] OK	+CGDCONT: 1,"IP","web.omnitel.it","91.80.140.199",0,0,0 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)]]] [+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) +CGDCONT: (1-3),"IPV6",,,(0-2),(0-4) OK

10.3.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>. The default value is 1.
<PDP_type>	String	See <PDP_type>. The default value is "IP".
<APN>	String	See <APN>. The default value is "" (blank APN).
<PDP_addr>	Number	See <PDP_addr>. The default value is "0.0.0.0"
<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 • 3: V.44
<h_comp>	Number	PDP header compression; it can have the values: • 0 (default value): off • 1: on (predefined compression type, i.e. RFC1144)

Parameter	Type	Description
		• 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
<request_type>	Number	Indicates the type of PDP context activation request for the PDP context: • 0: PDP context is for new PDP context establishment or for handover from a non-3GPP access network (how the MT decides whether the PDP context is for new PDP context establishment or for handover is implementation specific) • 1: PDP context is for emergency bearer services • 2 (default value): PDP context is for new PDP context establishment • 3: PDP context is for handover from a non-3GPP access network
<P-CSCF_discovery>	Number	Influences how the MT/TA requests to get the P-CSCF address, see 3GPP TS 24.229 [115] 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 [104] and 3GPP TS 24.008 [69].
<secure_PCO>	Number	Specifies if security protected transmission of PCO is requested or not (applicable for EPS only): • 0 (default value): Security protected transmission of PCO is not requested. • 1: Security protected transmission of PCO is requested.
<IPv4_MTU_discovery>	Number	Influences how the MT/TA requests to get the IPv4 MTU size: • 0 (default value): Preference of IPv4 MTU size discovery not influenced by +CGDCONT. • 1: Preference of IPv4 MTU size discovery through NAS signalling.
<Local_Addr_Ind>	Number	Indicates to the network whether or not the MS supports local IP address in TFTs: • 0 (default value): indicates that the MS does not support local IP address in TFTs. • 1: indicates that the MS supports local IP address in TFTs.
<Non_IP_MTU_discovery>	Number	Influences how the MT/TA requests to get the Non-IP MTU size (for more details, see 3GPP TS 24.008 [69]): • 0 (default value): preference of Non-IP MTU size discovery not influenced by +CGDCONT. • 1: preference of Non-IP MTU size discovery through NAS signalling.

10.3.4 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)	Test command

Command	Response	Description
	OK	
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","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-N2

- The context's setting is not permanently stored in NVM.
- <PDP_addr>, <d_comp>, <h_comp>, <IPv4AddrAlloc>, <emergency_indication>, <P-CSCF_discovery> and <IM_CN_Signalling_Flag_Ind> parameters are not supported.
- <cid>=0 is read only and is only defined when AUTOCONNECT is enabled.

SARA-N3

- When registering in LTE, the initial default EPS bearer is mapped to <cid>= 1 and by default it is configured as follows:
  - <APN>=""
  - <PDP_addr>="0.0.0.0"
  - <PDP_type>="IP"
- <IPv4AddrAlloc>, <emergency_indication>, <P-CSCF_discovery> and <IM_CN_Signalling_Flag_Ind> parameters are not supported.

10.4 Packet switched data configuration +UPSD

+UPSD						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	+UPSDA	No	-	+CME Error

10.4.1 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.

10.4.2 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>...	AT+UPSD=0 +UPSD: 0,0,0 +UPSD: 0,1,"apn.provider.com"

Type	Syntax	Response	Example
		+UPSD: <profile_id>,x,<param_valx>	+UPSD: 0,2,"username"
		OK	+UPSD: 0,4,"0.0.0.0"
			...
			+UPSD: 0,19,0
			OK

10.4.3 Defined values

Parameter	Type	Description
<profile_id>	Number	PSD profile identifier. Allowed values: • SARA-N3 - 0-6
<param_tag>	Number	Allowed values: • 0: protocol type - the allowed values of <param_val> parameter are: o 0 (default 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 default value is an empty string. • 2: username - <param_val> is the user name text string for the authentication phase. The default value is an empty string. The maximum length is 64 characters. • 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. The maximum length is 64 characters. • 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 default 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 default value is "0.0.0.0". • 6: authentication - the <param_val> parameter selects the authentication type: o 0 (default 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 default 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 (default value): off o 1: predefined, i.e. V.42bis o 2: V.42bis • 9: header compression - the <param_val> parameter refers to the default parameter named <h_comp> and selects the header compression type: o 0 (default value): off o 1: predefined, i.e. RFC1144 o 2: RFC1144 o 3: RFC2507 o 4: RFC3095 • 100: map the +UPSD profile to the specified <cid> in the +CGDCONT table. o 0: map the current profile to <cid> 0 (where supported) or to the default bearer PDP ID o 1: map the current profile to <cid> 1

Parameter	Type	Description
		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: map the current profile to <cid> 8 Allowed values: • SARA-N3 - 0, 1, 2, 3, 6, 7, 8, 9, 100

10.4.4 Notes

SARA-N3

- If <param_tag>=1 (APN) the maximum length of the <param_val> parameter is 50.
- If <param_tag>=6 (authentication) <param_val>=3 (automatic selection of authentication type) is not supported.
- If <param_tag>=100 (profile to <cid> mapping) the <param_val> parameter range goes from 1 to 7 and the default value is 1.

10.5 Packet switched data action +UPSDA

+UPSDA						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	Yes	Up to 3 min	+CME Error

10.5.1 Description

Performs the requested action for the specified PSD profile.

The command can be aborted. When a PDP context activation (<action>=3) or a PDP context deactivation (<action>=4) is aborted, the +UUPSDA URC is provided. The <result> parameter indicates the operation result. Until this operation is not completed, another set command cannot be issued.

The +UUPSDD URC is raised when the data connection related to the provided PSD profile is deactivated either explicitly by the network (e.g. due to prolonged idle time) or locally by the module after a failed PS registration procedure (e.g. due to roaming) or a user required detach (e.g. triggered by AT+COPS=2) or user required PDP context deactivation (e.g. triggered by AT+UPSDA=0,4).

10.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UPSDA=<profile_id>,<action>	OK	AT+UPSDA=2,1 OK
URC		+UUPSDD: <profile_id>	
URC		+UUPSDA: <result>[,<ip_addr>]	

10.5.3 Defined values

Parameter	Type	Description
<profile_id>	Number	PSD profile identifier, in range 0-6
<action>	Number	• 0: reset; it clears the specified profile resetting all the parameters to their factory-programmed values • 1: store; it saves all the parameters in NVM • 2: load: it reads all the parameters from NVM • 3: activate; it activates a PDP context with the specified profile, using the current parameters • 4: deactivate; it deactivates the PDP context associated with the specified profile
<result>	Number	• 0: action successful

Parameter	Type	Description
		• Different values mean an unsuccessful action (the codes are listed in the Appendix A.1)
<ip_addr>	String	The IP address assigned to the activated PDP context.

10.5.4 Notes

- Only one profile can be activated at the same time. The PDP context activation on more than one profile at the same time is not supported.
- The number of PDP contexts defined with AT+CGDCONT plus the number of contexts activated with +UPSDA cannot exceed three. Any further request to define a context with AT+CGDCONT or to activate a context with +UPSDA generates an error result code.
- In case of remote deactivation of the PDP context associated with a PSD profile, the URC is sent to the TE to inform the user, otherwise the user should deactivate the PDP context after the usage.
- In case of PDP deactivation (triggered by either network or the user) all the sockets that have been created will automatically be closed.

SARA-N3

- The +UUPSDD URC is not supported.

10.6 GPRS attach or detach +CGATT

+CGATT						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 3 min	+CME Error

10.6.1 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 if 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.

☞ The deregistration action is carried out even if the command is aborted.

10.6.2 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

10.6.3 Defined values

Parameter	Type	Description
<state>	Number	Indicates the state of GPRS attachment: • 0: detached

Parameter	Type	Description
		• 1 (default value): attached

10.6.4 Notes

SARA-N2

- When <state> = 1 is selected, an automatic network registration (+COPS=0) is automatically triggered.
- Further issuing of the +CGATT AT command prior to the completion of the previous +CGATT AT command will provide an error result code.

10.7 PDP context activate or deactivate +CGACT

+CGACT						
Modules	All products					
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

10.7.1 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 deactivation action is carried out even if the command is aborted.

10.7.2 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> [...]]] OK	+CGACT: 1,1 OK
Test	AT+CGACT=?	+CGACT: (list of supported <status>s) OK	+CGACT: (0-1) OK

10.7.3 Defined values

Parameter	Type	Description
<status>	Number	Indicates the state of PDP context activation: • 0: deactivated • 1: activated
<cid>	Number	See <cid>.

10.7.4 Notes

SARA-N3

- If <cid> is not defined, the command tries to activate or deactivate all the defined PDP contexts.
- The command does not deactivate the last defined PDP context.

SARA-N2

- Only one <cid> parameter can be defined.
- The <status> and <cid> parameters are mandatory in the set command.

- The command cannot deactivate the last defined PDP context.

Examples of usage of +CGDCONT, +CGACT, +CGPADDR command:

Command sent by the DTE	DCE response	Description
AT+CMEE=1	OK	Set the numeric error result codes
AT+CFUN=1	OK	Set the MT to full functionality
AT+COPS=0	OK	Set the automatic registration mode
AT+CEREG?	+CEREG: 0,1 OK	Read the registration status
AT+CGDCONT=1,"IP","web.omnitel.it"	OK	Define the PDP context 1
AT+COPS=2	OK	Deregister from the network
AT+CGACT=1,1	OK	Activate PDP context 1
AT+CGPADDR	+CGPADDR: 0 +CGPADDR: 1,"91.80.104.82" OK	Show the PDP address of the activated PDP context
AT+CGDCONT?	+CGDCONT: 0,"IP","ublox.com",,0,0,,,,,0 +CGDCONT: 1,"IP","web.omnitel.it",,0,0,,,,,1 OK	Read all defined PDP contexts
To define another PDP context, MT must be deregistered		
AT+COPS=2	OK	Deregister from the network
AT+CGDCONT=3,"IP","internet"	OK	Define the PDP context 3
AT+CGACT=1,3	OK	Activate the PDP context 3
AT+CGPADDR	+CGPADDR: 0 +CGPADDR: 1 +CGPADDR: 3,"91.80.101.207" OK	Show the PDP address of the activated PDP context
AT+CGDCONT?	+CGDCONT: 0,"IP","ublox.com",,0,0,,,,,0 +CGDCONT: 1,"IP","web.omnitel.it",,0,0,,,,,1 +CGDCONT: 3,"IP","internet",,0,0,,,,,1 OK	Read all defined PDP contexts

10.8 Enter data state +CGDATA

+CGDATA						
Modules	SARA-N3					
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)	+CME Error

10.8.1 Description

Causes the MT to set up a data communication channel between the DTE and the PDP network. For the u-blox specific L2 modes M-HEX and M-RAW_IP, this means performing a GPRS attach and one or more PDP context activations, if not already done.

If the parameters are accepted (and optionally the PDP context is successfully activated), the MT displays the CONNECT IRC on the DTE and enters the online data mode, thus allowing data transfer. Other commands following +CGDATA in the command line will be processed. When the data transfer is completed, the MT re-enters into command mode and the final result code is displayed on DTE.

If an error occurs, the final result code NO CARRIER or +CME ERROR: <error> is displayed.

☞ If not specified, value 1 is assumed for <cid>.

SARA-N3
The session is terminated sending **~+++**. Both <L2P> and <cid> parameters are compulsory in set command.

SARA-N3
Stop the session oriented services (i.e. MQTT, MQTT-SN, LwM2M and FOTA) before to trigger a PPP session.

When using PPP as L2 protocol, no GPRS attach and no PDP context activation are performed until the PPP on the DTE side starts communication with the PPP on the MT side.

The M-HEX L2 protocol (AT+CGDATA="M-HEX",1) can be used as follows:

```
<int: counter> <int: length[1-1500]> <hex-sequence>[0-9a-fA-F]
cid=<int: cid>
+++<CR>
```

The following table shows some examples:

Example	Description
1 200<CR>	Send 1 packet with 200 0x2B (fill character)
5 5<CR>	Send 5 packets with 5 0x2B (fill character)
1 5 31 32 33 34 35<CR>	Send 1 packet with the given contents
1 5 1 2 3 4 05<CR>	Send 1 packet with the given contents
1 10 31 Q<CR>	Send 1 packet with 10 0x31
cid=2	Send packets on cid 2 (this requires two active PDP contexts and the M-HEX L2 protocol entered on <cid> = 1
+++	Leave the online mode

A packet is sent if one of the following conditions is met:
- the length field is terminated with <CR>
- the length value is equal to # characters of hex-sequence and it is terminated with <CR>
- the input is terminated with a character not equal to a hex digit and <CR>

The PIN insertion is not mandatory for the local dial-up, started with <cid> set to 100.

This syntax of the command is mainly used to perform regulatory and conformance testing.

10.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGDATA=[<L2P>[,<cid>]]	CONNECT (data transfer starts)	AT+CGDATA="PPP",1 CONNECT
Test	AT+CGDATA=?	+CGDATA: (list of supported <L2P>s) OK	+CGDATA: ("PPP","M-HEX","M-RAW_IP","M-OPT-PPP") OK

10.8.3 Defined values

Parameter	Type	Description
<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>.

10.8.4 Notes

- The cid command, which has not to be confused with the <cid> parameter, can be used while in data mode for switching to a PDP context already active.

- The cid command accepts as parameter a <cid> value corresponding to a PDP context already active and has to be typed in lower-case.

SARA-N3

- Only <L2P>= "PPP" value is supported.

10.9 Enter PPP state/GPRS dial-up D*

D*						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	Up to 3 min	+CME Error

10.9.1 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.

☞ SARA-N3
Stop the session oriented services (i.e. MQTT, MQTT-SN, LwM2M and FOTA) before to trigger a PPP session.

10.9.2 Syntax

Type	Syntax	Response	Example
Set	ATD[<dialing_type_char>]*<dialing_number>[*[<address>][*[<L2P>][*[<cid>]]]]#	CONNECT (data transfer starts)	ATD*99***1# CONNECT

10.9.3 Defined values

Parameter	Type	Description
<dialing_type_char>	String	Optional (legacy) "T" or "P" character indicating the tone dialing or pulse dialing respectively
<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>

10.9.4 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-N3

- Only <L2P>= "PPP" is supported.

10.10 Show PDP address +CGPADDR

+CGPADDR						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

10.10.1 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.

10.10.2 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

10.10.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<PDP_addr>	Number	See <PDP_addr>

10.10.4 Notes

SARA-N2

- When the AUTOCONNECT functionality is enabled by means of the +NCONFIG AT command <cid>=0 will not be listed until an IP address is acquired.

10.11 Packet switched event reporting +CGEREP

+CGEREP						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	-	+CME Error

10.11.1 Description

Configures sending of URCs from MT to the DTE, if certain events occur in the packet switched MT or the network. By means of the <mode> parameter, it is possible to control the processing of the URCs codes specified within this command. The <bfr> parameter allows to control the effect on buffered codes when the <mode> parameter is set to 1 (discard URCs when V.24 link is reserved) or 2 (buffer URCs in the MT when link reserved and flush them to the DTE when the link becomes available).

10.11.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGEREP=[<mode>[,<bfr>]]	OK	AT+CGEREP=1,1

Type	Syntax	Response	Example
			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: 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 +CGEV: REJECT <PDP_type>,<PDP_addr> +CGEV: NW REACT <PDP_type>,<cid> +CGEV: NW ACT <PDP_type>,<cid>	+CGEV: NW CLASS "CC"

10.11.3 Defined values

Parameter	Type	Description
<mode>	Number	Controls the processing of URCs specified within this command. Allowed values: • 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>

Parameter	Type	Description
<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

10.11.4 Notes

SARA-N3

- <mode>= 2 is not supported.

10.11.5 Explanation of URCs

URC	Remarks
+CGEV: ME PDN ACT <cid>[,<reason>[,<cid_other>]]	The MT has activated a primary context. ☞ SARA-N3 Not supported.
+CGEV: ME ACT <p_cid>,<cid>,<event_type>	The network has responded to a MT initiated secondary context activation. ☞ SARA-N3 Not supported.
+CGEV: ME PDN DEACT <cid>	The MT has forced a primary context deactivation. ☞ SARA-N3 Not supported.
+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. ☞ SARA-N3 Not supported.
+CGEV: ME DEACT <p_cid>,<cid>,<event_type>	The MT has forced a secondary context deactivation. ☞ SARA-N3 Not supported.
+CGEV: ME MODIFY <cid>,<change_reason>,<event_type>	The MT has forced a context modification. ☞ SARA-N3 Not supported.
+CGEV: ME DETACH	The mobile station has forced a GPRS detach

URC	Remarks
+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. ☞ SARA-N3 Not supported.
+CGEV: NW ACT <p_cid>,<cid>,<event_type>	The network has forced a secondary context activation. ☞ SARA-N3 Not supported.
+CGEV: NW PDN DEACT <cid>	The network has forced a primary context deactivation. ☞ SARA-N3 Not supported.
+CGEV: NW DEACT <p_cid>,<cid>,0	The network has forced a secondary context deactivation. ☞ SARA-N3 Not supported.
+CGEV: NW DEACT <p_cid>,<cid>,<event_type>	The network has forced a secondary context deactivation. ☞ SARA-N3 Not supported.
+CGEV: NW DEACT <PDP_type>,<PDP_addr>,[<cid>]	The network has forced a context deactivation. ☞ SARA-N3 <PDP_addr> is not supported.
+CGEV: NW MODIFY <cid>,<change_reason>,<event_type>	The network has forced a context modification. ☞ SARA-N3 Not supported.
+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. ☞ SARA-N3 Not supported.
+CGEV: REJECT <PDP_type>,<PDP_addr>	The context activation is rejected.
+CGEV: NW REACT <PDP_type>,<cid>	The network has forced a context re-activation.
+CGEV: NW ACT <PDP_type>,<cid>	The network has forced a context activation.

10.12 PDP context modify +CGCMOD

+CGCMOD						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	Up to 40 s	+CME Error

10.12.1 Description

This execution command is used to modify the specified PDP context(s) with respect to QoS profiles and TFT's. After the command is complete, the MT returns to the V.25 online data state. If the requested modification for any specified context cannot be achieved, an error result code is returned. If no <cid>s are specified, the activation form of the command modifies all the active contexts.

10.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGCMOD=[<cid>[,<cid>[,,...]]]	OK	AT+CGCMOD=1 OK
Test	AT+CGCMOD=?	+CGCMOD: (list of <cid>s with active contexts) OK	

10.12.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>.

10.13 EPS network registration status +CEREG

+CEREG						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

10.13.1 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>][,,[,[<Assigned_Active_Time>,[<Assigned_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>][,[<Assigned_Active_Time>,[<Assigned_Periodic_TAU>]]]]] when <n>=5 and the value of <stat> changes

The parameters <AcT>, <tac>, <rac_or_mme>, <ci>, <cause_type>, <reject_cause>, <Assigned_Active_Time> and <Assigned_Periodic_TAU> are provided only if available.

The read command returns always at least the mode configuration (<n>), the EPS registration status (<stat>). The location parameters <tac>, <rac_or_mme>, <ci> and <AcT>, if available, are returned only when <n>=2, <n>=3, <n>=4 or <n>=5 and the MT is registered with the network. The parameters <cause_type>, <reject_cause>, if available, are returned when <n>=3 or <n>=5. The PSM related parameter <Assigned_Active_Time> is returned only when <n>=4 or <n>=5, the MT is registered with the network and PSM is granted by the network. The <Assigned_Periodic_TAU> parameter is returned only if when <n>=4 or <n>=5, the MT is registered with the network, PSM is granted by the network and an extended periodic TAU value (T3412_ext) is assigned.

10.13.2 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>][,[<Assigned_Active_Time>,[<Assigned_Periodic_TAU>]]]]]] 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>][,[<Assigned_Active_Time>,[<Assigned_Periodic_TAU>]]]]]	+CEREG: 1,"3a9b","0000c33d",7

10.13.3 Defined values

Parameter	Type	Description
<n>	Number	Mode configuration: • 0: network registration URC disabled • 1: network registration URC +CEREG: <stat> enabled

Parameter	Type	Description
		• 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>][,,[,[<Assigned_Active_Time>[,<Assigned_Periodic_TAU>]]]]] enabled • 5: PSM, network registration, location information and EMM cause value information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,[<cause_type>],[<reject_cause>][,[<Assigned_Active_Time>,[<Assigned_Periodic_TAU>]]]]] enabled Allowed values: • SARA-N2 / SARA-N3 - 0 (default value), 1, 2, 3, 4, 5
<stat>	Number	EPS registration status: • 0: not registered • 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 [69] and 3GPP TS 24.301 [104] 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: • 0: GSM • 3: GSM/GPRS with EDGE availability • 7: E-UTRAN (see 3GPP TS 44.060 [105] 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 NB-IoT Allowed values: • SARA-N2 - 7 • SARA-N3 - 9
<cause_type>	Number	<reject_cause> type: • 0: indicates that <reject_cause> contains an EMM cause value, see 3GPP TS 24.30 1 [104] Annex A • 1: indicates that <reject_cause> contains a manufacture-specific cause Allowed values: • SARA-N2 - 0
<reject_cause>	Number	Cause of the failed registration. The value is of type as defined by <cause_type>
<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 [69]. See also 3GPP TS 23.682 [144], 3GPP TS 23.060 [67]) and 3GPP TS 23.401 [145].
<Assigned_Periodic_TAU>	String	One byte in an 8 bit format. Assigned extended periodic TAU value (T3412_ext) allocated to the UE. 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. "01000 111" equals 70 hours). For the coding and the value range, see the GPRS Timer 2 IE in 3GPP TS 24.008 table 10.5.163a/3GPP TS 24.008 [69]. See also 3GPP TS 23.682 [144] and 3GPP TS 23.401 [145].
<rac_or_mme>	String	RAC (Routing Area Code) or MME Code (Mobile Management Entity) in hexadecimal format

10.13.4 Notes

SARA-N2 / SARA-N3

- If <stat>=0 the MT is not registered and it does not search an operator to register to.

10.14 Delete non-active PDP contexts +CGDEL

+CGDEL						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

10.14.1 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.

☞ SARA-N3
The command removes the associated PDP context data that can be set by the AT command +CGDCONT. For an attempt to delete PDP context(s) which would violate these rules, an error result code is returned.

10.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGDEL=[<cid>]	+CGDEL: <cid>[,<cid>[,...]] OK	AT+CGDEL=2 +CGDEL: 2 OK
Test	AT+CGDEL=?	OK	OK

10.14.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>

10.15 Configure the authentication parameters of a PDP/EPS bearer +UAUTHREQ

+UAUTHREQ						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	NVM	No	-	+CME Error

10.15.1 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.

10.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+UAUTHREQ=<auth_type>[,<username>,<password>]	OK	AT+UAUTHREQ=1,"user","pass" OK
Test	AT+UAUTHREQ=?	+UAUTHREQ: list of supported <auth_type>s) OK	+UAUTHREQ: (0-2) OK

10.15.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>.
<auth_type>	Number	Configure the authentication: • 0 (factory-programmed value): no authentication • 1: PAP • 2: CHAP • 3: automatic selection of authentication type (none/CHAP/PAP) Allowed values: • SARA-N3 - 0, 1, 2
<username>	String	Username. The factory-programmed value is an empty string: • SARA-N3 - The maximum length is 50.
<password>	String	Password. The factory-programmed value is an empty string: • SARA-N3 - The maximum length is 50.

10.15.4 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).

SARA-N3

- The <username> and <password> parameters are not provided if the authentication type is not set (<auth_type>=0).

10.16 PDP context read dynamic parameters +CGCONTRDP

+CGCONTRDP						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

10.16.1 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_Ind>, <LIPA_indication>, <IPv4_MTU> and <WLAN_offload> for an active non secondary PDP context with the context identifier <cid>.

If the MT indicates more than two IP addresses of P-CSCF servers or more than two IP addresses of DNS servers, multiple lines of information per <cid> will be returned.

A set command with an undefined <cid> provides an error result code.

☞ If the parameter <cid> is omitted, the relevant information for all active non secondary PDP contexts is returned.

☞ SARA-N3
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.

☞ The command is not effective if the <PDP_type>="NONIP".

10.16.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGCONTRDP[=<cid>]	[+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>[,<IPv4_MTU>[,<WLAN_offload>[,<Local_Addr_Ind>[,<Non_IP_MTU>[,<Serving_PLMN_rate_control_value>]]]]]]]]]]]]] [+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>[,<IPv4_MTU>[,<WLAN_offload>[,<Local_Addr_Ind>[,<Non_IP_MTU>[,<Serving_PLMN_rate_control_value>]]]]]]]]]]]]] [...]] OK	AT+CGCONTRDP=1 +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",,,,0,0,0,0 OK
Test	AT+CGCONTRDP=?	+CGCONTRDP: (list of active non secondary PDP contexts) OK	+CGCONTRDP: 1 OK

10.16.3 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
<IPv4_MTU>	Number	Provides the IPv4 MTU size in octets.

Parameter	Type	Description
<WLAN_offload>	Number	Indicates whether the traffic can be offloaded using the specified PDN connection via a WLAN or not. This refers to bits 1 and 2 of the WLAN offload acceptability IE as specified in 3GPP TS 24.008 [69] subclause 10.5.6.20. Allowed values: • 0: offloading the traffic of the PDN connection via a WLAN when in S1 mode or when in Iu mode is not acceptable • 1: offloading the traffic of the PDN connection via a WLAN when in S1 mode is acceptable, but not acceptable in Iu mode • 2: offloading the traffic of the PDN connection via a WLAN when in Iu mode is acceptable, but not acceptable in S1 mode • 3: offloading the traffic of the PDN connection via a WLAN when in S1 mode or when in Iu mode is acceptable
<Local_Addr_Ind>	Number	Indicates whether or not the MS and the network support local IP address in TFTs (see 3GPP TS 24.301 [104] and 3GPP TS 24.008 [69] subclause 10.5.6.3). Allowed values: • 0: indicates that the MS or the network or both do not support local IP address in TFTs • 1: indicates that the MS and the network support local IP address in TFTs
<Non_IP_MTU>	Number	Non-IP MTU size in octets.
<Serving_PLMN_rate_control_value>	Number	Indicates the maximum number of uplink messages the UE is allowed to send in a 6 minutes interval. This refers to octet 3 to 4 of the Serving PLMN rate control IE as specified in 3GPP TS 24.301 [104].

10.16.4 Notes

SARA-N3

- The <cid> parameter is mandatory.
- The <gw_addr>, <P-CSCF_prim_addr>, <P-CSCF_sec_addr>, <IM_CN_Signalling_Flag_Ind> and <LIPA_indication>, <IPv4_MTU>, <WLAN_offload>, <Local_Addr_Ind>, <Non_IP_MTU> and <Serving_PLMN_rate_control_value> parameters are not supported.
- The <local_addr_and_subnet_mask> parameter is set to 0.0.0.0.

10.17 Read counters of sent or received PS data +UGCNTRD

+UGCNTRD						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

10.17.1 Description

Allows reading the counters for total sent / received bytes for each defined context; for each <cid> the information is provided on a different row.

☞ The sent / received bytes are the gross payload evaluated by the protocol stack, therefore they comprise the TCP and IP header bytes and the packets used to open and close the TCP connection.

☞ SARA-N3
The total sent / received bytes are the grand sum of payload, not associated with any specific <cid>.

10.17.2 Syntax

Type	Syntax	Response	Example
Action	AT+UGCNTRD	+UGCNTRD: <cid>,<sent_sess_bytes>,<received_sess_bytes>,<sent_total_bytes>,<received_total_bytes> [[...] +UGCNTRD: <cid>,<sent_sess_bytes>,<received_sess_bytes>,<sent_total_bytes>,<received_total_bytes>]]	AT+UGCNTRD +UGCNTRD: 1,100,0,100,0 OK

Type	Syntax	Response	Example
		OK	
Test	AT+UGCNTRD=?	OK	

10.17.3 Defined values

Parameter	Type	Description
<cid>	Number	Local PDP context identifier; the range goes from 0 to 255.
<sent_sess_bytes>	Number	Sent bytes for the current PSD session.
<received_sess_bytes>	Number	Received GPRS session bytes for the current PSD session.
<sent_total_bytes>	Number	Total sent bytes.
<received_total_bytes>	Number	Total received bytes.

10.17.4 Notes

SARA-N3

- The <cid>, <sent_sess_bytes> and <received_sess_bytes> parameters are not supported.

10.18 Set/reset counter of sent or received PS data +UGCNTSET

+UGCNTSET						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	-	+CME Error

10.18.1 Description

Allows setting the counter for total sent/received bytes for each defined context to zero or any other offset value.

☞ Whenever the total counter for a <cid> is set (to zero or a certain value), the session counter for this <cid> will be set to zero.

☞ SARA-N3
If <cid>=0 than the total counter for every defined context is set to zero. The offset parameters are ignored in this case.

☞ SARA-N3
The <total_bytes_sent_offset> and <total_bytes_received_offset> parameters are set collectively irrespective of any specific <cid>.

10.18.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGCNTSET=<cid>,[<total_bytes_sent_offset>,<total_bytes_received_offset>]	OK	AT+UGCNTSET=0,20,20 OK
Test	AT+UGCNTSET=?	+UGCNTSET: (range of <cid>s),(range of <total_bytes_sent_offset>),(range of <total_bytes_received_offset>) OK	+UGCNTSET: (0-255),(0-2147483646),(0-2147483646) OK

10.18.3 Defined values

Parameter	Type	Description
<cid>	Number	Local PDP context identifier:
<total_bytes_sent_offset>	Number	Long number containing the offset of total sent bytes used for counting in the range 0-0x7FFFFFFE.

Parameter	Type	Description
<total_bytes_received_offset>	Number	Long number containing the offset of total received bytes used for counting in the range 0-0x7FFFFFFE.
<sim_id>	Number	SIM identity. Only value 0 is supported.

10.18.4 Notes

SARA-N3

- The <cid> parameter is replaced with the <sim_id> parameter and always set to 0.

10.19 Initial PDP context activation +CIPCA

+CIPCA						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

10.19.1 Description

Controls whether an initial PDP context shall be established automatically following an attach procedure when the UE is attached to E-UTRAN RAT with or without a PDN connection.

Changing <n> will never cause a PDP context deactivation.

☞ SARA-N3
If the initial PDP context activation (<n>=1) is enabled, issue the +CFGDFTPDN AT command to configure the PDP type and APN. Otherwise (<n>=0) these parameters shall be configured by means of the +CGDCONT AT command.

10.19.2 Syntax

Type	Syntax	Response	Example
Set	AT+CIPCA=[<n>[,<attach_without_PDN>]]	OK	AT+CIPCA=1 OK
Read	AT+CIPCA?	+CIPCA: <n>,<attach_without_PDN> OK	+CIPCA: 1,0 OK
Test	AT+CIPCA=?	+CIPCA: (list of supported <n>s),(list of supported <attach_without_PDN>s) OK	+CIPCA: (0,1,3),(0,1) OK

10.19.3 Defined values

Parameter	Type	Description
<n>	Number	Activation of PDP context upon attach. Allowed values: • 0: do not activate. If the <n> parameter differs than 0, deactivating the last (active) PDP context can lead to a (re)establishment of the initial PDP context. • 1: always activate. Setting this value from 0 causes an immediate attempt to (re)establish the initial PDP context if no PDP context is active. • 3: no change in current setting. This value applies to E-UTRAN RAT. Allowed values: • SARA-N2 - 3 (default value, applies to E-UTRAN RAT) • SARA-N3 - 0 , 1 (factory-programmed value)
<attach_without_PDN>	Number	EPS attach with or without PDN connection: • 0 (factory-programmed value): EPS attach with PDN connection • 1: EPS attach without PDN connection

10.19.4 Notes

SARA-N2

- The command setting is not stored in the NVM.

10.20 APN rate control +CGAPNRC

+CGAPNRC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

10.20.1 Description

Returns the APN rate control parameters (see the 3GPP TS 24.008 [69]) associated to the corresponding <cid>.

If the <cid> parameter is omitted, the APN rate control parameters for all active contexts are returned.

☞ The test command returns the list of <cid>s associated with secondary and non secondary active PDP contexts.

10.20.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGAPNRC[=<cid>]	[+CGAPNRC: <cid>[,<Additional_exception_reports>[,<Uplink_time_unit>[,<Maximum_uplink_rate>]]] [...] [+CGAPNRC: <cid>[,<Additional_exception_reports>[,<Uplink_time_unit>[,<Maximum_uplink_rate>]]]]] OK	AT+CGAPNRC=1 +CGAPNRC: 1,0,2,2 OK
Test	AT+CGAPNRC=?	+CGAPNRC: (list of <cid>s associated with active contexts) OK	+CGAPNRC: (1,2) OK

10.20.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<Additional_exception_reports>	Number	Indicates whether or not additional exception reports are allowed to be sent when the maximum uplink rate is reached. This refers to bit 4 of octet 1 of the APN rate control parameters (see the 3GPP TS 24.008 [69] subclause 10.5.6.3.2): • 0: Additional exception reports are not allowed to be sent • 1: Additional exception reports are allowed to be sent
<Uplink_time_unit>	Number	Specifies the time unit to be used for the maximum uplink rate. This refers to bit 1 to 3 of octet 1 of the APN rate control parameters (see the 3GPP TS 24.008 [69] subclause 10.5.6.3.2): • 0: unrestricted • 1: minute • 2: hour • 3: day • 4: week
<Maximum_uplink_rate>	Number	Specifies the maximum number of messages the UE is restricted to send per uplink time unit. This refers to octet 2 to 4 of the APN rate control parameters (see the 3GPP TS 24.008 [69] subclause 10.5.6.3.2).

10.20.4 Notes

SARA-N2 / SARA-N3

- The information text response to the test command is provided without brackets.

10.21 Define PDP context authentication parameters +CGAUTH

+CGAUTH						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

10.21.1 Description

Configures the authentication parameters for a PDP context, identified by the <cid> parameter.

The read command lists the settings for all the defined <cid>s.

10.21.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGAUTH=<cid>[,<auth_prot>[,<userid>[,<password>]]]	OK	AT+CGAUTH=1,2,"1234","4321" OK
Read	AT+CGAUTH?	[+CGAUTH: <cid>[,<auth_prot>[,<userid>[,<password>]]] [..]] OK	+CGAUTH: 1,1,"1234","4321" OK
Test	AT+CGAUTH=?	+CGAUTH: (list of supported <cid>s),(list of supported <auth_prot>s),(list of supported <userid>s),(list of supported <password>s) OK	+CGAUTH: (0-10),(0,1,2),(0-60),(0-60) OK

10.21.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>.
<auth_prot>	Number	Authentication protocol used for the PDP context: • 0 (default value): none; the <userid> and <password> parameter values are removed if defined previously • 1: PAP • 2: CHAP
<userid>	String	Username to access the IP network; the maximum length is 60 characters. The parameter will be provided by the network if it supports the PDP context authentication.
<password>	String	Password to access the IP network; the maximum length is 60 characters. The parameter will be provided by the network if it supports the PDP context authentication.

10.21.4 Notes

SARA-N2

- The command is not supported by SARA-N200-02B-00, SARA-N201-02B-00, SARA-N210-02B-00, SARA-N211-02X-00, SARA-N280-02B-00.

10.22 PDP IP configuration when roaming +UDCONF=75

+UDCONF=75						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

10.22.1 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.

10.22.2 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

10.22.3 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>.

10.22.4 Notes

SARA-N3

- The PIN insertion is not mandatory before the command execution.

10.23 Disable data when roaming +UDCONF=76

+UDCONF=76						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

10.23.1 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.

10.23.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=76,<cid>,<Data_Flag>	OK	AT+UDCONF=76,1,0

Type	Syntax	Response	Example
			OK
Read	AT+UDCONF=76	+UDCONF: 76,<cid>,<Data_Flag> OK	AT+UDCONF=76 +UDCONF: 76,1,0 OK

10.23.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>.
<Data_Flag>	Number	PDP data configuration when roaming: • 0 (default value): OFF - PDP is enabled when roaming • 1: ON - PDP is disabled when roaming

10.24 Default PDP type configuration +CFGDFTPDN

+CFGDFTPDN						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	NVM	No	-	+CME Error

10.24.1 Description

Configures and queries the default PDP type and APN.

☞ SARA-N3
The command setting is considered for the automatic attach procedure when an initial PDP context activation is enabled by means of +CIPCA AT command.

10.24.2 Syntax

Type	Syntax	Response	Example
Set	AT+CFGDFTPDN=<default_PDP_type>,<APN>	OK	AT+CFGDFTPDN=1,"APN_name" OK
Read	AT+CFGDFTPDN?	+CFGDFTPDN: <default_PDP_type>, <APN> OK	+CFGDFTPDN: 2,"APN_name" OK
Test	AT+CFGDFTPDN=?	+CFGDFTPDN: (list of supported <default_PDP_type>s) OK	+CFGDFTPDN: (1-3,5) OK

10.24.3 Defined values

Parameter	Type	Description
<default_PDP_type>	Number	Indicates the default PDP type. Allowed values: • 1: IP • 2: IPv6 • 3: IPv4v6 • 5: NON-IP For more detais, see <PDP_type>.
<APN>	String	See <APN>.

11 System features

11.1 Firmware installation +UFWINSTALL

+UFWINSTALL						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	FW Install Error

11.1.1 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. Do not remove the power supply or reset the module during the installation procedure even if it is fault tolerant! 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.

Once the command has been sent correctly, the FW resets and at the next boot-up, the FW install will start.

☞ SARA-N3
When the FW update is completed, a +UUFWINSTALL URC will notify the final result of the operation.

☞ 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).

11.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UFWINSTALL	OK	AT+UFWINSTALL OK
Test	AT+UFWINSTALL=?	OK	OK
URC		+UUFWINSTALL: <status_install>	

11.1.3 Defined values

Parameter	Type	Description
<status_install>	Number	Provide the installation status: • 0: installation failed • 1: installation successful

11.1.4 Notes

SARA-N3

- After the command is issued, the module reboots and starts the install process which can take up to 5 minutes long.
- No result codes are issued on the terminal during this phase and the UART interface is 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 by means of the +UFWUPD AT command.

11.2 Firmware update Over AT (FOAT) +UFWUPD

+UFWUPD						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	< 20 s	FOAT Error

11.2.1 Description

Triggers the firmware update over the AT command interface. The set command with <file_size> parameter allows to download the FW package file. The FW package is a binary compressed (.pack) file provided by the u-blox.

If the given <file_size> is accepted, the >' prompt will be provided to the user; after that, it is possible to provide the stream of FW package bytes. The file transfer is terminated exactly when <file_size> bytes have been entered and either "OK" final result code or an error result code is returned. The feed process cannot be interrupted.

If the file download is interrupted or module power is loss during the file download, all the downloaded FW package data will be deleted.

☞ If the file download pauses, after 20 s the download is stopped and "Timeout" error result code is returned.

☞ If the "OK" final result code is received after the complete file download and the module is powered off unexpectedly, the FW install will be triggered automatically on next start-up.

☞ Enable the HW flow control by means of AT&K AT command, to avoid the possible data loss.

11.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UFWUPD=<file_size>	> OK	AT+UFWUPD=25600 > OK
Test	AT+UFWUPD=?	OK	OK

11.2.3 Defined values

Parameter	Type	Description
<file_size>	Number	FW update file size in bytes, the range goes from 0 to 327680 bytes

11.3 Antenna detection +UANTR

+UANTR						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

11.3.1 Description

Measures the DC component of load of the cellular antenna (the GPS antenna is RFU). The antenna load is expressed in kOhm.

11.3.2 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)	+UANTR: (0) OK

Type	Syntax	Response	Example
		OK	

11.3.3 Defined values

Parameter	Type	Description
<antenna_id>	Number	Antenna identifier: • 0 (default value): cellular antenna
<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)

11.3.4 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.

SARA-N3

- <antenna_id>=1 is not supported.

11.4 ADC read command +UADC

+UADC						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

11.4.1 Description

Reads the current value of the specified analog to digital converter (ADC) in millivolts (mV). The parameters range is shown in the response to the test command if ADC are supported; if no ADC is supported by the module, an error result code is returned.

11.4.2 Syntax

Type	Syntax	Response	Example
Read	AT+UADC=<adc_id>	+UADC: <adc_id>,<adc_val> OK	AT+UADC=0 +UADC: 0,480 OK
Test	AT+UADC=?	+UADC: (range of <adc_id>s) OK	+UADC: (0-1) OK

11.4.3 Defined values

Parameter	Type	Description

<adc_id>	Number	ADC identifier. Allowed values:
		• SARA-N3
		  o 0: ANT_DET
		  o 1: ADC1

<adc_val>	Number	Current ADC value measured on the specified ADC pin: • SARA-N3 - the range goes from 0 to 1920 mV.

11.5 Production test +UTEST

+UTEST						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	Up to 1 s	+CME Error

11.5.1 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. Improper usage of this command on a real network could disturb other users and the network itself.

u-blox assumes no responsibility for the inappropriate use of this command.

SARA-N3
For more test command examples, guidance about test equipment setup, and more information on module reboot, see the SARA-N3 series application development guide [32].

SARA-N2
For more test command examples and more information on module reboot, see the NB-IoT application development guide [29].

11.5.2 SARA-N2 RF test description

Sets the module in non-signalling (or test) mode, or returns to the signalling (or normal) mode.

In non-signalling mode, the module switches off the protocol stack for performing single tests which could not be performed during signalling mode.

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):

- 4G transmission of an LTE SC-FDMA OFDM signal (5 MHz bandwidth) in the desired channel in the FDD band and power level
- Receiving signal detection and RF level measurement on the desired 4G (LTE) channel

Disable the AUTOCONNECT functionality by means of the +NCONFIG AT command in order to issue +UTEST AT commands.

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: 4").

In RX and TX mode the set command without parameters is not allowed.

The execution of these actions is performed in non-signalling mode. In non-signalling mode:

- The module only accepts +UTEST commands
- The +CMEE AT command cannot be set.

In normal mode:

- Before entering the test mode the module must not be registered with the network, otherwise an error result code ("+CME ERROR: 3") is provided.
- 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: 3")

Configure the CTS pin as "pad disabled" by means of the +UGPIOC AT command, before using this pin as digital pin test.

To return to the normal mode, perform one of these actions:

- A module reset
- Power off the module
- Send AT+UTEST=0

11.5.3 SARA-N3 RF test description

Sets the module in non-signalling (or test) mode, or returns to the signalling (or normal) mode.

In non-signalling mode, the module switches off the protocol stack for performing single tests which could not be performed during signalling mode.

When entering the test mode, it is possible to sequentially trigger the following actions for testing purposes:

- 4G transmission of an LTE SC-FDMA OFDM signal (5 MHz bandwidth) in the desired channel in the FDD band and power level
- Receiving signal detection and RF level measurement on the desired 4G (LTE) channel

☞ The command setting is not stored in the NVM.

☞ 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
- The +CMEE AT command cannot be set.

In normal mode:

- Before entering the test mode, a network deregistration is needed: issue the AT+CFUN=0 command to deactivate the protocol stack , otherwise an error result code ("+CME ERROR: operation not allowed" or "+CME ERROR: 3" depending on the +CMEE AT command setting) is provided.
- 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)

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)

After the module returns the normal mode, issue the AT+CFUN=1 command to restore the module full functionality.

11.5.4 SARA-N2 Syntax

Type	Syntax	Response	Example
Set	If <mode>=0 or 1 AT+UTEST=<mode>	OK	AT+UTEST=0 OK
	If <mode>=2 AT+UTEST=2,<RX_channel>,<RX_time_interval>	+UTEST: <RX_channel>,<RX_time_interval>[,<min>,<avg>,<max>] OK	AT+UTEST=2,103625,1000 +UTEST: 103625,1000,-75.2,-73.2,-71.1 OK
	If <mode>=3 AT+UTEST=3,<TX_channel>,<power_control_level>,<TX_time_interval>	+UTEST: <TX_channel>,<power_control_level>,<TX_time_interval> OK	AT+UTEST=3,121466,5,1000 +UTEST: 121466,5,1000 OK
Read	AT+UTEST?	+UTEST: <mode> OK	+UTEST: 1 OK
Test	AT+UTEST=?	+UTEST: (list of supported <mode>s) OK	+UTEST: (0-3) OK

11.5.5 SARA-N3 Syntax

Type	Syntax	Response	Example
Generic syntax			

Type	Syntax	Response	Example
Set	AT+UTEST=<mode>[,[<param_val1>][,[<param_val2>][,[<param_val3>][,[<param_val4>][,[<param_val5>]]]]]]	[+UTEST: [<param_val1>,<param_val2>][,<param_val3>][,<param_val4>,<param_val5>][,<measured_power>]] OK	AT+UTEST=0 OK
Entering normal mode			
Set	AT+UTEST=0	OK	AT+UTEST=0 OK
Entering test mode			
Set	AT+UTEST=1	OK	AT+UTEST=1 OK
RX test mode			
Set	AT+UTEST=2[,[<RX_channel>][,[<RX_time_interval>][,[<receiver_path>][,[<expected_power>]]]]]	+UTEST: <RX_channel>,<RX_time_interval>,<receiver_path>,<measured_power> OK	AT+UTEST=2,101205,5000,0,-110 +UTEST: 101205,5000,0,-118 OK
TX test mode			
Set	AT+UTEST=3,<TX_channel>,<power_control_level>,<training_sequence>[,<modulation_mode>,<TX_time_interval>]	+UTEST: <TX_channel>,<power_control_level>,<training_sequence>,<modulation_mode>,<TX_time_interval> OK	AT+UTEST=3,119200,23,0,1,1000 +UTEST: 119200,23,0,1,1000 OK
Read	AT+UTEST?	+UTEST: <mode> OK	+UTEST: 1 OK
Test	AT+UTEST=?	+UTEST: (list of supported <mode>s) OK	+UTEST: (0-3,10) OK

11.5.6 Defined values

Parameter	Type	Description
<mode>	Number	Test mode setting: • 0: the module returns to the normal mode • 1: the module enters the test mode • 2: RX test mode (measuring the antenna level estimation of the received RF signal) • 3: TX test mode (GSMK/8-PSK burst or transmission in 3G bands) • 4: antenna dynamic tuner configuration mode (enable/disable antenna dynamic tuner control)
<RX_channel>	Number	For the parameter description and its range, see Notes.
<RX_time_interval>	Number	For the parameter description and its range, see Notes.
<receiver_path>	Number	For the parameter description and its range, see Notes.
<expected_power>	Number	For the parameter description and its range, see Notes.
<measured_power>	Number	For the parameter description and its range, see Notes.
<TX_channel>	Number	For the parameter description and its range, see Notes.
<power_control_level>	Number	For the parameter description and its range, see Notes.
<training_sequence>	Number	For the parameter description and its range, see Notes.
<modulation_mode>	Number	For the parameter description and its range, see Notes.
<TX_time_interval>	Number	For the parameter description and its range, see Notes.
<ant_tuner_enable>	Number	Enable/disable antenna dynamic tuner control. Allowed values: • 0 (factory-programmed value): antenna dynamic tuner control disabled • 1: antenna dynamic tuner control enabled
<param_valx>	Number	Supported content depends on related <mode> (details are given above).

11.5.7 Notes

SARA-N2

- <mode>=4 (antenna dynamic tuner configuration mode) is not supported.
- The <receiver_path>, <training_sequence>, <modulation_mode> parameters are not supported.
- The <expected_power> and <measured_power> parameters are not supported.
- **RX mode setting (<mode>=2)**

Parameter	Description	Range	Notes
<RX_channel>	Channel	0 ÷ 165535	RX channel 4G RAT: the value corresponds to EARFCN with an offset of 100000. **<RX_channel> range / LTE band / EARFCN range** [106150-106449] / FDD 20 / [6150-6449] [109210-109659] / FDD 28 / [9210-9659] [102400-102649] / FDD 5 / [2400-2649] [103450-103799] / FDD 8 / [3450-3799] **Table 6: <RX_channel> parameter range** ☞ The "+CME ERROR: 4" error result code will be provided in these cases: o A value not belonging to the above ranges is set o The RX channel parameter value belongs to a non-supported 4G RAT or band
<RX_time_interval>	Time	42 ÷ 600000	Time interval for RX test expressed in milliseconds
<min>	Minimum antenna RF level estimation	-140 ÷ -20	Expressed in dBm.
<avg>	Average antenna RF level estimation	-140 ÷ -20	Expressed in dBm.
<max>	Maximum antenna RF level estimation	-140 ÷ -20	Expressed in dBm.

- **TX mode setting (<mode>=3)**

Parameter	Description	Range	Notes
<TX_channel>	Tx channel	0 ÷ 165535	TX channel 4G RAT: the value corresponds to EARFCN with an offset of 100000. **<TX_channel> range / LTE band / EARFCN range** [102400-102649] / FDD 5 / [20400-20649] [121450-121799] / FDD 8 / [21450-21799] [124150-124449] / FDD 20 / [24150-24449] [127210-127659] / FDD 28 / [27210-27659] **Table 7: <TX_channel> parameter range** ☞ The "+CME ERROR: 4" error result code will be provided in these cases: o A value not belonging to the above ranges is set o The TX channel parameter value belongs to a non-supported 4G RAT or band
<power_control_level>	Power control level	-40 ÷ 24	Absolute output power expressed in dBm ☞ Only the values indicated in the above ranges are valid, otherwise an error result code will be provided ("+CME ERROR: 4").
<TX_time_interval>	Time	0 ÷ 600000	Time interval for TX test expressed in milliseconds 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

Parameter	Description	Range	Notes
			stop the burst sequence transmission, any other +UTEST commands can be set and the current sequence transmission is stopped.

SARA-N3

- <mode>=4 (antenna dynamic tuner configuration mode) is not supported.
- Check the corresponding module data sheet for the list of supported bands.
- **RX mode setting (<mode>=2)**

Parameter	Description	Range	Default	Notes
<RX_channel>	Channel	0 ÷ max value of supported band	101200	RX channel 4G RAT: the value corresponds to EARFCN with an offset of 100000. **<RX_channel> range / LTE band / EARFCN range** [101200-101949] / FDD 3 / [1200-1949] [102400-102649] / FDD 5 / [2400-2649] [103450-103799] / FDD 8 / [3450-3799] [106150-106449] / FDD 20 / [6150-6449] [109210-109659] / FDD 28 / [9210-9659] **Table 8: <RX_channel> 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 non-supported RAT (2G or 3G or 4G RAT) or band
<RX_time_interval>	Time	50 ÷ 600000	1000	Time interval for RX test expressed in milliseconds and fixed to 5 s. ☞ The value set is ignored.
<receiver_path>	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) ☞ The value set is ignored and fixed to 0 (main / primary antenna).
<expected_power>	Expected antenna RF level estimation	-30 ÷ -110	-85	Expressed in dBm for 4G RAT
<measured_power>	Measured antenna RF level estimation	-30 ÷ -110		Expressed in dBm for 4G RAT

- **TX mode setting (<mode>=3)**

Parameter	Description	Range	Default	Notes
<TX_channel>	Tx channel	0 ÷ max value of supported band		TX channel 4G RAT: the value corresponds to EARFCN with an offset of 100000. **<TX_channel> range / LTE band / EARFCN range** [119200-119949] / FDD 3 / [19200-19949] [120400-120649] / FDD 5 / [20400-20649] [121450-121799] / FDD 8 / [21450-21799] [124150-124449] / FDD 20 / [24150-24449]

Parameter	Description	Range	Default	Notes
				<TX_channel> range / LTE band / EARFCN range: [127210-127659] / FDD 28 / [27210-27659] **Table 9: <TX_channel> 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 TX channel parameter value belongs to a non-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.
<power_control_level>	Power control level	-50 to 30		Absolute output power expressed in dBm for 4G RAT ☞ 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).
<training_sequence>	Training sequence	0 ÷ 255		Training sequence to be used (to be changed only in case of link with network simulator, else use default) for 4G RAT ☞ The value set is ignored.
<modulation_mode>	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 ☞ The value set is ignored.
<TX_time_interval>	Time	50 ÷ 600000	0	Time interval for TX test expressed in milliseconds 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. ☞ The value set is ignored.

11.5.8 SARA-N2 RF test examples

☞ In RX mode test command examples the information text response is issued after the timeout configured in the set command.

Command	Response	Description
Channel 2525 (band 5, frequency 881.5 MHz)		
AT+UTEST=2,102525,1000	+UTEST: 102525,1000,-85.9,-85.4,-84.7 OK	This command gives an estimation of RX input power over a time period of 1 s. The information text response provides the typical power level for an unconnected input. ☞ The RX frequency is specified by the EARFCN with an offset of +100000.
Channel 3625 (band 8, frequency 942.5 MHz)		

Command	Response	Description
AT+UTEST=2,103625,2000	+UTEST: 103625,2000,-60.1,-60.0,60.0 OK	This command gives an estimation of RX input power over a time period of 2 s. The information text response provides the typical power level for input at 942.6 MHz, -60 dBm. ☞ The input signal must have an offset of +100 to the EARFCN.

Table 10: RX mode test command examples

Command	Response	Description
Channel 20525 (band 5, frequency 836.5 MHz)		
AT+UTEST=3,120525,23,5000	+UTEST: 120525,23,5000 OK	This command sets a transmission signal of continuous waveform (CW) tone with the following parameters: • Frequency: 836.5 MHz • Power: 23 dBm • Duration: 5 s ☞ The TX frequency is specified by the EARFCN with an offset of +100000.
Channel 21450 (band 8, frequency 880 MHz)		
AT+UTEST=3,121450,13,3500	+UTEST: 121450,13,3500 OK	This command sets a transmission signal of CW tone with the following parameters: • Frequency: 880.0 MHz • Power: 13 dBm • Duration: 3.5 s ☞ The TX frequency is specified by the EARFCN with an offset of +100000.
Channel 21799 (band 8, frequency 914.9 MHz)		
AT+UTEST=3,121799,-5,12000	+UTEST: 121799,-5,12000 OK	This command sets a transmission signal of CW tone with the following parameters: • Frequency: 914.9 MHz • Power: -5 dBm • Duration: 12 s ☞ The TX frequency is specified by the EARFCN with an offset of +100000.

Table 11: TX mode test command examples

11.5.9 SARA-N3 RF test examples

Command	Response	Description
Channel 1205 (band 3, frequency 1805.5 MHz)		
AT+UTEST=2,101205,5000,0,-110	+UTEST: 101205,5000,0,-116 OK	This command gives an estimation of RX input power over a time period of 5 s. The information text response provides the typical power level for an unconnected input. ☞ The RX frequency is specified by the EARFCN with an offset of +100000.

Table 12: RX mode test command examples

Command	Response	Description
Channel 20400 (band 5, frequency 824 MHz)		
AT+UTEST=3,120400,23,0,1,1000	+UTEST: 120400,23,0,1,1000 OK	This command sets a transmission signal of continuous waveform (CW) tone with the following parameters:

Command	Response	Description
		• Frequency: 824 MHz • Power: 23 dBm • Duration: 1 s ☞ The TX frequency is specified by the EARFCN with an offset of +100000.

Table 13: TX mode test command examples

11.5.10 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.

☞ The <op_code>, <bit_padding>, <pin_seq> parameters setting is not stored in the NVM.

☞ SARA-N2
See the SARA-N2 series data sheet [28] for the pins levels characteristics.

☞ SARA-N3
See the SARA-N3 series data sheet [30] for the pins levels characteristics.

11.5.11 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,"00000004200000001000" 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

Type	Syntax	Response	Example
			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

11.5.12 Defined values

Parameter	Type	Description
<op_code>	Number	Test mode setting: • 0: exits the digital test mode and restores the pins to the original configuration • 2: defines a set of pins that will be tested and initializes 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. If a non 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 no output pins to configure. In the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: o 0: the pin will output a "low" logic level o 1: the pin will output a "high" logic level • 5: applies 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-N2 - See the Notes for detailed number description

11.5.13 Notes

- Consider these steps to construct the [<bit_padding>]<pin_seq> sequence:
  - o Consider the total number of the module's pins available
    - SARA-N2 / SARA-N3 - 96 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-N2 / SARA-N3

- An example of the AT commands sequence to test the digital pins is reported below.

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,"00000494004000C01800"	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,"00000360008000182700"	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, PI_MRDY/GPIO14: "high" level detected
AT+UTEST=0	OK	Module exits from the test mode and normal pin configuration is restored.

Table 14: 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 initialized state.

11.6 RING line handling +URING

+URING						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

11.6.1 Description

Configures the RING line handling of the UART interface for other events besides the usual ones, that is the incoming call indication (RING) (linked to the "RING" URC) and the incoming SMS indication (linked to the +CMT and the +CMTI URCs).

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). Same behavior will be applied if the events are the incoming call or the incoming SMS.

11.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+URING=<mode>	OK	AT+URING=1 OK
Read	AT+URING?	+URING: <mode> OK	+URING: 1 OK
Test	AT+URING=?	+URING: (list of the supported <mode>s) OK	+URING: (0-3) OK

11.6.3 Defined values

Parameter	Type	Description
<mode>	Number	Configures the RING line handling: • 0 (factory-programmed value): feature disabled (RING line is asserted only on incoming call and incoming SMS) • 1: RING line asserted for all the URCs • 2: RING line asserted for all the incoming data (PPP, sockets in Direct Link mode, FTP in Direct Link mode) • 3: RING line asserted for all URCs and all incoming data (PPP, sockets in Direct Link mode, FTP in Direct Link mode)

11.6.4 Notes

SARA-N2

- <mode>=2, 3 are not supported.
- The "RING" URC is not supported.

11.7 PPP/LCP silent mode configuration +UDCONF=0

+UDCONF=0						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

11.7.1 Description

Configures the advanced settings for the PPP/LCP silent mode. It means that it is possible to configure whether the module must wait for the first LCP frame or send the first LCP frame while establishing a PPP connection.

11.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=0,<ppp_lcp_silent_mode>	OK	AT+UDCONF=0,0 OK
Read	AT+UDCONF=0	+UDCONF: 0,<ppp_lcp_silent_mode> OK	AT+UDCONF=0 +UDCONF: 0,0 OK

11.7.3 Defined values

Parameter	Type	Description
<ppp_lcp_silent_mode>	Number	Enables/disables the PPP-LCP silent mode. Allowed values: • 0: silent mode disabled, the module sends the first LCP frame • 1 (factory-programmed value): silent mode enabled, the module waits for the other end to start first

11.8 Restore factory configuration +UFACTORY

+UFACTORY						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	5 s	+CME Error

11.8.1 Description

Force, at the next module boot, the restore of the factory configuration for FS and/or NVM.

When the command is issued, a flag is written into the NVM: no action is done and it will be triggered to be executed only at the next module boot. If, before the next boot, the triggered operation must be deleted, then it is possible to issue the command with parameter 0,0.

11.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+UFACTORY=<fs_op>,<nvm_op>	OK	AT+UFACTORY=0,1 OK
Read	AT+UFACTORY?	+UFACTORY: <fs_op>,<nvm_op> OK	+UFACTORY: 0,1 OK
Test	AT+UFACTORY=?	+UFACTORY: (list of supported <fs_op>s),(list of supported <nvm_op>s) OK	+UFACTORY: (0-2),(0-2) OK

11.8.3 Defined values

Parameter	Type	Description
<fs_op>	Number	FS factory restore type: • 0 (factory-programmed value): no factory restore • 1: see Notes • 2: all files stored in FS deleted
<nvm_op>	Number	NVM factory restore type: • 0 (factory-programmed value): no factory restore • 1: NVM flash sectors erased • 2: see Notes

11.8.4 Notes

SARA-N3

- <fs_op>=1 is not supported.
- <nvm_op>=2 is not supported.
- The following AT commands settings are not affected by +UFACTORY:
  - +NVSETRELEASEVERSION
  - +CCIOTOPT
  - +CEDRXS
  - +CFGCIOT
  - +NPOWERCLASS
  - +NVSETRRCRLSTIMER10
  - +NVSETRSRPOFFSET
  - +UECLS
  - +UJAD
  - +CFGDFTPDN
  - +CIPCA
  - +UAUTHREQ
  - +CPSMS
  - +NVSETPM

- +NVSETPM2IDLETIME
- +CALA

11.9 Debug logging level setting +NLOGLEVEL

+NLOGLEVEL						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

11.9.1 Description

Sets the logging level. The information text response to read command provides the setting of each logging level in separated lines.

11.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+NLOGLEVEL=<core>,<level>	OK	AT+NLOGLEVEL="PROTOCOL", "ERROR" OK
Read	AT+NLOGLEVEL?	[+NLOGLEVEL: <core>,<level> [..]] OK	+NLOGLEVEL: "PROTOCOL", "ERROR" +NLOGLEVEL: "SECURITY","NONE" +NLOGLEVEL: "APPLICATION", "WARNING" OK
Test	AT+NLOGLEVEL=?	+NLOGLEVEL: (list of supported <core>s),(list of supported <level>s) OK	+NLOGLEVEL: ("PROTOCOL", "APPLICATION","SECURITY"), ("VERBOSE","NORMAL", "WARNING","ERROR","NONE") OK

11.9.3 Defined values

Parameter	Type	Description
<level>	String	Required logging level. Allowed strings: • VERBOSE • NORMAL (default value) • WARNING • ERROR • NONE
<core>	String	Allowed strings: • PROTOCOL • SECURITY • APPLICATION

11.10 Cancel FOTA download +UFOTA

+UFOTA						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

11.10.1 Description

Cancels the FW download to the device when a FOTA session is in progress. To make use of this command, enable URCs for FOTA sessions (for more details on enabling FOTA URCs, see +UFOTASTAT AT command).

The device does not reboot after cancelling FOTA download. At the next power-on, the module will boot the previous firmware version.

11.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+UFOTA=<op_code>	OK	AT+UFOTA=0 OK
Test	AT+UFOTA=?	+UFOTA: 0 OK	+UFOTA: 0 OK

11.10.3 Defined values

Parameter	Type	Description
<op_code>	Number	Allowed value: • 0: abort FOTA download

11.11 Sets FOTA status URCs +UFOTASTAT

+UFOTASTAT						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

11.11.1 Description

Enables URC reporting status for FOTA downloads and updates.

11.11.2 Syntax

Type	Syntax	Response	Example
Set	AT+UFOTASTAT=<n>	OK	AT+UFOTASTAT=1 OK
Read	AT+UFOTASTAT?	+UFOTASTAT: <n> OK	+UFOTASTAT: 1 OK
Test	AT+UFOTASTAT=?	+UFOTASTAT: (list of supported<n>s) OK	+UFOTASTAT: (0,1) OK
Generic syntax			
URC		+UFOTASTAT: <event>,<param1>[,<param2>] OK	+UFOTASTAT: 3,1,0 OK
Download progress			
URC		+UFOTASTAT: 0,<progress_status>[,<percentage>] OK	+UFOTASTAT: 0,1,10 OK
Download start			
URC		+UFOTASTAT: 1,<start_triggered>,0 OK	+UFOTASTAT: 1,0,0 OK
Download complete			
URC		+UFOTASTAT: 2,<status>,<status_details> OK	+UFOTASTAT: 2,2,100 OK
FOTA status			
URC		+UFOTASTAT: 3,<update_result>,<update_state>	+UFOTASTAT: 3,1,0 OK

Type	Syntax	Response	Example
		OK	
Registration status			
URC		+UFOTASTAT: 4,<registration_result> OK	+UFOTASTAT: 4,2 OK

11.11.3 Defined values

Parameter	Type	Description
<n>	Number	Enable FOTA status URCs: • 0: FOTA status URC disabled • 1 (factory-programmed value): FOTA status +UFOTASTAT URC enabled
<event>	Number	Event type: • 0: download progress • 1: download start • 2: download complete • 3: FOTA status • 4: registration status Allowed values: • SARA-N3 - 0, 1, 2, 3, 4
<progress_status>	Number	Allowed value: • 1: download in progress
<percentage>	Number	Download completion in percentage
<start_triggered>	Number	Allowed value: • 0: download start triggered
<status>	Number	FOTA completed download status: • 2: success • 3: fail
<status_details>	Number	Provides more information about FOTA completed download status: • 100: success if <status>=2 • 100: user cancel if <status>=3 • 101: memory error. This value can be returned only when <status>=3 • 102: network error. This value can be returned only when <status>=3 • 103: unknown error.This value can be returned only when <status>=3 • 104: bad url.This value can be returned only when <status>=3 • 105: failure due to connectivity loss.This value can be returned only when <status>=3
<update_result>	Number	Provides more information about FOTA update result: • 0: initial • 1: success • 2: memory error • 3: RAM error • 4: connection lost • 5: checksum error • 6: unsupported package • 7: URI error • 8: firmware update fail • 9: unsupported protocol
<update_state>	Number	Provides more information about FOTA update status: • 0: idle • 1: downloading • 2: downloaded • 3: updating
<registration_result>	Number	Provides more information about registration status: • 0: idle • 1: bootstrap started • 2: bootstrap successful

Parameter	Type	Description
		• 3: bootstrap failed • 4: connect successful • 5: connect failed • 6: registration successful • 7: registration failed • 8: registration timeout • 9: client life time timeout • 10: client halted • 11: update successful • 12: update failed • 13: update timeout • 14: response failed • 15: notify failed • 16: deregistration successful • 17: deregistration failed
<param1>	Number	Contains additional information depending on <event> value.
<param2>	Number	Contains additional information depending on <event> and <param1> values.

11.11.4 Notes

SARA-N3

- The <percentage> parameter is not supported.
- <status_details>=101, 102, 104, 105 are not supported.
- <update_result>=6, 8 and 9 are not supported.

11.12 uFOTA configuration +UFOTACONF

+UFOTACONF						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

11.12.1 Description

Configures the uFOTA registration and timer for periodic connections to the uFOTA server.

11.12.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UFOTACONF=<mode>,<param>[,<param1>]	OK	AT+UFOTACONF=2,604800 OK
uFOTA server address			
Set	AT+UFOTACONF=0,<hostname>[,<remote_port>]	OK	AT+UFOTACONF=0,"leshan.com" 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
uFOTA retry timer			
Set	AT+UFOTACONF=3,<retry_timer>	OK	AT+UFOTACONF=3,120 OK
Read	AT+UFOTACONF=<mode>	+UFOTACONF: <mode>,<param> OK	+UFOTACONF: 1,1 OK

Type	Syntax	Response	Example
Test	AT+UFOTACONF=?	+UFOTACONF: (list of supported <mode>s),(list of supported <timer>s) OK	+UFOTACONF: (0-3),(-1,1-4294967295) OK

11.12.3 Defined values

Parameter	Type	Description
<mode>	Number	uFOTA parameter to be configured: • 0: address of uFOTA server • 1: module registration to uFOTA server • 2: timer for periodic connection to the uFOTA server • 3: retry timer for periodic connection to the uFOTA server
<hostname>	String	Hostname of the FOTA server. The maximum length is 128 characters. The factory-programmed value is the empty string.
<remote_port>	Number	Remote port of the FOTA server. The range goes from 1 to 65535. The default and factory-programmed value is: • 5683 if DTLS is disabled • 5684 if DTLS is enabled
<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): • If <timer>=-1 or 0 the module never periodically connects to the uFOTA server • 1-4294967295: range in seconds for periodic connections
<retry_timer>	Number	Timer for periodic connection to the uFOTA server expressed in seconds; the allowed range is 0-86400. The factory-programmed value is 60.
<param>	Number / String	Type and supported content depend on the related <op_code> parameter; details are given above
<param1>	Number / String	Type and supported content depend on the related <op_code> parameter; details are given above

11.12.4 Notes

SARA-N3

- The list of supported <timer>s is not returned in the information text response to the test command.

11.13 Last gasp configuration +ULGASP

+ULGASP						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	< 10 s	+CME Error

11.13.1 Description

Enables/disables and configures the last gasp feature. The application is automatically triggered by a properly configured GPIO (see GPIO introduction, <gpio_mode>=19). 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 to be notified about the operation result.

☞ This AT command must be issued after a proper configuration of the GPIO pin via the +UGPIOC command, <gpio_mode>=19. 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 if they are omitted in the set command.

11.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULGASP=<GPIO_mode>,<text>,<msg_format>,[<tel_number>],<IP_protocol>,<IP_addr:PORT>[,[<method>],[<urc_enable>],[<tx_count>],[<shutdown>]]	OK	AT+ULGASP=0,"Power_loss",0,"+39347123456",17,"192.168.100.20:8080" OK
Read	AT+ULGASP?	+ULGASP: <GPIO_mode>,<text>,<msg_format>,<tel_number>,<IP_protocol>,<IP_addr:PORT>,<method>,<urc_enable>,<tx_count>,<shutdown> OK	+ULGASP: 0,"Power_loss",0,"+39347123456",17,"192.168.100.20:8080",1,1,1,0 OK
Test	AT+ULGASP=?	+ULGASP: (list of supported <GPIO_mode>'s),,(list of supported <msg_format>'s),,(list of supported <IP_protocol>'s),,(list of supported <method>'s),(list of supported <urc_enable>'s),(list of supported <tx_count>'s),(list of supported <shutdown>'s) OK	+ULGASP: (0-2),,(0-1),,(6,17),,(0-1),(0,1),(1-10),(0,1) OK
URC		+UULGASP: <result>,<bearer>	+UULGASP: 0,1

11.13.3 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 characters is allowed. When the binary format is selected, a maximum of 512 characters (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
<tel_number>	String	Destination number of the SMS, it is mandatory if <method> is 0 or 2. Factory-programmed value: empty string.
<IP_protocol>	Number	IP protocol used for socket connection. Allowed values: • 6: TCP • 17 (factory-programmed value): 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: • 0: send SMS • 1 (factory-programmed value): 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

Parameter	Type	Description
<tx_count>	Number	Indicates the number of times to transmit the last gasp message. Valid range is 1-10. Factory-programmed value: 1.
<shutdown>	Number	Enables the module shutdown after sending of a predefined last notification. Allowed values: • 0 (factory-programmed value): disabled • 1: enabled

11.13.4 Notes

SARA-N3

- The <msg_format> and <text> parameters must be either both specified or both omitted.

11.14 Firmware update Over AT (FOAT) +NFWUPD

+NFWUPD						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

11.14.1 Description

Triggers the firmware update over the AT command interface. The AT command allows the FW package download, validation and installation. The FW package is a binary (.bin) file provided by u-blox.

- Download the FW package file by means of the package segment download command (AT+NFWUPD=1,<sn>,<len>,<data>,<crc>). If the file size exceeds 256 bytes then the download command can be issued several times.
- Validate the FW package file by means of the AT+NFWUPD=<cmd>=2. The validation cannot be aborted, hence do not issue any other command during the package validation.
- If the validation succeeds, then issue the upgrade firmware command (AT+NFWUPD=<cmd>=5) to complete the FOAT process.

The FW update generally takes two minutes to complete the process. In case of failure during the FW update, the process will be rolled back and an error result code will be provided. At the end of upgrade process the module will be rebooted and the data stored in the NVM are set to the factory-programmed values of the new firmware version.

11.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+NFWUPD=<cmd>[,<sn>,<len>,<data>,<crc>]	OK	AT+NFWUPD=5 OK
Test	AT+NFWUPD=?	+NFWUPD: (list of supported <cmd>s) OK	+NFWUPD: (1-5) OK

11.14.3 Defined values

Parameter	Type	Description
<cmd>	Number	Firmware package process command: • 1: download a FW package segment. The <sn>,<len>,<data>,<crc> parameters are mandatory • 2: package validation • 3: get the package name • 4: get the package version • 5: firmware upgrade
<sn>	Number	Sequence number for each package segment, starting with zero
<len>	Number	Data length expressed in bytes. The maximum length is 256 bytes.
<data>	Number	Data to be transmitted, expressed in hexadecimal format
<crc>	Number	CRC8 of the package segment binary data

11.14.4 Notes

SARA-N200-02B / SARA-N201-02B / SARA-N210-02B / SARA-N211 / SARA-N280-02B

- <cmd>=3 and 4 are not supported.

11.15 Low clock mode setting +CSCLK

+CSCLK						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	Profile	No	-	+CME Error

11.15.1 Description

Configures and reads the low clock mode. To disable it, the Power Mode PM0 shall be enabled firstly (by means of +NVSETPM AT command).

11.15.2 Syntax

Type	**Syntax**	**Response**	**Example**
Set	AT+CSCLK=<pas>	OK	AT+CSCLK=1 OK
Read	AT+CSCLK?	+CSCLK: <pas> OK	+CSCLK: 0 OK
Test	AT+CSCLK=?	+CSCLK: (list of supported <pas>s) OK	+CSCLK: (0-2) OK

11.15.3 Defined values

Parameter	**Type**	**Description**
<pas>	Number	Allowed values: • 0: low clock mode disabled • 1: low clock mode enabled when the DTR line is set high • 2 (factory-programmed value): low clock mode automatically enabled when the UART interface is free, and disabled when the UART interface receives or sends data

12 Power management

12.1 Power Saving Mode Setting +CPSMS

+CPSMS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	NVM / OP	No	< 10 s	+CME Error

12.1.1 Description

Controls the setting of the UEs Power Saving Mode (PSM) parameters. The command controls whether the UE wants to apply PSM or not, 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.

The read command returns the requested values:

- If the Power Saving Mode is enabled (+CPSMS: 1) and granted by the network (+UCPSMS: 1), i.e. Active Time has been assigned, after the expiry of the assigned Active Time (T3324), every SW and HW component on the device will power down except for the real time clock (RTC). It will stay powered down until the expiry of the assigned extended periodic TAU value (T3412_ext) or the assigned periodic TAU value (T3412) (if the former has not been assigned) or the power on line is toggled.
- If the Power Saving Mode is disabled (+CPSMS: 0) or not granted by the network (+UCPSMS: 0) the device will not enter Power Saving Mode (PSM).

Check whether the Active Time and the extended periodic TAU have been assigned to the UE by means of the AT+CEREG=4 command.

12.1.2 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

12.1.3 Defined values

Parameter	Type	Description
<mode>	Number	Indication to disable or enable the use of PSM in the UE. Allowed values: • 0 (default value): disable the use of PSM • 1: enable the use of PSM

Parameter	Type	Description
		• 2: disable the use of PSM and reset all parameters for PSM to factory-programmed values. The factory-programmed value is: • SARA-N3 - 1 • SARA-N2 - The command setting is not persistent
<Requested_ Periodic_RAU>	String	One byte in an 8 bit format. Requested extended periodic RAU value (T3312_ext) to be allocated to the UE in GERAN/UTRAN. The requested extended periodic RAU 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 GPRS Timer 3 IE in 3GPP TS 24.008 table 10.5.163a/3GPP TS 24.008 [69]. See also 3GPP TS 23.682 [69]. See also 3GPP TS 23.682 [144] and 3GPP TS 23.060 [67]. The factory-programmed value is: • SARA-N2 / SARA-N3 - The parameter is not supported.
<Requested_GPRS_ READY_timer>	String	One byte in an 8 bit format. Requested GPRS READY timer value (T3314) to be allocated to the UE in GERAN/UTRAN. The requested GPRS READY timer value is coded as one byte (octet 2) of the GPRS Timer information element coded as bit format (e.g. "01000011" equals 3 decihours or 18 minutes). For the coding and the value range, see the GPRS Timer IE in 3GPP TS 24.008 table 10.5.172/3GPP TS 24.008 [69]. See also 3GPP TS 23.060 [67]. The factory-programmed value is: • SARA-N2 / SARA-N3 - The parameter is not supported.
<Requested_ Periodic_TAU>	String	One byte in an 8 bit format. Requested extended periodic TAU value (T3412_ext) to be allocated to the UE 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 value range, see the GPRS Timer 3 IE in 3GPP TS 24.008 table 10.5.163a/3GPP TS 24.008 [69]. See also 3GPP TS 23.682 [144] and 3GPP TS 23.401 [145]. • SARA-N2 - The default value is "01000001" (10 hours). • SARA-N3 - The factory-programmed and default value is "01000101" (50 hours).
<Requested_Active_ Time>	String	One byte in an 8 bit format. Requested Active Time value (T3324) to be allocated to the UE in GERAN/UTRAN or in EUTRAN. 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 value range, see the GPRS Timer 2 IE in 3GPP TS 24.008 table 10.5.163/3GPP TS 24.008 [69]. See also 3GPP TS 23.682 [144], 3GPP TS 23.060 [67] and 3GPP TS 23.401 [145]. • SARA-N2 - The default value is "00000101" (10 s). • SARA-N3 - The factory-programmed and default value is "00000000" (0 s).

12.1.4 Notes

SARA-N3

- The <Requested_Periodic_RAU> and <Requested_GPRS_READY_timer> parameters are not supported and must be left empty.

SARA-N2

- The <Requested_Periodic_RAU> and <Requested_GPRS_READY_timer> parameters are not supported and must be left empty.
- The <mode> parameter is mandatory.

12.2 Power Saving Mode status report +NPSMR

+NPSMR						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

12.2.1 Description

Returns the status of MT's power mode. The set command configures the +NPSMR URC. When enabled, the URC is issued at each change in power mode of MT.

☞ The <mode> parameter is issued in the information text response to the read command when +NPSMR URC is enabled.

12.2.2 Syntax

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

12.2.3 Defined values

Parameter	Type	Description
<n>	Number	Configure the corresponding URC: • 0 (default value): +NPSMR URC disabled • 1: +NPSMR URC enabled
<mode>	Number	Indicates the power mode status: • 0 (default value): normal mode • 1: Power Saving Mode

12.3 Power mode setting +NVSETPM

+NVSETPM						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

12.3.1 Description

Defines how the module switches between different power modes from PM0 to PM3.

Enable firstly the low clock mode (by means of +CSCLK AT command) to enter the idle mode, sleep mode and deep-sleep mode.

☞ Reboot the module (AT+CFUN=16) to make the setting effective.

Selects the PM according to the <power_setting> parameter:

Power mode	Operating mode	AT interface	PSRAM	Remarks
PM0	Active mode	On	On	
PM1	Idle mode	On	On	The UE can be waked up via AT interface
PM2	Sleep mode	Off	On	**PWR_ON** pin or timers are used to wake up the UE
PM3	Deep-sleep mode	Off	Off	**PWR_ON** pin or timers are used to wake up the UE

Table 15: Power mode description

☞ When the network does not support the PSM or eDRX, the <power_setting> parameter can be set to 9: the PM will be selected by the UE according to the sleep time.

12.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+NVSETPM=<power_setting>	OK	AT+NVSETPM=1 OK
Read	AT+NVSETPM?	+NVSETPM: <power_setting> OK	+NVSETPM: 1 OK
Test	AT+NVSETPM=?	+NVSETPM: (list of supported <power_setting>s) OK	+NVSETPM: (0-2,9,10) OK

12.3.3 Defined values

Parameter	Type	Description
<power_setting>	Number	Power mode setting. Allowed values: • 0 (default and factory-programmed value): the UE does not enter PM1 / PM2 / PM3 • 1: the UE enters PM1 every time it can • 2: the UE enters PM3 when it is going to sleep for more than 300 s (according to PSM or eDRX state), otherwise it enters PM1 every time it can • 9: the UE enters PM3 when it is going to sleep for more than 300 s (according to PSM or eDRX state), enters PM2 when it is going to sleep for less or equal to 300 s (according to PSM or eDRX state), otherwise it enters PM1 every time it can • 10: the UE enters PM2 when it is going to sleep (according to PSM or eDRX state), otherwise it enters PM1 every time it can

12.3.4 Examples

In PM examples some examples are provided for PM usage.

Command	Response	Description
Use case 1: No data services are needed for hours. No active UART interface is needed to follow PM modes, accordingly to PSM and eDRX state. The UE can do data services after wake up with **PWR_ON** pin or by timers.		
AT+CSCLK=2	OK	Set automatic low clock mode
AT+CPSMS=1	OK	Enable the use of PSM
AT+CEDRXS=1	OK	Enable the use of eDRX
AT+NVSETPM=9	OK	Enable the use of PM1/PM2/PM3 with best power consumption performance
AT&W	OK	Store the current configuration
Use case 2: Data services are little frequent. An active UART interface is needed and the idle mode is required. The UE can be waked up via the AT UART interface and do data services.		
AT+CSCLK=2	OK	Set automatic low clock mode
AT+CPSMS=0	OK	Disable the use of PSM
AT+CEDRXS=0	OK	Disable the use of eDRX
AT+NVSETPM=1	OK	Enable the use of PM1
AT&W	OK	Store the current configuration
Use case 3: Data services need to response very promptly. No power saving is needed as an external power source is provided.		
AT+CSCLK=0	OK	Disable low clock mode
AT+CPSMS=0	OK	Disable the use of PSM
AT+CEDRXS=0	OK	Disable the use of eDRX
AT+NVSETPM=0	OK	Disable the use of PM1/PM2/PM3
AT&W	OK	Store the current configuration

Table 16: PM examples

12.4 PM2 idle time configuration +NVSETPM2IDLETIME

+NVSETPM2IDLETIME						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

12.4.1 Description

Configures and reads the PM2 idle time representing the time between the module wake-up (via wake-up key) and re-enter in the PM2 state.

12.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+NVSETPM2IDLETIME=<pm2_idle_time>	OK	AT+NVSETPM2IDLETIME=500

Type	Syntax	Response	Example
Read	AT+NVSETPM2IDLETIME?	AT+NVSETPM2IDLETIME: <pm2_idle_time> OK	+NVSETPM2IDLETIME: 0 OK
Test	AT+NVSETPM2IDLETIME=?	+NVSETPM2IDLETIME: (list of supported <pm2_idle_time>s) OK	+NVSETPM2IDLETIME: (0-65535) OK

12.4.3 Defined values

Parameter	Type	Description
<pm2_idle_time>	Number	PM2 idle time expressed in milliseconds. The range goes from 0 to 65535 ms (the default value is 19531 ms).

13 GPIO

13.1 Introduction

The section describes the AT commands used to configure the GPIO pins provided by u-blox cellular modules.

13.1.1 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 17 for an overview of the custom functions supported by u-blox cellular modules.

<gpio_mode>	Output	Input	Network status indication	External GNSS supply enable	External GNSS data ready	External GNSS RTC sharing	Jamming detection indication	SIM card detection	Headset detection	GSM Tx burst indication	Module status indication	Module operating mode indication	I2S digital audio interface	SPI serial interface	Master clock generation	UART (DSR, DTR, DCD and RI) interface	Wi-Fi enable	Ring indicator	Last gasp	External GNSS antenna / LNA control	Time pulse GNSS	Time pulse output	Time stamp of external interrupt	Fast and safe power-off	LwM2M pulse	Hardware flow control (RTS, CTS)	Antenna dynamic tuning	External GNSS time pulse input	External GNSS time stamp of external interrupt	DTR mode for power saving control	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	20	21	22	23	24	25	26	27	28	29	30	32	255
SARA-N3	*	*	*								*							*	*							*						*
SARA-N2			*															*														*

Table 17: 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.

13.1.2 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.

13.1.2.1 SARA-N3 GPIO mapping

<gpio_id>	Pin name	Pin number	Factory-programmed function	Remarks
7	RI	7	Ring indication	Only pin 7 can be configured for "Ring indication" functionality
10	RTS	10	Hardware flow control (RTS, CTS)	Only pin 10 can be configured for "Hardware flow control RTS" functionality
11	CTS	11	Hardware flow control (RTS, CTS)	Only pin 11 can be configured for "Hardware flow control CTS" functionality
16	GPIO1	16	Pad disabled	-
23	GPIO2	23	Pad disabled	-
24	GPIO3	24	Pad disabled	Only pin 24 can be configured for "Last gasp" functionality

<gpio_id>	Pin name	Pin number	Factory-programmed function	Remarks
25	GPIO4	25	Pad disabled	Only pin 25 can be configured for "Module status indication" functionality
42	GPIO5	42	Pad disabled	-

Table 18: SARA-N3 series GPIO mapping

13.1.2.2 SARA-N2 GPIO mapping

<gpio_id>	Pin name	Pin number	Factory-programmed function	Remarks
16	GPIO1	16	Pad disabled	Reserved for internal use
11	CTS	11	Pad disabled	Pin 11 can be configured for "Network status indication" or "Ring indication"

Table 19: SARA-N2 series GPIO mapping

13.1.2.3 Additional notes

☞ <gpio_mode>=24 (fast and safe power-off) triggers the emergency fast shutdown of the module. The process status is provided by means of the +UUFASTSHUTDOWN URC. For more details about the URC syntax, see +CFUN AT command.

☞ SARA-N3
Pin 10 and pin 11 are dedicated for RTS and CTS lines respectively when the UART HW flow control is enabled. Enabling the HW flow control on any of the pins will be effective to the other pin automatically.

☞ See the corresponding module system integration manual for the complete overview of all allowed configurations.

13.1.3 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 NB-IoT: indicates registered state on home network in NB-IoT
- 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 NB-IoT: indicates registered state with visitor NB-IoT network (roaming in NB-IoT)
- 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

☞ SARA-N2 / SARA-N3
Only the registered home network NB-IoT and the registered roaming NB-IoT are supported.

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.

13.1.3.1 No service (no network coverage or not registered)

- Continuous Output / Low

Figure 1: GPIO pin progress for no service

13.1.3.2 Registered home network 2G

- Cyclic Output / High for 100 ms, Output / Low for 2 s

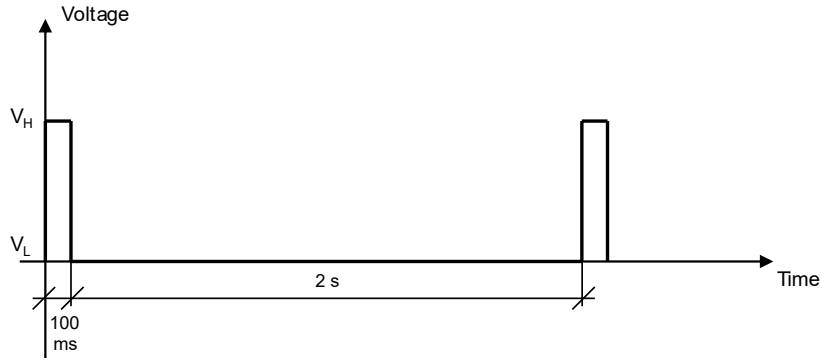

Figure 2: GPIO pin progress for registered home network 2G

13.1.3.3 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

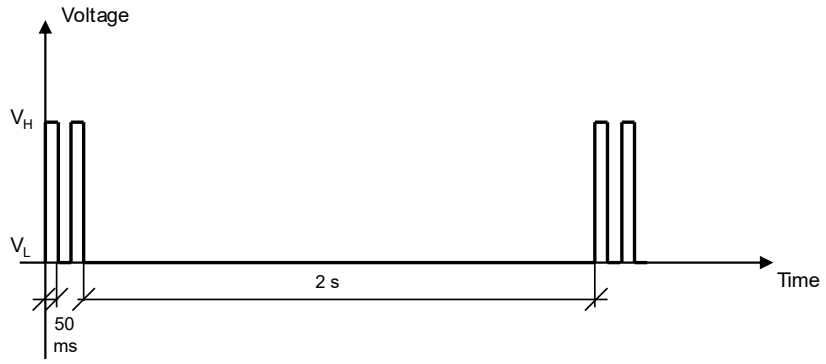

Figure 3: GPIO pin progress for registered home network 3G

13.1.3.4 Registered home network NB-IoT

- Cyclic Output / High for 100 ms, Output / Low for 30 s

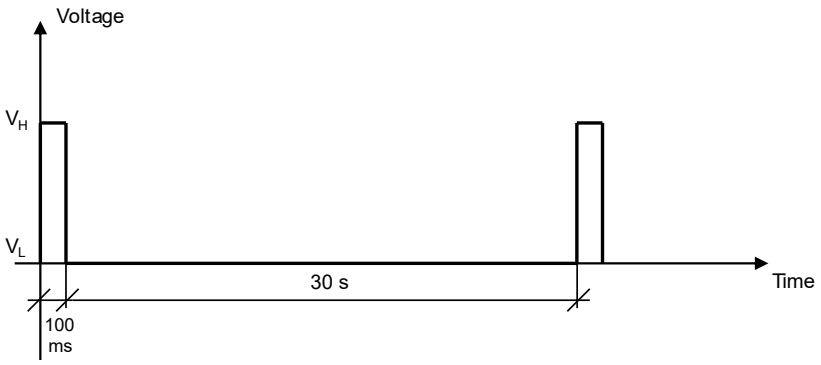

Figure 4: GPIO pin progress for registered home network NB-IoT

13.1.3.5 Registered roaming 2G

- Cyclic Output / High for 100 ms, Output / Low for 100 ms, Output / High for 100 ms, Output / Low for 2 s

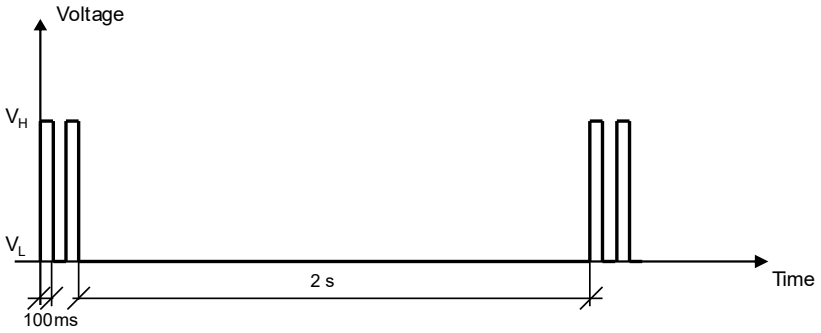

Figure 5: GPIO pin progress for registered roaming 2G

13.1.3.6 Registered roaming 3G

- Cyclic Output / High for 50 ms, Output / Low for 50 ms, Output / High for 50 ms, Output / Low for 100 ms

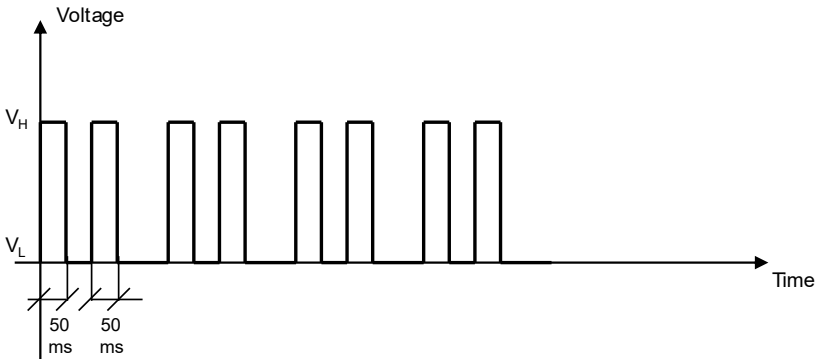

Figure 6: GPIO pin progress for registered roaming 3G

13.1.3.7 Registered roaming NB-IoT

- Cyclic Output / High for 100 ms, Output / Low for 100 ms, Output / High for 100 ms, Output / Low for 30 s

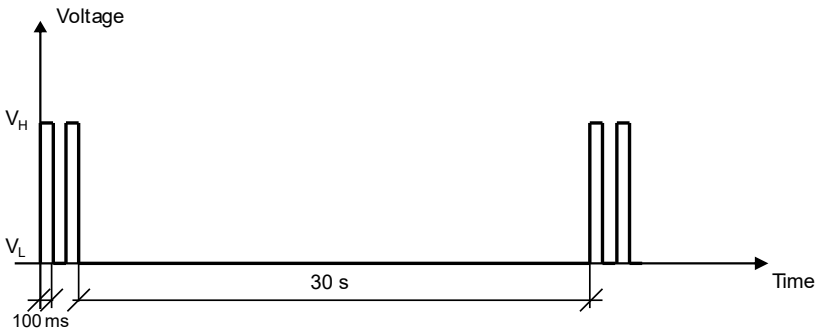

Figure 7: GPIO pin progress for registered roaming NB-IoT

13.1.3.8 Data transmission

- Continuous Output / High

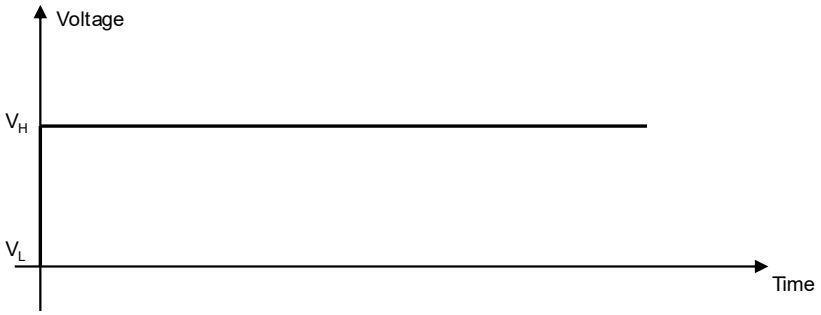

Figure 8: GPIO pin progress for data transmission

13.1.3.9 Data transmission roaming

- Cyclic Output / High for 800 ms, Output / Low for 200 ms

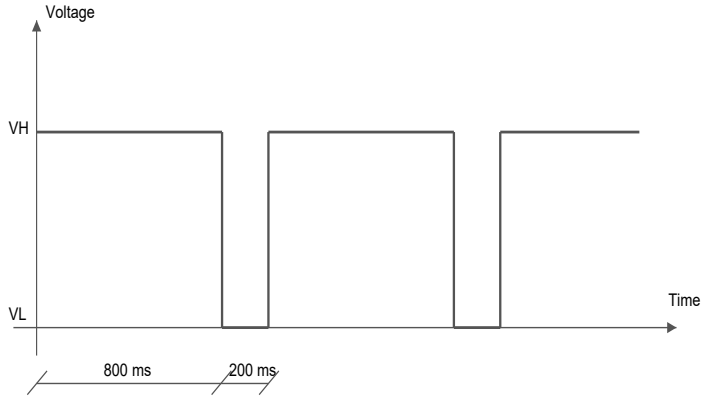

Figure 9: GPIO pin progress for data transmission roaming

13.1.4 Module status indication

When a GPIO pin is configured to provide module status indication, its progress depends on the current module status (power-off mode, i.e. module switched off, versus idle, active or connected mode, i.e. module switched on):

- Output / High, when the module is switched on (any operating mode during module normal operation: idle, active or connected mode)
- Output / Low, when the module is switched off (power-off mode)

13.1.5 Module operating mode indication

When a GPIO pin is configured to provide module operating mode indication, its progress depends on the current module operating mode (the low power idle mode versus active or connected mode):

- Output / High, when the module is in active or connected mode
- Output / Low, when the module is in idle mode (that can be reached if the power saving is enabled by the +UPSV AT command)

13.2 GPIO select configuration command +UGPIOC

+UGPIOC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	< 10 s	+CME Error

13.2.1 Description

Configures the GPIO pins as input, output or to handle a custom function. When a GPIO pin is configured as an 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
- External GNSS supply enable
- External GNSS data ready
- External GNSS RTC sharing
- Jamming detection indication
- SIM card detection
- Headset detection
- GSM Tx burst indication
- Module status indication
- Module operating mode indication
- Ring indicator
- Last gasp
- External GNSS antenna / LNA control
- Time pulse GNSS
- Time pulse output
- Time stamp of external interrupt
- Fast and safe power-off
- External GNSS time pulse input
- External GNSS time stamp of external interrupt
- DTR mode for power saving control
- 32.768 kHz output

☞ 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.

☞ SARA-N2 / SARA-N3
The <gpio_out_val> parameter setting is not stored in the NVM.

☞ SARA-N2

Network status indication and Ring indicator are mutually exclusive modes, selecting both simultaneously will return an error result code.

13.2.2 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 42,7 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: (20,21,23,24,42),(0-5,7,9,255),(0-2) OK

13.2.3 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: external GNSS supply enable • 4: external GNSS data ready • 5: external GNSS RTC sharing • 6: jamming detection indication • 7: SIM card detection • 8: headset detection • 9: GSM Tx burst indication • 10: module status indication • 11: module operating mode 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 indicator • 19: last gasp • 20: external GNSS antenna / LNA control enable • 21: time pulse GNSS

Parameter	Type	Description
		• 22: time pulse output • 23: time stamp of external interrupt • 24: fast and safe power-off • 25: LwM2M pulse • 26: hardware flow control (RTS, CTS) • 27: antenna dynamic tuning • 28: external GNSS time pulse input • 29: external GNSS time stamp of external interrupt • 30: DTR mode for power saving control • 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): • 0 (default value): no resistor activated • 1: pull up resistor active • 2: pull down resistor active

13.2.4 Notes

SARA-N3

- The <gpio_in_pull> parameter is not supported.
- Only NB-IoT home/roaming network is supported.

SARA-N2

- <gpio_in_pull> and <gpio_out_val> are not supported.
- Only NB-IoT home/roaming network is supported.

13.3 GPIO read command +UGPIOR

+UGPIOR						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

13.3.1 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.

13.3.2 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

13.3.3 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.

Parameter	Type	Description
<gpio_val>	Number	GPIO value. Allowed values are 0 and 1.

13.3.4 Notes

- The set command works only if the <gpio_mode> parameter of the +UGPIOC AT command is set to 0 or 1.

13.4 GPIO set command +UGPIOW

+UGPIOW						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

13.4.1 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).

13.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPIOW=<gpio_id>,<gpio_out_val>	OK	AT+UGPIOW=20,1 OK
Test	AT+UGPIOW=?	+UGPIOW: (list of supported <gpio_id>s),(list of supported <gpio_out_val>s) OK	+UGPIOW: (20, 21),(0-1) OK

13.4.3 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.

13.4.4 Notes

- The set command works only if the <gpio_mode> parameter of the +UGPIOC AT command is set to 0.

14 File System

14.1 File tags

14.1.1 Description

File system commands have the optional <tag> parameter that allows the user to specify a file type when a file system 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.

The file tag applicability depends on the module series: see Table 20 for the allowed tags supported by the interested product. An overview about each file tag is provided in Table 21.

Module	"USER"	"FOAT"	"AUDIO"	"ECALL_EXT"	"FOTA_EXT"	"AUDIO_EXT"	"PROFILE"	"GNSS"	"CALLSRV_EXT"	"XLWM2M"	"MNO"
SARA-N3	*										

Table 20: Tag applicabilities 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 overwritten with AT&W<X> command.
"ECALL_EXT"	eCall controller configuration and custom eCall prompts	This tag is used to read, download and delete the eCall controller configuration (see the eCall implementation in u-blox cellular modules application note [44]) or download and delete custom eCall prompts (see the 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.
"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

Tag	Name	Specification
		• +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.
"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.
"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. All numbers in the list will be treated as emergency numbers when dialled and will result in disabling the thermal daemon software shutdown. Some notes about ECNL:
		• If eCall is enabled, the ECNL list is not used and call is treated as any normal call.
		• Conflict manager will not manage these calls, meaning no ongoing calls will be dropped.
		• Maximum allowed numbers in the ECNL list is 20. Numbers after 20 will be ignored.
		• Reboot is required to reload the ECNL list after download.
		
		File should be composed by text lines consisting of 'type','number' lines that end with carriage return where 'type' is a type of the number in 'number' according to one of the formats supported by 3GPP TS 24.008 [69] sub-clause 10.5.4.7).
		
		All numbers that start with '00' should be stored with '+' instead in order to keep only one occurrence for international number. In order to manage numbers properly the configuration file should contain the number with international prefix and without it.
		
		Example of a two line ECNL file:
		`2,+390123456789`
		`2,390123456789`

"XLWM2M"	LwM2M object script files	This tag is used to read or store Lua files defining a LwM2M object for use by the LwM2M client. The file specified with the "XLWM2M" can be only downloaded completely (see +UDWNFILE AT command), deleted (see +UDELFILE AT command), fully or partially read (see +URDFILE or +URDBLOCK) and queried (see +ULSTFILE AT command).

"MNO"	ICCID and MCC/MNC MNO lists	This tag refers to the files containing the ICCID and MCC/MNC MNO lists used by the SIM ICCID/IMSI selection (see the +UMNOPROF AT command). The file specified with the "MNO" tag can be downloaded to the module (see the +UDWNFILE AT command), deleted (see the +UDELFILE AT command), fully or partially read (see the +URDFILE or +URDBLOCK AT commands) and queried (see the +ULSTFILE AT command). Depending on the file name (<filename>) the file contains the ICCID and MCC/MNC MNO lists. The allowed file names are:
		• "iccid_list": SIM Issuer Identifier Number (IIN) list. The list format is: `MNO1%iccid1%iccid2%MNO2%iccid3%iccid4...%MNOn%iccidm`. By factory-programmed configuration no iccid_list file is stored in the module file system.
		• "mno_list": MCC and MNC list. The list format: `MNO1%mcc1mnc1%mcc2mnc2%MNO2%mcc3mnc3...%MNOn%mcckmnck`. By factory-programmed configuration the following mno_list file is stored in the module file system:
		`ATT%310150%310170%310410%310560%311180%310030%310280`
		`%310950%313790%VZW%310890%311480%311270%310010%310012`
		`%310013%310590%310890%310910%311110%311270%311271`
		`%311272%311273%311274%311275%311276%311277%311278`
		`%311279%311280%311281%311282%311283%311284%311285`
		`%311286%311287%311288%311289%311390%311480%311481`

Tag	Name	Specification
		%311482%311483%311484%311485%311486%311487%311488 %311489%TELSTRA%50501%50571%50572%FN%313100%312670 %313130%313140%313110%313120%TMOUS%310660%310160 %310270%310310%310490%310800%310200%310210%310220 %310230%310240%310250%310260 Allowed MNO1,..., MNOn values for both iccid_list and mno_list files are: • ATT: AT&T • VZW: Verizon • CB: Generic voice capable AT&T • FN: FirstNet • TELSTRA: Telstra • TMOUS: T-Mobile US The maximum entries number in the MCC/MNC list and ICCID list is 256 and the file overall maximum size is 2048 bytes.

Table 21: Tag meanings

14.2 Download file +UDWNFILE

+UDWNFILE						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

14.2.1 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 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.

☞ SARA-N3

- The available free memory space is checked before starting the file transfer. If the file size exceeds the available space, the "+CME ERROR: FFS MEMORY NOT AVAILABLE" error result code will be provided (if +CMEE: 2).
- If the file already exists, the data will be overwritten.
- If an error occurs during the file writing, all bytes of the file will be deleted.

☞ SARA-N2 / SARA-N3
If the HW flow control is disabled (AT&K0), a data loss could be experienced. So the HW flow control usage is strongly recommended.

14.2.2 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
Download audio configuration			

Type	Syntax	Response	Example
Set	AT+UDWNFILE=<filename>,<size>,"AUDIO_EXT"	OK	AT+UDWNFILE="audioconfig",4873,"AUDIO_EXT" OK

14.2.3 Defined values

Parameter	Type	Description
<filename>	String	Filename. For file system filename and data size limits see File system limits.
<size>	Number	File size expressed in bytes. For file system filename 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. For more details on specific limitations, see Notes.
<text>	String	Stream of bytes.

14.2.4 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".

14.3 List files information +ULSTFILE

+ULSTFILE						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

14.3.1 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.

14.3.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+ULSTFILE=[<op_code>[,<param1>[,<param2>]]]	+ULSTFILE: [<param3>,...[,<paramN>]] OK	
List of files stored into the FS			
Set	AT+ULSTFILE=[0[,<tag>]]	+ULSTFILE: [<filename1>[,<filename2>[,...[,<filenameN>]]]] OK ☞ See notes below	AT+ULSTFILE= +ULSTFILE: "filename1","filename2" OK ☞ See notes below
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

14.3.3 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	Filename. For file system filename 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).

14.3.4 Notes

SARA-N3

- The AT+ULSTFILE= command is not allowed; if the <op_code> parameter is omitted the AT+ULSTFILE command shall be issued and it is equivalent to AT+ULSTFILE=0.
- If <op_code>=1 (get remaining free FS space), the <tag> parameter is not supported.

14.4 Read file +URDFILE

+URDFILE						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	partial	No	No	No	-	+CME Error

14.4.1 Description

Retrieves a file from the file system.

14.4.2 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

14.4.3 Defined values

Parameter	Type	Description
<filename>	String	Filename. For file system filename 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.

14.4.4 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.

14.5 Partial read file +URDBLOCK

+URDBLOCK						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

14.5.1 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.

14.5.2 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

14.5.3 Defined values

Parameter	Type	Description
<filename>	String	Filename. For file system filename 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.

14.5.4 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.
- If a size larger than the whole file size is required the command returns the file size only, indicating the amount of bytes read.
- If an offset larger than the whole file size is required, the "+CME ERROR: FFS file range" error result code is triggered.

14.6 Delete file +UDELFILE

+UDELFILE						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

14.6.1 Description

Deletes a stored file from the file system.

☞ SARA-N3
If <filename> file is not stored in the file system the following error result code will be provided: "+CME ERROR: FILE NOT FOUND".

14.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDELFILE=<filename>[,<tag>]	OK	AT+UDELFILE="filename","USER" OK

14.6.3 Defined values

Parameter	Type	Description
<filename>	String	Filename. For file system filename 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.

14.7 File system limits

14.7.1 Allowed characters in filenames

A filename cannot contain the following characters: / * : % | " < > ?

14.7.2 Limits

Here below are listed the maximum filename length, the maximum data size of the file system and the maximum number of files for the u-blox cellular modules.

Maximum filename length:

- SARA-N3 - 47 characters

Maximum file size:

- SARA-N3 - 5120 bytes

Maximum number of files:

- SARA-N3 - The theoretical maximum number of files that can be stored is 60.

☞ 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.

15 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.

15.1 Resolve name / IP number through DNS +UDNSRN

+UDNSRN						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 130 s	TCP/UDP/IP Error

15.1.1 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 if 8 servers are used to perform this task.

☞ SARA-N3
The domain name to an IP address will always be resolved asynchronously, so the <async> parameter is not supported.

15.1.2 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

15.1.3 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: • 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

Parameter	Type	Description
		• 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

15.1.4 Notes

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- <resolution_type>=1 is not supported.

15.2 Dynamic DNS update +UDYNDNS

+UDYNDNS						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	- (except URC)	+CME Error

15.2.1 Introduction

The IP address assigned to a module by the network provider is often dynamic; this means the IP address changes every time a PDP context is enabled.

This could be a problem when it is needed to identify an internet host with a domain name, because they are usually used with static IP address that never changes (or rarely changes).

To solve this problem, the dynamic DNS services provide a way to assign a domain name to a host that owns a dynamic IP address, but they require a client that sends the latest IP given by the network to these services, to update their DNS tables.

With the +UDYNDNS command u-blox cellular modules can access to dynamic DNS services.

This functionality is disabled by default, but once configured and enabled it automatically sends updates to the configured Dynamc DNS service every time the module IP address change. The functionality only works for internal PDP context (see Multiple PDP contexts).

15.2.2 Description

Sets up the dynamic DNS client functionality. This command is part of the internal TCP/IP stack so it only works for internal PDP contexts (managed by +UPSD and +UPSDA command; see the Multiple PDP contexts).

The command configuration is stored into the NVM: if enabled, it automatically works after a reboot.

The following dynamic DNS providers are supported:

- TZO.com
- DynDNS.org
- DynDNS.it
- No-IP.org
- DNSDynamic.org

During the service subscription phase the dynamic DNS provider gives a domain name, a username and a password that the AT application will use later.

If the DYNDNS client is enabled when an internal PDP connection is already active, the DYNDNS client starts working on the next PDP context activation.

☞ SARA-N3

This functionality is only available for the PDP context enabled with +UPSDA command.

☞ Before changing the dynamic DNS client configuration it is required to stop (deactivate) it. Any attempt to reconfigure an already running DNS client raises an error.

☞ The dynamic DNS update is not allowed during the first 60 s after module power on. If a PDP connection is established before this time, a URC notifies that the update has been delayed. In this case the update is performed once the 60 s are elapsed.

☞ The dynamic DNS protocol does not allow more than one update every 60 s, anyhow the module's DYNDNS client will respect specific timing rules depending on the selected provider policies.

☞ Due to the various caches involved in the DNS resolution process, the time since the DNS update is done until it is available for a user, can significantly change among different internet providers.

15.2.3 Syntax

Type	Syntax	Response	Example
Set	AT+UDYNDNS=<on_off>[,<service_id>,<domain_name>,<username>,<password>]	OK	**Enable the dynamic DNS client using the TZO DNS service and the domain name "remote001.tzo.net".** AT+UDYNDNS=1,0,"remote001.tzo.net","dummy_username","dummy_password" OK
			Disable the dynamic DNS client: AT+UDYNDNS=0 OK
Read	AT+UDYNDNS?	+UDYNDNS: <on_off>,<service_id>,<domain_name>,<username>,<password> OK	+UDYNDNS: 1,0,"remote001.tzo.net","dummy_username","dummy_password" OK
Test	AT+UDYNDNS=?	+UDYNDNS: (list of supported <on_off>),(list of supported <service_id>),<domain_name>,<username>,<password>) OK	+UDYNDNS: (0-1),(0-4),"domain_name","username","password" OK
URC		+UUDYNDNS: <status>,<code>	+UUDYNDNS: 1,0

15.2.4 Defined values

Parameter	Type	Description
<on_off>	Number	Enable / disable the dynamic DNS client: • 0 (factory-programmed value): disable the client • 1: enable the client
<service_id>	Number	Indicates which dynamic DNS service provider to use: • 0 (factory-programmed value): TZO.com • 1: DynDNS.org • 2: DynDNS.it • 3: No-IP.org • 4: DynamicDNS.org Mandatory parameter with <on_off>=1, not allowed with <on_off>=0.
<domain_name>	String	Indicates which domain name should be associated with the module IP address. The dynamic DNS service provider provides this value. Maximum length: 64 bytes. Mandatory parameter with <on_off>=1, not allowed with <on_off>=0. The factory-programmed value is an empty string.
<username>	String	The username used for the client authentication. Maximum length: 64 characters.

Parameter	Type	Description
		Mandatory parameter with <on_off>=1, not allowed with <on_off>=0. The factory-programmed value is an empty string.
<password>	String	The password used for the client authentication. Maximum length: 32 characters. Mandatory parameter with <on_off>=1, not allowed with <on_off>=0. The factory-programmed value is an empty string.
<status>	Number	This is the internal status of the dynamic DNS client. Each time the internal status changes or there is an error the URC +UUDYNDNS is issued: • 0: client inactive/stopped • 1: client enabled/active • 2: DNS update successfully executed • 3: DNS update failed • 4: DNS update delayed • 5: No DNS update is required • 6: Self deactivation: the dynamic DNS client will stop due to internal error or DynDNS protocol specification
<code>	Number	This is the code returned by the +UUDYNDNS URC. The meaning of the <code> value is described in Dynamic DNS unsolicited indication codes (see Dynamic DNS unsolicited indication codes).

15.2.5 Notes

- In case of self deactivation (+UUDYNDNS <status> = 6), the client is disabled (saving the disabled setting into the NVM); the customer has then to identify the cause (usually bad configuration of the client) and manually re-activate it. After a self deactivation it is always required to re-activate the client.
- If UDYNDNS is enabled and properly configured an +UUDYNDNS URC (+UUDYNDNS: 1,0) will be displayed at the "system power on" on AT terminal. The +UUDYNDNS URC (+UUDYNDNS: 1,0) notifies that the UDYNDNS service is enabled and that an dynamic IP address update will occur when an Internal PDP context will be activated or when an Internal PDP context IP address will change.

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- <service_id>= 0, 2 and 4 are not supported. The factory-programmed value is 1.

15.2.6 DynDNS client behavior in case of error

When the error result code is in range 1-10 and 100-108 the client waits for 60 s before allowing any update operation.

In all the other cases (error in range from 40 to 57) the following behaviors are applied:

- SARA-N3 - For DynDNS.org, DynDNS.it, No-IP.org and DNSDynamic.org:

DynDNS client error code	Provider error code	Client action
40	good	Next update will be possible after 60 s
41	nochg	Next update will be possible after 10 minutes
45	badauth	Next update will be possible after 24 hours
47	!donator	Next update will be possible after 24 hours
42	notfqdn	Client self deactivation
43	nohost	Client self deactivation
44	numhost	Client self deactivation
48	abuse	Client self deactivation
46	badagent	Client self deactivation
49	dnserr	Next update will be possible after 30 minutes
50	911	Next update will be possible after 30 minutes
51	badsys	Client self deactivation
52	!yours	Client self deactivation

16 Internet protocol transport layer

16.1 Introduction

SARA-N3
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-N3
See +UPSD and +UPSDA AT commands for establishing a PSD connection.

SARA-N3
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 depends on the module series:

- SARA-N2 - 7
- SARA-N3 - 8 (starting from 1), where the secure sockets that can be managed is 1

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

SARA-N3
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

16.2 IPv4/IPv6 addressing

16.2.1 Introduction

The section describes the IP addressing formats and IP address rules used by TCP/IP UDP/IP enabled applications.

16.2.2 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 22: IPv4 address format examples

16.2.3 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 23: 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 switched services AT commands (i.e. PDP_addr in +CGDCONT) the format is specified in the corresponding command section.

16.3 Create Socket +USOCR

+USOCR						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

16.3.1 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:

- SARA-N3 - Up to 8 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.

☞ SARA-N3
The <IP_type> parameter will be ignored when the PDP context of <PDP_type>="IPv4" or "IPv6" is created by means of +CGDCONT AT command.

16.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCR=<protocol>[,<local_port>[,<IP_type>]]	+USOCR: <socket> OK	AT+USOCR=17 +USOCR: 2 OK
Test	AT+USOCR=?	+USOCR: (list of supported <protocol>s),(list of supported <local_port>s),(list of supported <IP_type>s) OK	+USOCR: (6,17),(1-65535),(0,1) OK

16.3.3 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. • SARA-N3 - The range goes from 1 to 8.
<IP_type>	Number	Selects the specific IP type (for the required <socket>) between IPv4 and IPv6 when <PDP_type> is set to "IPV4V6" while the PDP context is created by means of +CGDCONT AT command. Allowed values: • 0 (default value): IPv4 • 1: IPv6

16.4 SSL/TLS/DTLS mode configuration on TCP/UDP socket +USOSEC

+USOSEC						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	< 120 s	+CME Error

16.4.1 Description

Enables or disables the use of SSL/TLS/DTLS connection (where supported) on a TCP/UDP socket. The configuration of the SSL/TLS/DTLS properties is provided with an SSL/TLS/DTLS 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/DTLS is enabled on the interested socket.

☞ SARA-N3
The command is applicable only with TCP sockets.

☞ The enable or disable operation can be performed only after the socket has been created with +USOCR AT command.

☞ The SSL/TLS/DTLS is supported only with +USOCO command (socket connect command). The SSL/TLS/DTLS is not supported with +USOLI command (socket set listen command is not supported and the +USOSEC settings will be ignored).

☞ The command response time may vary depending on the module series. For more details, see the Appendix B.4.

16.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOSEC=<socket>,<ssl_tls_dtls_status>[,<usecmng_profile_id>]	OK	AT+USOSEC=0,1,1 OK
Read	AT+USOSEC=<socket>	+USOSEC: <socket>,<ssl_tls_dtls_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_dtls_status>s),(list of supported <usecmng_profile_id>s) OK	+USOSEC: (0-6),(0,1),(0-4) OK

16.4.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier defined by the AT+USOCR command. • SARA-N3 - The range goes from 1 to 8.
<ssl_tls_dtls_status>	Number	• 0 (default value): disable the SSL/TLS/DTLS on the socket. • 1: enable the socket security; 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/DTLS properties to be used for the SSL/TLS/DTLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see USECMNG section).

16.5 Set socket option +USOSO

+USOSO						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.5.1 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.

16.5.2 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

16.5.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • SARA-N3 - The range goes from 1 to 8.
<level>	Number	Allowed values: • 0: IP protocol <opt_name> for IP protocol level may be: o 1: type of service (TOS)

Parameter	Type	Description
		<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 [160] 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 <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).

16.5.4 Notes

SARA-N3

- <level>=65535 (socket) is replaced with 4095.
- <level>=4095 (socket), <opt_name>=32 supports only for UDP sockets.
- <level>=4095 (socket), <opt_name>=512 (local address and port re-use) is not supported.
- The range of the linger time (<opt_val2> parameter) goes from 0 to 32000 ms: the parameter value can be configured as multiple of 1000 ms.

16.6 Get Socket Option +USOGO

+USOGO						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.6.1 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.

16.6.2 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

16.6.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • SARA-N3 - The range goes from 1 to 8.
<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 [160]. 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

Parameter	Type	Description
		- 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

16.6.4 Notes

SARA-N3

- <level>=65535 (socket) is replaced with 4095.
- <level>=4095 (socket), <opt_name>=512 (local address and port re-use) is not supported.
- <level>=4095 (socket), <opt_name>=32 supports only for UDP sockets.
- The range of the linger time (<opt_val2> parameter) goes from 0 to 32000 ms, the parameter value will be returned as multiple of 1000 ms.

16.7 Close Socket +USOCL

+USOCL						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	< 120 s	+CME Error

16.7.1 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.

☞ SARA-N3
The specified socket will be closed asynchronously, so the <async_close> parameter is not supported.

☞ The command response time may vary depending on the module series. For more details, see the Appendix B.4.

16.7.2 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

16.7.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • SARA-N3 - The range goes from 1 to 8.

Parameter	Type	Description
<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.

16.8 Get Socket Error +USOER

+USOER						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	TCP/UDP/IP Error +CME Error

16.8.1 Description

Retrieves the last error occurred in the last socket operation, stored in the BSD standard variable error.

16.8.2 Syntax

Type	Syntax	Response	Example
Action	AT+USOER	+USOER: <socket_error> OK	+USOER: 104 OK

16.8.3 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.6 • 0: no error

16.9 Connect Socket +USOCO

+USOCO						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	partial	No	No	No	< 130 s	+CME Error

16.9.1 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.

☞ SARA-N3
Socket connections will be established asynchronously, so <async_connect> parameter is not supported.

16.9.2 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
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

16.9.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier to be used for any future operation on that socket. • SARA-N3 - The range goes from 1 to 8.
<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.6: • 0: no error, connection successful

16.9.4 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.

16.10 Write socket data +USOWR

+USOWR						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	< 120 s	+CME Error

16.10.1 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 behavior
- 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 acknowledgment received by the remote server the socket is connected to.

The command response time may vary depending on the module series. For more details, see the Appendix B.4.

16.10.2 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

16.10.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • SARA-N3 - The range goes from 1 to 8.
<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

Parameter	Type	Description
<data>	String	Data bytes to be written. Not all of the ASCII charset can be used.

16.10.4 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 [71], 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-N3

- The binary syntax is not supported.

16.11 SendTo command (UDP only) +USOST

+USOST						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 130 s	+CME Error

16.11.1 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. To enable it, see the AT+UDCONF=1 command description.
- **Binary extended syntax**: mandatory for writing any character in the ASCII range [0x00, 0xFF].

☞ If no network signal is available, outcoming UDP packet may be lost.

☞ The information text response to the test command provides the information about the bynary extended syntax only where supported.

☞ SARA-N3
After having issued the set command the final result of +USOST command will be returned to the user via the +UUSOST URC.
The binary extended syntax is not supported.

☞ The command response time may vary depending on the module series. For more details, see the Appendix B.4.

☞ In binary mode the command will never return if less characters than the expected length are issued after the prompt.

16.11.2 Syntax

Type	Syntax	Response	Example
Base syntax			
Set	AT+USOST=<socket>,<remote_addr>,<remote_port>,<length>,<data>,[<seq_no>]	+USOST: <socket>,<length> OK	AT+USOST=3,"151.9.34.66",449,16,"16 bytes of data" +USOST: 3,16 OK
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),(list of supported <seq_no>s),"HEX data" +USOST: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <length>s),(list of supported <seq_no>s),"data" [+USOST: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <length>s)] OK	+USOST: (1-8),"remote_host",(1-65535),(1-512),(1-255),"HEX data" +USOST: (1-8),"remote_host",(1-65535),(1-1024),(1-255),"data" OK
URC		+UUSOST: <socket>,<seq_no>,<UDP_result>	+USOST: 3,1,1

16.11.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • SARA-N3 - The range goes from 1 to 8.
<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: • SARA-N3 o Base syntax normal mode: range 1-1460 o Base syntax HEX mode: range 1-1460 ☞ SARA-N3 On SARA-N310-00X-00 the allowed ranges are: • Base syntax normal mode: range 1-1024 • Base syntax HEX mode: range 1-512
<data>	String	Data bytes to be written (not all of the ASCII charset can be used)
<seq_no>	Number	Sequence number of UDP packet, in range 1-255. The default value is 1.
<UDP_result>	Number	Supported values: • 0: fail • 1: success

16.11.4 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 [71], 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
  - In binary mode the command response time value specified in Estimated command response time takes effect after the last expected character has been issued

16.12 Read Socket Data +USORD

+USORD						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 1 s (except URC)	+CME Error

16.12.1 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.

☞ If the UART interface of the application processor has a RX FIFO of only 1 character, it is highly recommended to set the <length> parameter lower than 64.

☞ (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.

☞ SARA-N3
Once the host server closes the TCP connection and the socket data buffer is not empty, it goes in CLOSE_WAIT state. The socket is closed after a successful read operation using the +USORD AT command.

16.12.2 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

16.12.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • SARA-N3 - The range goes from 1 to 8.
<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

16.12.4 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>.

SARA-N3

- <length>=0 is not supported.
- UDP socket data reading is not supported.

16.13 Receive From command (UDP only) +USORF

+USORF						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 1 s (except URC)	+CME Error

16.13.1 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.

16.13.2 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
URC		+UUSORF: <socket>,<length>	+UUSORF: 3,16

16.13.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • SARA-N3 - The range goes from 1 to 8.
<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 stored in buffer (if in the set command), or read from the buffer (if in the information text response to the set command), or stored in the buffer (for the URC). The allowed range when issued in the set command or returned in the information text response is: • SARA-N3 - Not supported, see Notes.
<data>	String	Data bytes to be read

16.13.4 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>.

SARA-N3

- The <length> parameter is not supported.

16.14 Set Listening Socket +USOLI

+USOLI						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 1 s (except URC)	+CME Error

16.14.1 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.

16.14.2 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

16.14.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • SARA-N3 - The range goes from 1 to 8.
<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.

16.14.4 Notes

- In case of notification via the URC +UUSOLI <port> is intended as the remote port.

16.15 HEX mode configuration +UDCONF=1

+UDCONF=1						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.15.1 Description

Enables/disables the HEX mode for +USOWR, +USOST, +USORD and +USORF AT commands.

16.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=1,<enable_hex_mode>	OK	AT+UDCONF=1,0 OK
Read	AT+UDCONF=1	+UDCONF: 1,<enable_hex_mode> OK	AT+UDCONF=1 +UDCONF: 1,1 OK

16.15.3 Defined values

Parameter	Type	Description
<enable_hex_mode>	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

16.16 Set socket in Direct Link mode +USODL

+USODL						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 1 s	+CME Error

16.16.1 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.

SARA-N3
The +UDCONF=5, +UDCONF=6, +UDCONF=7 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.

16.16.2 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

16.16.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • SARA-N3 - The range goes from 1 to 8.

16.16.4 Notes

SARA-N3

- The +UDCONF=2 and +UDCONF=3 commands allow the UDP direct link configuration.

16.16.5 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.

SARA-N3
See the +UDCONF=5, +UDCONF=6, +UDCONF=7 commands description for the transmission triggers configuration.

16.16.5.1 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.

☞ SARA-N3
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.

16.16.5.2 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.

☞ SARA-N3
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.

16.16.5.3 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.

16.16.5.4 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.

16.16.5.5 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.

16.16.5.6 Data from the network

The data received from the network is immediately forwarded to the serial interface.

16.16.5.7 Congestion timer

The congestion timer represents the time after which, in case of network congestion, the module exits from direct link.

- SARA-N3 - The congestion timer is not supported.

16.17 UDP Direct Link Packet Size configuration +UDCONF=2

+UDCONF=2						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.17.1 Description

Set the packet size for the UDP direct link packet.

16.17.2 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

16.17.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings: • SARA-N3 - The range goes from 1 to 8.
<packet_size>	Number	Packet size (in bytes) for UDP direct link; valid range is 100-1472; the factory-programmed value is 1024 bytes

16.18 UDP Direct Link Sending timer configuration +UDCONF=3

+UDCONF=3						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.18.1 Description

Configures the UDP direct link set sending timer.

16.18.2 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

16.18.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings: • SARA-N3 - The range goes from 1 to 8.
<sending_timer_timeout>	Number	Sending timer (in milliseconds) for UDP direct link; valid range is 100-120000; the default value is 1000 ms

16.19 Timer Trigger configuration for Direct Link +UDCONF=5

+UDCONF=5						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.19.1 Description

Sets the timer trigger of the interested socket identifier for the data transmission enhanced Direct Link.

16.19.2 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

16.19.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings: • SARA-N3 - The range goes from 1 to 8.
<timer_trigger>	Number	Enhanced Direct Link sending timer trigger (in milliseconds); valid range is 0 (trigger disabled), 100-120000; • SARA-N3 - the factory-programmed value is 500 ms for UDP, 0 ms for TCP.

16.20 Data Length Trigger configuration for Direct Link +UDCONF=6

+UDCONF=6						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.20.1 Description

Sets the data length trigger of the interested socket identifier for the data transmission enhanced Direct Link.

16.20.2 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

16.20.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings: • SARA-N3 - The range goes from 1 to 8.
<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.

16.21 Character trigger configuration for Direct Link +UDCONF=7

+UDCONF=7						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.21.1 Description

Sets the character trigger of the interested socket identifier for the data transmission enhanced Direct Link.

16.21.2 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

16.21.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the Direct Link settings: • SARA-N3 - The range goes from 1 to 8.
<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.

16.22 Socket control +USOCTL

+USOCTL						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

16.22.1 Description

Allows interaction with the low level socket layer.

16.22.2 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
Test	AT+USOCTL=?	+USOCTL: (list of supported <socket>s),(list of supported <param_id>s) OK	+USOCTL: (0-6),(0-4,10-11) OK

16.22.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • SARA-N3 - The range goes from 1 to 8.
<param_id>	Number	Control request identifier: • 0: query for socket type

Parameter	Type	Description
		• 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 Allowed values: • SARA-N3 - 0, 1, 4, 10
<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" [167]) • 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.

16.23 Socket Always On +USOAO

+USOAO						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	- (except URC)	+CME Error

16.23.1 Description

Allows the configuration of the Socket Always On feature.

The Socket Always On (SAO) causes the module to try establishing an automatic Direct Link (DL) IP connection (or to start listening on an IP port, and if establish a DL connection) over the UART interface as soon as the module is powered on, so that "dumb" terminals (equipments without the logic to send AT commands and parse the responses) can directly use an IP connection.

The Direct Link connection used by SAO cannot be established over the USB or SPI physical interfaces but over the UART physical interface only.

SAO may work in "client" and "server" modes:

- **Client mode**: the module establishes a Direct Link IP connection with a defined remote server
- **Server mode**: the module waits for an incoming connection request on a defined IP port; when an acceptable remote client is recognized, the Direct Link is established

For client mode, the user must specify these parameters:

- Internal PDP profile to be used for GPRS connection
- Destination host IP number or hostname
- Destination host port

For server mode, the user must specify these parameters:

- Internal PDP profile to be used for GPRS connection
- Listening port
- White list of remote hosts (optional)

If the feature is enabled, it starts working at the next module power on.

☞ When using SAO in server mode, the network dynamically assigns an IP address and the remote client uses an IP hostname rather than a numerical IP address to connect to the module, then it is advisable to enable the dynamic DNS feature. See the +UDYNDNS command description.

☞ The Direct Link connection used by SAO is affected by the triggers (as specified in Enhanced Direct Link). If they are not explicitly modified, the default triggers will apply.

16.23.1.1 Usage example

A usage example for client mode configuration follows:

AT command	Comment
PSD connection settings	
AT+UPSD=0,1,"your.apn"	Configures the APN for internal PDP profile 0; "your.apn" is an example
AT+UPSDA=0,1	Stores the parameters of PDP profile 0 to NVM
Socket Always On configuration	
AT+USOAO=1,0	Sets PDP profile 0 as default connection to be activated after module start-up
AT+USOAO=2,0	Sets client mode
AT+USOAO=3,"somehost.somedomain.com"	Sets the remote host for the TCP connection. The value can also be an IP address.
AT+USOAO=4,8084	Sets the remote port for the TCP connection
AT+USOAO=0,1	Enables the Socket Always On functionality.
AT+NRB	Reboot the module. On the next boot the functionality is active.
+UUSOAOC: "122.26.56.55",8084	This is a notification of the connection establishment to the remote host. The IP address shown is the IP address got after the DNS resolution of the hostname. The IP shown here is for example purpose only. The module is connected in direct link mode (the data sent to the UART port is forwarded to the network and vice-versa).

A usage example for server mode configuration follows:

AT command	Comment
PSD connection settings	
AT+UPSD=0,1,"your.apn"	Configures the APN for internal PDP profile 0; "your.apn" is an example
AT+UPSDA=0,1	Stores the parameters of PDP profile 0 to NVM
Socket Always On configuration	
AT+USOAO=1,0	Sets PDP profile 0 as default connection to be activated after module start up
AT+USOAO=2,1	Sets server mode
AT+USOAO=4,2000	Sets the listening port

AT command	Comment
AT+USOAO=0,1	Enables the Socket Always On functionality. If any of the previous settings is not performed the command returns error.
AT+NRB	Reboot the module. On the next boot the functionality is active.
+UUSOAOL: "151.22.34.66",2000	Notifies the Socket Always On is enabled in server mode and listening on IP 151.22.34.66 and port 2000
	A new connection is accepted
+UUSOAOC: "143.22.33.1",5996	Notifies a new connection has been accepted from IP 143.22.33.01 and port 5996. Now it is possible to exchange data with the remote host. The data sent to the UART port is forwarded to the network and vice-versa.

☞ In order for SAO to work, the following conditions must be true:
- the UART must be correctly configured for speed (see the +IPR) and flow control (AT&K)
- the PSD connection parameters must be configured with the +UPSD command and stored in NVM
- the automatic or manual network registration must be enabled (see +COPS command description).

If any of the SAO settings are wrong (e.g. setting the server mode when using UDP protocol), the SAO can be enabled but will not start.

☞ When the module boots with SAO enabled, the PSD and TCP/IP commands cannot be reliably used (their functionalities are being used by the SAO). The only safe option is to disable SAO and reboot (with AT +USOAO=0,0 and AT+NRB).

☞ The module will exit from the direct link mode in case of a remote client disconnection. A module reboot is needed to re-establish the direct link mode.

16.23.2 Syntax

Type	Syntax	Response	Example
Socket Always On generic syntax			
Set	AT+USOAO=<op_code>,<param1>	OK	AT+USOAO=0,1 OK
Read	AT+USOAO=<op_code>	+USOAO: <op_code>,<param1> OK	+USOAO: 0,1 OK
Enable/disable Socket Always On			
Set	AT+USOAO=0,<enable>	OK	AT+USOAO=0,1 OK
Read	AT+USOAO=0	+USOAO: 0,<enable> OK	+USOAO: 0,0 OK
PSD connection setting			
Set	AT+USOAO=1,<profile_id>	OK	AT+USOAO=1,5 OK
Read	AT+USOAO=1	+USOAO: 1,<profile_id> OK	+USOAO: 1,6 OK
Client or server mode configuration			
Set	AT+USOAO=2,<server_mode>	OK	AT+USOAO=2,0 OK
Read	AT+USOAO=2	+USOAO: 2,<server_mode> OK	+USOAO: 2,0 OK
Remote host (for client mode) configuration			
Set	AT+USOAO=3,<remote_host>	OK	AT+USOAO=3,"www.remotehost.it" OK
Read	AT+USOAO=3	+USOAO: 3,<remote_host> OK	+USOAO: 3,"www.remotehost.it" OK
IP port number configuration			

Type	Syntax	Response	Example
Set	AT+USOAO=4,<ip_port>	OK	AT+USOAO=4,8088 OK
Read	AT+USOAO=4	+USOAO: 4,<ip_port> OK	+USOAO: 4,8088 OK
IP protocol configuration			
Set	AT+USOAO=5,<protocol>	OK	AT+USOAO=5,17 OK
Read	AT+USOAO=5	+USOAO: 4,<protocol> OK	+USOAO: 5,17 OK
SIM PIN configuration			
Set	AT+USOAO=10,<pin>	OK	AT+USOAO=10,"123456" OK
Read	AT+USOAO=10	+USOAO: 10,******** OK	+USOAO: 10,******** OK
Set the i-th element of the white list of IP addresses (i=0..9)			
Set	AT+USOAO=20+i,<client_address>	OK	AT+USOAO=22,"123.156.0.2" OK
Read	AT+USOAO=20+i	+USOAO: 20+i,<client_address> OK	+USOAO: 22,"123.156.0.2" OK
Test	AT+USOAO=?	+USOAO: (list of supported <op_code>'s) OK	+USOAO: (0-5,10,20-29) OK
URC	(listening URC)	+UUSOAOL: <local_ip>,<local_port>	+UUSOAOL: "151.22.34.66",2000
URC	(connection URC)	+UUSOAOC: <remote_ip>,<remote_port>	+UUSOAOC: "122.26.56.55",8084

16.23.3 Defined values

Parameter	Type	Description
<op_code>	Number	Identifier of the meaning of the next parameter(s). Allowed values/ranges are: 0-5, 10 and 20-29. Meanings: • 0: enable/disable the socket always on feature • 1: configure the default PSD connection • 2: client/server mode • 3: remote host (for client mode only) • 4: remote host port for client mode or local listening port for server mode • 5: socket type: UDP (for client mode only) or TCP • 10: SIM PIN • 20-29: white list items (for server mode only)
<enable>	Number	Configures the Socket Always On feature at the next power on: • 0 (factory-programmed value): feature disabled • 1: feature enabled
<profile_id>	Number	This is the same <profile_id> used in +UPSD command. Range between 0 and 6. The factory-programmed value is 0.
<server_mode>	Number	Defines the client or server module behavior. Allowed values: • 0 (factory-programmed value): client mode • 1: server mode
<remote_host>	String	The remote server IP address or hostname to connect to while in client mode. This value is ignored for server configuration. The factory-programmed value is an empty string (").
<ip_port>	Number	In client mode it represents the remote port to connect to. In server mode it represents the local port on which the module must wait incoming connection. The range 1-65535. The factory-programmed value is 2000.
<protocol>	Number	Protocol type to be used for socket creation. Allowed values:

Parameter	Type	Description
		• 6 (factory-programmed value): TCP • 17: UDP (not valid for server mode)
<pin>	String	SIM PIN: 4-to-8 characters long string of decimal digits. It is used if the SIM requires it and only if there are 3 attempts left. If empty, no PIN is attempted. The factory-programmed value is an empty string (no PIN). The PIN cannot be revealed - the read command AT+USOAO=10 only returns a string of asterisks "********".
<client_address>	String	An entry in the "white list" of remote clients IP addresses, in quoted numerical format (e.g. "123.45.67.89"). If the list is non-empty (i.e. it does not contain only null addresses), only connection requests from the listed addresses is accepted. An empty IP address ("0.0.0.0") is a null address. The factory-programmed value is an empty IP address.
<local_ip>	String	Local IP address. Only used in +UUSOAOL URC (when the module is in server mode).
<local_port>	Number	Local IP port. Range between 1 and 65535. Used only in +UUSOAOL URC (when the module is in server mode).
<remote_ip>	String	IP address of the remote host connected to the module. Used in +UUSOAOC URCs.
<remote_port>	Number	IP port of the remote host connected to the module. Range between 1 and 65535. Used in +UUSOAOC URCs
<param1>	Number	Type and supported content depend on the related <op_code> parameter; see the <op_code> specification.

16.23.4 Notes

- +UUSOAOL and +UUSOAOC URCs are displayed only if the socket always on connection is active.
- +UUSOAOL URC is only displayed if socket always on is set in server mode.
- Only the UART interface displays +UUSOAOL and +UUSOAOC.

SARA-N3

- The <op_code>=10 and 20-29 are not supported.

16.24 Create socket +NSOCR

+NSOCR						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.24.1 Description

Creates a socket on the UE. If the port is set, receiving is enabled and +NSONMI URCs will appear for any message that is received on that port. Only a socket with a specific protocol and port combination can be created otherwise an error result code is provided.

☞ A maximum of 7 sockets are supported.

16.24.2 Syntax

Type	Syntax	Response	Example
Set	AT+NSOCR=<type>,<protocol>,<listen_port>[,<receive_control>]	<socket> OK	AT+NSOCR="DGRAM",17,42000,1 1 OK

16.24.3 Defined values

Parameter	Type	Description
<type>	String	Socket type. Supported value is "DGRAM".
<protocol>	Number	Standard internet protocol definition. Allowed value:

Parameter	Type	Description
		• 17: UDP
<listen_port>	Number	Local port that will be included in sent messages and on which messages will be received. The range goes from 0 to 65535 except for 5683.
<receive_control>	Number	Allowed values: • 0: incoming messages will be ignored • 1 (default value): incoming messages will trigger a +NSONMI URC
<socket>	Number	Socket identifier to be referenced by the other socket AT commands

16.25 SendTo command (UDP only) +NSOST

+NSOST						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.25.1 Description

Sends a UDP datagram to the specified host port. It will return the socket identifier where the data was sent on, and the number of bytes of data sent. If the amount of data is larger than the largest datagram that can be sent, the information text response will provide the data quantity successfully sent.

16.25.2 Syntax

Type	Syntax	Response	Example
Action	AT+NSOST=<socket>,<remote_ip_address>,<remote_port>,<length>,<data>	<socket>,<sent_length> OK	AT+NSOST=1,"192.158.5.1",1024,2,"07FF" 1,2 OK

16.25.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier returned by +NSOCR.
<remote_ip_address>	String	Remote host IP address of the remote host in IPv4 format. IP addresses can be specified in decimal, octal or hexadecimal notation.
<remote_port>	Number	A number in the range 0-65535. Remote port the messages will be received on.
<length>	Number	Size of the data to send. The maximum length 512 bytes.
<data>	String	Data to be sent in hexadecimal format
<sent_length>	Number	Amount of data successfully sent

16.26 SendTo command with Flags (UDP only) +NSOSTF

+NSOSTF						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.26.1 Description

Sends a UDP datagram to the specified host:port and sets meta-data flags. It will return the socket identifier where the data was sent on, and the number of bytes of data sent. If the amount of data is larger than the largest datagram that can be sent, the information text response will provide the data quantity successfully sent.

16.26.2 Syntax

Type	Syntax	Response	Example
Action	AT+NSOSTF=<socket>,<remote_ip_address>,<remote_port>,<flag>,<length>,<data>	<socket>,<sent_length> OK	AT+NSOSTF=1,"192.158.5.1",1024,0x100,2,"07FF"

Type	Syntax	Response	Example
			1,2 OK

16.26.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier returned by +NSOCR.
<remote_ip_address>	String	Remote host IP address of the remote host. IP addresses can be specified in decimal, octal or hexadecimal format. For IP address format reference, see the IP addressing.
<remote_port>	Number	Remote port where the messages will be received on, in range 0-65535.
<flag>	Number	Specifies the type of message transmission. • SARA-N2 - The values, expressed in hexadecimal format, are formed by logically OR'ing zero or more of the following flags: o 0x000: no flags are set o 0x100: exception message. Send message with high priority o 0x200: release indicator. Indicate release after next message o 0x400: release indicator. Indicate release after next message has been replied to • SARA-N3 - Allowed values are: o 0: RAI disabled o 1: release the connection after uplink data is sent o 2: release the connection after first data is received on downlink
<length>	Number	Indicates the length of data to be sent: • SARA-N2 - The maximum length is 511 bytes • SARA-N3 - The maximum length is 512 bytes
<data>	String	Data to be sent in hexadecimal format
<sent_length>	Number	Amount of data successfully sent

16.26.4 Notes

SARA-N3

- The <remote_ip_address> parameter is only supported in decimal format.

16.27 Received message indication +NSONMI

+NSONMI						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

16.27.1 Description

Notifies by means of a URC that data has been received on a socket and is ready to be read.

Returns the socket number and number of bytes of data available to read for the first message that is queued. The message received on the same socket will be queued, and it will be issued when the preceding message has been completely read.

16.27.2 Syntax

Type	Syntax	Response	Example
URC		+NSONMI:<socket>,<length>	+NSONMI:1,34

16.27.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier returned by +NSOCR
<length>	Number	Number of bytes to read from the specified socket

16.28 Receive command (UDP only) +NSORF

+NSORF						
Modules	SARA-N2					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	+CME Error

16.28.1 Description

Receives data on a socket. When data arrives a +NSONMI URC will be issued indicating the socket the message was received on and the amount of data. This command takes a length, which is the maximum amount of data that will be returned. If the requested length is larger than the actual size of the returned data, only the length of returned data is provided, and the remaining length is returned as 0. If the requested length is less than the amount of data returned, only the requested amount of data will be returned, plus an indication of the number of bytes remaining. Once a message has been fully read, a new +NSONMI URC will be sent if there is another message to process.

16.28.2 Syntax

Type	Syntax	Response	Example
Action	AT+NSORF=<socket>,<req_length>	<socket>,<ip_addr>,<port>,<length>,<data>,<remaining_length> OK	AT+NSORF=1,10 1,"192.158.5.1",1024,5,"hello",0 OK

16.28.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier returned by +NSOCR
<req_length>	Number	Maximum amount of data to be returned as a decimal byte length
<ip_addr>	String	Remote host IP address
<port>	Number	Remote port the messages were sent from. A number in the range 0-65535
<length>	Number	Amount of data returned as a decimal byte length
<data>	String	Data received in hexadecimal format
<remaining_length>	Number	Amount of data still to be read

16.29 Close socket +NSOCL

+NSOCL						
Modules	SARA-N2					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	+CME Error

16.29.1 Description

Close the specified socket. The pending messages to be read (if present) will be dropped. No further +NSONMI URCs will be generated. If the socket has already been closed, or was never created, an error result code will be issued.

16.29.2 Syntax

Type	Syntax	Response	Example
Set	AT+NSOCL=<socket>	OK	AT+NSOCL=1 OK

16.29.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier to be referenced by the other socket AT commands.

17 Device and data security

17.1 Data security

17.1.1 Introduction

17.1.1.1 SSL/TLS/DTLS

SSL/TLS/DTLS (where supported) provides a secure connection between two entities using TCP/UDP socket for communication (i.e. HTTP/FTP server and HTTP/FTP client).

The SSL/TLS/DTLS 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/DTLS configuration and features supported by the communicating entities.

u-blox cellular modules support all the described aspects of SSL/TLS/DTLS 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/DTLS connection.

The USECMNG provides a default SSL/TLS/DTLS profile which cannot be modified. The default USECMNG profile provides the following SSL/TLS/DTLS settings:

Setting	Value	Meaning
Certificates validation level	Level 0	The server certificate will not be checked or verified.
Minimum SSL/TLS/DTLS version	Any	The server can use any of the TLS1.0/TLS1.1/TLS1.2/DTLS1.2 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.
Client private key password	"" (none)	No client private key password will be used.
Pre-shared key	"" (none)	No pre-shared key key password will be used.
Server certificate pinning	"" (none)	No server certificate will be used.
Server certificate pinning level	Level 0	No server certificate will be used.

For the configuration of the settings listed above, see the +USECPRF AT command.

SARA-N3
The secure re-negotiation is currently not supported, and if mandated by the server the SSL/TLS/DTLS connection will fail with a generic SSL/TLS/DTLS handshake alert.

17.1.2 SSL/TLS certificates and private keys manager +USECMNG

+USECMNG						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

17.1.2.1 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

For more details on X.509 certificates and private keys see RFC 5280 [183].

The number and the format of the certificates and the private keys accepted depend on the module series:

- SARA-N3 - certificates and private keys both in DER (Distinguished Encoding Rules) and in PEM (Privacy-Enhanced Mail) format are accepted. If the provided format is PEM, the imported certificate or private key will be automatically converted in DER format for the internal storage. It is also possible to validate certificates and private keys. Up to 4 certificates or private keys can be imported.

☞ 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.

☞ SARA-N3
The SSL/(D)TLS connection can be successfully performed only if keys with at least 512-bit size and/or certificates generated with at least 512-bit key size are used.

☞ 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 completion, 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.

☞ SARA-N3
Enable the RTS/CTS DTE flow control (see &K command description) before to import a stream of bytes.

☞ All the imported certificates or private keys are listed if the type of the security data is omitted.

☞ SARA-N3
The imported certificates and private keys are:

- PERSISTED after the module FW is upgraded using +UFWINSTALL or +UFWUPD AT commands.
- PERSISTED after a factory reset using +UFACTORY AT command.

☞ SARA-N3
The FW upgrade using EasyFlash is not supported.

☞ The USECMNG import command supports only X.509 certificate format.

☞ 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).

17.1.2.2 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...) +USECMNG: 0,0,"AddTrustCA","77107370ec4db40a08a6e36a64a1435b" 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","77107370ec4db40a08a6e36a64a1435b" 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","2010/01/01" "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","77107370ec4db40a08a6e36a64a1435b" OK
Test	AT+USECMNG=?	+USECMNG: (list of supported <op_code>s),(list of supported <type>s) OK	+USECMNG: (0-4),(0-2) OK

17.1.2.3 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

Parameter	Type	Description
		• 2: client private key • 3: server certificate • 4: signature verification certificate • 5: signature verification public key Allowed values: • SARA-N3 - 0, 1, 2
<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 • "PU": signature verification public key Allowed values: • SARA-N3 - "CA", "CC", "PK"
<internal_name>	String	Unique identifier of an imported certificate or private key. If an existing name is used the data will be overridden. • SARA-N3 - The maximum length is 200 characters.
<data_size>	Number	Size in bytes of a certificate or private key being imported. • SARA-N3 - The maximum allowed size of a certificate is 5120 bytes. The maximum allowed size of a private key is 4096 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. • SARA-N3 - The maximum allowed file size is 5120 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.

17.1.3 SSL/TLS/DTLS security layer profile manager +USECPRF

+USECPRF						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

17.1.3.1 Description

Manages security profiles for the configuration of the following SSL/TLS/DTLS 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

- **Minimum DTLS version to be used:**
  - DTLS 1.2
- **Cipher suite to be configured using the following methods:**
  - **Legacy cipher suite** to be used. See Syntax description and Table 24 for the supported cipher suites.
  - **Additional cipher suite** to be used with Internet Assigned Numbers Authority (IANA) enumeration set command. See Syntax description and Table 24 for the supported cipher suites.
  - **List of cipher suites** to be used is configured with add / remove commands and using IANA enumeration. See Syntax description and Table 24 for the supported cipher suites.

☞ For the applicability of cipher suite depending on the module series, see Cipher suites applicability.

☞ Cipher suite configuration methods are exclusive and the last configured method is used.

☞ The cipher suite configuration read command response is related to the selected cipher suite type, see Syntax description for more details.

- **Certificate to be used for server and mutual authentication:**
  - The trusted root certificate. The CA certificate should be imported with the +USECMNG AT command.
  - The client certificate that should be imported with the +USECMNG AT command.
  - The client private key that should be imported with the +USECMNG AT command.
  - The server certificate that should be imported with the +USECMNG AT 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. When SNI is not used the modules might receive a non host specific SSL/TLS configuration (version/cipher suites/certificate) when used with virtual hosts.
- **(D)TLS session resumption.** The session resumption feature allows to reuse the secure session data in order to reestablish a SSL/(D)TLS secure session. Since the secure session data are available, the SSL/(D)TLS handshake is not performed during the session resumption. Once the session resumption feature is enabled, the session resumption type (provided by the server) and the secure session data (negotiated during the SSL/(D)TLS handshake) are displayed via +USECPRF URC message. The session resumption feature configuration and secure session data are not stored in the NVM, hence the session resumption may be performed until power cycle.

☞ 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/DTLS version, ...).

☞ To reset (set to factory-programmed value) all the parameters of a specific security profile, issue the AT +USECPRF=<profile_id> command.

17.1.3.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+USECPRF=<profile_id>[,<op_code>[,<param_val1>[,<param_val2>[,<param_val3>]]]]	OK	AT+USECPRF=0,0,0 OK
Read	AT+USECPRF=<profile_id>,<op_code>	+USECPRF: <profile_id>,<op_code>,<param_val1> OK	AT+USECPRF=0,0 +USECPRF: 0,0,0 OK
URC		+UUSECPRF: <profile_id>,<op_code>[,<param_val1>[,<param_val2>[,<param_val3>]]] OK	+UUSECPRF: 0,13,1,0 OK
Legacy cipher suite selection			

Type	Syntax	Response	Example
Set	AT+USECPRF=<profile_id>,2,<legacy_cs>	OK	AT+USECPRF=0,2,2 OK
Cipher suite selection using IANA enumeration			
Set	AT+USECPRF=<profile_id>,2,99,<iana_b1>,<iana_b2>	OK	AT+USECPRF=0,2,99,"C0","2B" OK
Read	AT+USECPRF=<profile_id>,2	+USECPRF: <profile_id>,2,99,<iana_b1>,<iana_b2> OK	AT+USECPRF=0,2 +USECPRF: 0,2,99,"C0","2B" OK
Add/remove of IANA cipher suite to the configured cipher suites list			
Set	AT+USECPRF=<profile_id>,2,100,<iana_b1>,<iana_b2>,<operation>	OK	AT+USECPRF=0,2,100,"C0","2A",0 OK
Add an IANA cipher suite to the configured cipher suites list			
Set	AT+USECPRF=<profile_id>,2,100,<iana_b1>,<iana_b2>,0	OK	AT+USECPRF=0,2,100,"C0","2A",0 OK
Remove an IANA cipher suite from the configured cipher suites list			
Set	AT+USECPRF=<profile_id>,2,100,<iana_b1>,<iana_b2>,1	OK	AT+USECPRF=0,2,100,"C0","2B",1 OK
Read the list of configured cipher suites			
Read	AT+USECPRF=<profile_id>,2	+USECPRF: <profile_id>,2,100,<list of configured cipher suites separated by ";"> OK	AT+USECPRF=0,2 +USECPRF: 0,2,100,"C02A;C02C" OK
Pre-shared key configuration			
Set	AT+USECPRF=<profile_id>,8,<preshared_key>[,<string_type>]	OK	AT+USECPRF=0,8,"0sFpZ0AZqE0N6Ti9s0qt40ZP5Eqx" OK
Pre-shared key identity configuration			
Set	AT+USECPRF=<profile_id>,9,<preshared_key_id>[,<string_type>]	OK	AT+USECPRF=0,9,"0ceEZ0AZqP0K60i9o04xz0ZP8zyu0Eqx" OK
Server certificate pinning			
Set	AT+USECPRF=<profile_id>,12,<server_certificate>,<pinning_level>	OK	AT+USECPRF=0,12,"my_srv_cert",0 OK
(D)TLS session resumption generic syntax			
Set	AT+USECPRF=<profile_id>,13,<tag>,<param_val1>[,<param_val2>]	OK	AT+USECPRF=0,13,0,1 OK
Read	AT+USECPRF=<profile_id>,13,<tag>	+USECPRF: <profile_id>,13,<tag>,<param_val1>[,<param_val2>] OK	AT+USECPRF=0,13,0 +USECPRF: 0,13,0,1 OK
URC		+UUSECPRF: <profile_id>,13,<tag>,<param_val1>[,<param_val2>] OK	+UUSECPRF: 0,13,1,0 OK
(D)TLS session resumption status			
Set	AT+USECPRF=<profile_id>,13,0,<sess_status>	OK	AT+USECPRF=0,13,0,1 OK
Read	AT+USECPRF=<profile_id>,13,0	+USECPRF: <profile_id>,13,0,<sess_status> OK	AT+USECPRF=0,13,0 +USECPRF: 0,13,0,1 OK
(D)TLS session resumption session type			
Set	AT+USECPRF=<profile_id>,13,1,<sess_type>	OK	AT+USECPRF=0,13,1,0 OK

Type	Syntax	Response	Example
Read	AT+USECPRF=<profile_id>,13,1	+USECPRF: <profile_id>,13,1,<sess_type> OK	AT+USECPRF=0,13,1 +USECPRF: 0,13,1,0 OK
URC		+UUSECPRF: <profile_id>,13,1,<sess_type>	+UUSECPRF: 0,13,1,0
(D)TLS session resumption session data having session ID as session resumption type			
Set	AT+USECPRF=<profile_id>,13,2,<session_id_base64>,<master_secret_base64>	OK	AT+USECPRF=0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo" OK
Read	AT+USECPRF=<profile_id>,13,2	+USECPRF: <profile_id>,13,2,<session_id_base64>,<master_secret_base64> OK	AT+USECPRF=0,13,2 +USECPRF: 0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo" OK
URC		+UUSECPRF: <profile_id>,13,2,<session_id_base64>,<master_secret_base64>	+UUSECPRF: 0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo"
(D)TLS session resumption session data having encrypted session ID with local encryption as session resumption type			
Set	AT+USECPRF=<profile_id>,13,12,<encrypted_session_data>,<enc_session_data_size>	OK	AT+USECPRF=0,13,12,"AAECAwQFBgcICQoLDA0ODxAREhMUFRYXGBkaGxwdHh/Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0in6aGVISJGBWCAAKJo6Qw5Q+ugXaRZFquG0O69WeHnPRBkcwY2SN4bwnDbyR+709i0pt2nIaYMSCL77MAA=",156 OK
Read	AT+USECPRF=<profile_id>,13,12	+USECPRF: <profile_id>,13,12,<encrypted_session_data>,(0-203) OK	AT+USECPRF=0,13,12 +USECPRF: 0,13,12,"AAECAwQFBgcICQoLDA0ODxAREhMUFRYXGBkaGxwdHh/Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0in6aGVISJGBWCAAKJo6Qw5Q+ugXaRZFquG0O69WeHnPRBkcwY2SN4bwnDbyR+709i0pt2nIaYMSCL77MAA=",156 OK
URC		+UUSECPRF: <profile_id>,13,12,<encrypted_session_data>,(0-203)	+UUSECPRF: 0,13,12,"AAECAwQFBgcICQoLDA0ODxAREhMUFRYXGBkaGxwdHh/Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0in6aGVISJGBWCAAKJo6Qw5Q+ugXaRZFquG0O69WeHnPRBkcwY2SN4bwnDbyR+709i0pt2nIaYMSCL77MAA=",156
Test	AT+USECPRF=?	+USECPRF: (list of supported <profile_id>s),(list of supported <op_code>s) OK	+USECPRF: (0-4),(0-13) OK

17.1.3.3 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_val1> (number): o 0: level 0 - No validation; the server certificate will not be checked or verified. The server in this case is not authenticated. 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_val1>(number): o 0 (factory-programmed value): any; server can use any version for the connection. o 1: TLS v1.0; connection allowed only to TLS/SSL servers which support TLS v1.0 o 2: TLS v1.1; connection allowed only to TLS/SSL servers which support TLS v1.1 o 3: TLS v1.2; connection allowed only to TLS/SSL servers which support TLS v1.2 • 2: cipher suite; allowed values for <legacy_cs> (number) legacy cipher suites are listed in Table 24. The factory-programmed value for <legacy_cs> is 0. For <legacy_cs>=0 a list of default cipher suites is proposed at the beginning of handshake process, and a cipher suite will be negotiated among the cipher suites proposed in the list. For <legacy_cs>=99 the cipher suite selection is performed with IANA enumeration, <iana_b1> and <iana_b2> are strings containing the 2 bytes that compose the IANA enumeration, see Table 24. For <legacy_cs>= 100 the list of cipher suites is configured using IANA enumeration, <iana_b1> and <iana_b2> are strings containing the 2 bytes that compose the IANA enumeration, see Table 24. ☞ The cipher suite configuration read command response is related to the selected cipher suite type. In the case of <legacy_cs>=99 the configured <byte_1> and <byte_2> are reported in the information text response to the read command. In the case of <legacy_cs>=100 a ";" separated list with configured cipher suites is reported in the information text response to the read command. ☞ For <legacy_cs>=100, when all added cipher suites are removed the cipher suite is automatically set to 0 (factory-programmed value). ☞ For the applicability of default cipher suite lists depending on the module series, see Cipher suites applicability. • 3: trusted root certificate internal name; o <param_val1> (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_val1> (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_val1> (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_val1> (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_val1> (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 <preshared_key> (string) is the pre-shared key used for connection; the factory-programmed value is an empty string. The accepted string type and length depends on the <string_type> value. o <string_type> (number) defines the type and the maximum length of the <preshared_key> string. Allowed values for <string_type>: - 0 (default value): <preshared_key> is an ASCII string and its maximum length is 64 characters - 1: <preshared_key> is an hexadecimal string and its maximum length is 128 characters

Parameter	Type	Description
		• 9: pre-shared key identity; o <preshared_key_id> (string) is the pre-shared key identity used for connection; the factory-programmed value is an empty string. The accepted string type and length depends on the <string_type> value. o <string_type> (number) defines the type of the <preshared_key_id> string. Allowed values for <string_type>: - 0 (default value): <preshared_key_id> is an ASCII string and its maximum length is 128 characters - 1: <preshared_key_id> is an hexadecimal string and its maximum length is 256 characters • 10: SNI (Server Name Indication); o <param_val1> (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: PSK key and PSK key identity generated by RoT (Root of trust); allowed values for <param_val1> (number): o 0 (factory-programmed value): OFF - The PSK and PSK key ID are NOT generated by RoT o 1: ON - The PSK and PSK key ID are generated by RoT in the process of SSL/TLS connection negotiation • 12: server certificate pinning; o <server_certificate> (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> (number) 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 • 13: (D)TLS session resumption Allowed values: • SARA-N3 - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
<legacy_cs>	Number	Legacy cipher suite enumeration
<iana_b1>	String	First byte of IANA cipher suite enumeration
<iana_b2>	String	Second byte of IANA cipher suite enumeration
<operation>	Number	Operation to execute when using <legacy_cs>=100 configuration using a list of IANA enumeration. Allowed values for <operation>: • 0: add cipher suite defined by <iana_b1> and <iana_b2> to the list • 1: remove cipher suite defined by <iana_b1> and <iana_b2> from the list
<tag>	Number	Configures the (D)TLS session resumption. Allowed values: • 0: session resumption status • 1: session resumption type • 2: session resumption data when the session resumption type is session ID • 12: session resumption data for when the session resumption type is encrypted session ID with local encryption
<sess_status>	Number	(D)TLS session resumption status. Allowed values: • 0 (factory-programmed value): disabled • 1: enabled
<sess_type>	Number	(D)TLS session resumption type. Allowed values: • 0: session ID • 10: encrypted session ID with local encryption
<session_id_base64>	String	base64 encoded session ID value. The maximum length is 48 characters.
<master_secret_base64>	String	base64 encoded session master key. The maximum length is 64 characters.
<encrypted_session_data>	String	base64 encoded session ID value encrypted with local encryption. The maximum length is 203 characters
<enc_session_data_size>	Number	length of base64 encoded session ID value encrypted with local encryption.

Parameter	Type	Description
<param_val1>	String	Type and supported content depend on related <op_code> (details are given above)
<param_val2>	String	Type and supported content depend on related <op_code> (details are given above)
<param_val3>	String	Type and supported content depend on related <op_code> (details are given above)

17.1.3.4 Notes

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- The factory-programmed value for <op_code>=0 (certificate validation level) is 0 (level 0 - No validation; the server certificate will not be checked or verified. The server in this case is not authenticated).
- If <op_code>=0 (certificate validation level) the <param_val1>=2 and <param_val1>=3 are not supported.
- The factory-programmed value for <op_code>=1 (SSL/TLS version to use) is 0 (any; server can use any version for the connection).
- Certificate chaining feature is not supported.
- If <op_code>=2 (cipher suite) the <legacy_cs>=100 (cipher suite list configuration using IANA enumeration) is not supported.
- The <op_code>=4 (expected server hostname) and <op_code>=10 (Server Name Indication) are mutually exclusive.
- If <op_code>=8 (pre-shared key) the <string_type> parameter is not supported. The <preshared_key> parameter is an ASCII string (maximum length 64 characters).
- If <op_code>=9 (pre-shared key identity) the <string_type> parameter is not supported. The <preshared_key_id> parameter is an ASCII string (maximum length 128 characters).

17.1.3.5 List of the supported cipher suites

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
0x0000	TLS_NULL_WITH_NULL_NULL		"00"	"00"
0x000A	TLS_RSA_WITH_3DES_EDE_CBC_SHA	5	"00"	"0A"
0x0013	TLS_DHE_DSS_WITH_3DES_EDE_CBC_SHA		"00"	"13"
0x0015	TLS_DHE_RSA_WITH_DES_CBC_SHA		"00"	"15"
0x0016	TLS_DHE_RSA_WITH_3DES_EDE_CBC_SHA		"00"	"16"
0x001A	TLS_DH_anon_WITH_DES_CBC_SHA		"00"	"1A"
0x001B	TLS_DH_anon_WITH_3DES_EDE_CBC_SHA		"00"	"1B"
0x002F	TLS_RSA_WITH_AES_128_CBC_SHA	1	"00"	"2F"
0x0032	TLS_DHE_DSS_WITH_AES_128_CBC_SHA		"00"	"32"
0x0033	TLS_DHE_RSA_WITH_AES_128_CBC_SHA		"00"	"33"
0x0034	TLS_DH_anon_WITH_AES_128_CBC_SHA		"00"	"34"
0x0035	TLS_RSA_WITH_AES_256_CBC_SHA	3	"00"	"35"
0x0039	TLS_DHE_RSA_WITH_AES_256_CBC_SHA		"00"	"39"
0x003A	TLS_DH_anon_WITH_AES_256_CBC_SHA		"00"	"3A"
0x003C	TLS_RSA_WITH_AES_128_CBC_SHA256	2	"00"	"3C"
0x003D	TLS_RSA_WITH_AES_256_CBC_SHA256	4	"00"	"3D"
0x0040	TLS_DHE_DSS_WITH_AES_128_CBC_SHA256		"00"	"40"
0x0041	TLS_RSA_WITH_CAMELLIA_128_CBC_SHA		"00"	"41"
0x0045	TLS_DHE_RSA_WITH_CAMELLIA_128_CBC_SHA		"00"	"45"
0x0067	TLS_DHE_RSA_WITH_AES_128_CBC_SHA256		"00"	"67"
0x006B	TLS_DHE_RSA_WITH_AES_256_CBC_SHA256		"00"	"6B"
0x006C	TLS_DH_anon_WITH_AES_128_CBC_SHA256		"00"	"6C"
0x006D	TLS_DH_anon_WITH_AES_256_CBC_SHA256		"00"	"6D"
0x0084	TLS_RSA_WITH_CAMELLIA_256_CBC_SHA		"00"	"84"
0x0088	TLS_DHE_RSA_WITH_CAMELLIA_256_CBC_SHA		"00"	"88"
0x008A	TLS_PSK_WITH_RC4_128_SHA		"00"	"8A"
0x008B	TLS_PSK_WITH_3DES_EDE_CBC_SHA	8	"00"	"8B"
0x008C	TLS_PSK_WITH_AES_128_CBC_SHA	6	"00"	"8C"
0x008D	TLS_PSK_WITH_AES_256_CBC_SHA	7	"00"	"8D"

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
0x008E	TLS_DHE_PSK_WITH_RC4_128_SHA		"00"	"8E"
0x008F	TLS_DHE_PSK_WITH_3DES_EDE_CBC_SHA		"00"	"8F"
0x0090	TLS_DHE_PSK_WITH_AES_128_CBC_SHA		"00"	"90"
0x0091	TLS_DHE_PSK_WITH_AES_256_CBC_SHA		"00"	"91"
0x0092	TLS_RSA_PSK_WITH_RC4_128_SHA		"00"	"92"
0x0093	TLS_RSA_PSK_WITH_3DES_EDE_CBC_SHA	11	"00"	"93"
0x0094	TLS_RSA_PSK_WITH_AES_128_CBC_SHA	9	"00"	"94"
0x0095	TLS_RSA_PSK_WITH_AES_256_CBC_SHA	10	"00"	"95"
0x009C	TLS_RSA_WITH_AES_128_GCM_SHA256		"00"	"9C"
0x009D	TLS_RSA_WITH_AES_256_GCM_SHA384		"00"	"9D"
0x009E	TLS_DHE_RSA_WITH_AES_128_GCM_SHA256		"00"	"9E"
0x009F	TLS_DHE_RSA_WITH_AES_256_GCM_SHA384		"00"	"9F"
0x00A8	TLS_PSK_WITH_AES_128_GCM_SHA256	16	"00"	"A8"
0x00A9	TLS_PSK_WITH_AES_256_GCM_SHA384	17	"00"	"A9"
0x00AA	TLS_DHE_PSK_WITH_AES_128_GCM_SHA256		"00"	"AA"
0x00AB	TLS_DHE_PSK_WITH_AES_256_GCM_SHA384		"00"	"AB"
0x00AC	TLS_RSA_PSK_WITH_AES_128_GCM_SHA256	18	"00"	"AC"
0x00AD	TLS_RSA_PSK_WITH_AES_256_GCM_SHA384	19	"00"	"AD"
0x00AE	TLS_PSK_WITH_AES_128_CBC_SHA256	12	"00"	"AE"
0x00AF	TLS_PSK_WITH_AES_256_CBC_SHA384	13	"00"	"AF"
0x00B2	TLS_DHE_PSK_WITH_AES_128_CBC_SHA256		"00"	"B2"
0x00B3	TLS_DHE_PSK_WITH_AES_256_CBC_SHA384		"00"	"B3"
0x00B6	TLS_RSA_PSK_WITH_AES_128_CBC_SHA256	14	"00"	"B6"
0x00B7	TLS_RSA_PSK_WITH_AES_256_CBC_SHA384	15	"00"	"B7"
0x00BA	TLS_RSA_WITH_CAMELLIA_128_CBC_SHA256		"00"	"BA"
0x00BE	TLS_DHE_RSA_WITH_CAMELLIA_128_CBC_SHA256		"00"	"BE"
0x00C0	TLS_RSA_WITH_CAMELLIA_256_CBC_SHA256		"00"	"C0"
0x00C4	TLS_DHE_RSA_WITH_CAMELLIA_256_CBC_SHA256		"00"	"C4"
0xC002	TLS_ECDH_ECDSA_WITH_RC4_128_SHA		"C0"	"02"
0xC003	TLS_ECDH_ECDSA_WITH_3DES_EDE_CBC_SHA		"C0"	"03"
0xC004	TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA		"C0"	"04"
0xC005	TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA		"C0"	"05"
0xC007	TLS_ECDHE_ECDSA_WITH_RC4_128_SHA		"C0"	"07"
0xC008	TLS_ECDHE_ECDSA_WITH_3DES_EDE_CBC_SHA	20	"C0"	"08"
0xC009	TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA	21	"C0"	"09"
0xC00A	TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA	22	"C0"	"0A"
0xC00C	TLS_ECDH_RSA_WITH_RC4_128_SHA		"C0"	"0C"
0xC00D	TLS_ECDH_RSA_WITH_3DES_EDE_CBC_SHA		"C0"	"0D"
0xC00E	TLS_ECDH_RSA_WITH_AES_128_CBC_SHA		"C0"	"0E"
0xC00F	TLS_ECDH_RSA_WITH_AES_256_CBC_SHA		"C0"	"0F"
0xC010	TLS_ECDHE_RSA_WITH_NULL_SHA		"C0"	"10"
0xC011	TLS_ECDHE_RSA_WITH_RC4_128_SHA		"C0"	"11"
0xC012	TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA	23	"C0"	"12"
0xC013	TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA	24	"C0"	"13"
0xC014	TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA	25	"C0"	"14"
0xC017	TLS_ECDH_anon_WITH_3DES_EDE_CBC_SHA		"C0"	"17"
0xC018	TLS_ECDH_anon_WITH_AES_128_CBC_SHA		"C0"	"18"
0xC019	TLS_ECDH_anon_WITH_AES_256_CBC_SHA		"C0"	"19"
0xC023	TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256	26	"C0"	"23"
0xC024	TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384	27	"C0"	"24"
0xC025	TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA256		"C0"	"25"
0xC026	TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA384		"C0"	"26"

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
0xC027	TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256	28	"C0"	"27"
0xC028	TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384	29	"C0"	"28"
0xC029	TLS_ECDH_RSA_WITH_AES_128_CBC_SHA256		"C0"	"29"
0xC02A	TLS_ECDH_RSA_WITH_AES_256_CBC_SHA384		"C0"	"2A"
0xC02B	TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256	30	"C0"	"2B"
0xC02C	TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384	31	"C0"	"2C"
0xC02D	TLS_ECDH_ECDSA_WITH_AES_128_GCM_SHA256		"C0"	"2D"
0xC02E	TLS_ECDH_ECDSA_WITH_AES_256_GCM_SHA384		"C0"	"2E"
0xC02F	TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256	32	"C0"	"2F"
0xC030	TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384	33	"C0"	"30"
0xC031	TLS_ECDH_RSA_WITH_AES_128_GCM_SHA256		"C0"	"31"
0xC032	TLS_ECDH_RSA_WITH_AES_256_GCM_SHA384		"C0"	"32"
0xC033	TLS_ECDHE_PSK_WITH_RC4_128_SHA		"C0"	"33"
0xC034	TLS_ECDHE_PSK_WITH_3DES_EDE_CBC_SHA		"C0"	"34"
0xC035	TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA		"C0"	"35"
0xC036	TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA		"C0"	"36"
0xC037	TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA256		"C0"	"37"
0xC038	TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA384		"C0"	"38"
0xC072	TLS_ECDHE_ECDSA_WITH_CAMELLIA_128_CBC_ SHA256		"C0"	"72"
0xC073	TLS_ECDHE_ECDSA_WITH_CAMELLIA_256_CBC_ SHA384		"C0"	"73"
0xC074	TLS_ECDH_ECDSA_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"74"
0xC075	TLS_ECDH_ECDSA_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"75"
0xC076	TLS_ECDHE_RSA_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"76"
0xC077	TLS_ECDHE_RSA_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"77"
0xC078	TLS_ECDH_RSA_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"78"
0xC079	TLS_ECDH_RSA_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"79"
0xC07A	TLS_RSA_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"7A"
0xC07B	TLS_RSA_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"7B"
0xC07C	TLS_DHE_RSA_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"7C"
0xC07D	TLS_DHE_RSA_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"7D"
0xC086	TLS_ECDHE_ECDSA_WITH_CAMELLIA_128_GCM_ SHA256		"C0"	"86"
0xC087	TLS_ECDHE_ECDSA_WITH_CAMELLIA_256_GCM_ SHA384		"C0"	"87"
0xC088	TLS_ECDH_ECDSA_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"88"
0xC089	TLS_ECDH_ECDSA_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"89"
0xC08A	TLS_ECDHE_RSA_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"8A"
0xC08B	TLS_ECDHE_RSA_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"8B"
0xC08C	TLS_ECDH_RSA_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"8C"
0xC08D	TLS_ECDH_RSA_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"8D"
0xC08E	TLS_PSK_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"8E"
0xC08F	TLS_PSK_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"8F"
0xC090	TLS_DHE_PSK_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"90"
0xC091	TLS_DHE_PSK_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"91"
0xC092	TLS_RSA_PSK_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"92"
0xC093	TLS_RSA_PSK_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"93"
0xC094	TLS_PSK_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"94"
0xC095	TLS_PSK_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"95"
0xC096	TLS_DHE_PSK_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"96"
0xC097	TLS_DHE_PSK_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"97"
0xC098	TLS_RSA_PSK_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"98"

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
0xC099	TLS_RSA_PSK_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"99"
0xC09A	TLS_ECDHE_PSK_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"9A"
0xC09B	TLS_ECDHE_PSK_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"9B"
0xC09C	TLS_RSA_WITH_AES_128_CCM		"C0"	"9C"
0xC09D	TLS_RSA_WITH_AES_256_CCM		"C0"	"9D"
0xC09E	TLS_DHE_RSA_WITH_AES_128_CCM		"C0"	"9E"
0xC09F	TLS_DHE_RSA_WITH_AES_256_CCM		"C0"	"9F"
0xC034	TLS_ECDHE_PSK_WITH_3DES_EDE_CBC_SHA		"C0"	"34"
0xC035	TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA		"C0"	"35"
0xC036	TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA		"C0"	"36"
0xC037	TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA256		"C0"	"37"
0xC038	TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA384		"C0"	"38"
0xC0A0	TLS_RSA_WITH_AES_128_CCM_8		"C0"	"A0"
0xC0A1	TLS_RSA_WITH_AES_256_CCM_8		"C0"	"A1"
0xC0A2	TLS_DHE_RSA_WITH_AES_128_CCM_8		"C0"	"A2"
0xC0A3	TLS_DHE_RSA_WITH_AES_256_CCM_8		"C0"	"A3"
0xC0A4	TLS_PSK_WITH_AES_128_CCM		"C0"	"A4"
0xC0A5	TLS_PSK_WITH_AES_256_CCM		"C0"	"A5"
0xC0A6	TLS_DHE_PSK_WITH_AES_128_CCM		"C0"	"A6"
0xC0A7	TLS_DHE_PSK_WITH_AES_256_CCM		"C0"	"A7"
0xC0A8	TLS_PSK_WITH_AES_128_CCM_8		"C0"	"A8"
0xC0A9	TLS_PSK_WITH_AES_256_CCM_8		"C0"	"A9"
0xC0AA	TLS_PSK_DHE_WITH_AES_128_CCM_8		"C0"	"AA"
0xC0AB	TLS_PSK_DHE_WITH_AES_256_CCM_8		"C0"	"AB"
0xC0AC	TLS_ECDHE_ECDSA_WITH_AES_128_CCM		"C0"	"AC"
0xC0AD	TLS_ECDHE_ECDSA_WITH_AES_256_CCM		"C0"	"AD"
0xC0AE	TLS_ECDHE_ECDSA_WITH_AES_128_CCM_8		"C0"	"AE"
0xC0AF	TLS_ECDHE_ECDSA_WITH_AES_256_CCM_8		"C0"	"AF"
0xCCA8	TLS_ECDHE_RSA_WITH_CHACHA20_POL1305_SHA256		"CC"	"A8"
0xCCA9	TLS_ECDHE_ECDSA_WITH_CHACHA20_POL1305_ SHA256		"CC"	"A9"
0xCCAA	TLS_DHE_RSA_WITH_CHACHA20_POL1305_SHA256		"CC"	"AA"
0xCCAB	TLS_PSK_WITH_CHACHA20_POL1305_SHA256		"CC"	"AB"
0xCCAC	TLS_ECDHE_PSK_WITH_CHACHA20_POL1305_SHA256		"CC"	"AC"
0xCCAD	TLS_DHE_PSK_WITH_CHACHA20_POL1305_SHA256		"CC"	"AD"
0xCCAE	TLS_RSA_PSK_WITH_CHACHA20_POL1305_SHA256		"CC"	"AE"

Table 24: Supported cipher suite

17.1.4 AT+USECMNG command example

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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 DER formatted trusted root certificate data bytes. Output MD5 hash string of the stored trusted root certificate DER.
Step 2: List all available certificates and private keys		

Command	Response	Description
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
092a864886f70d01010505003061310b3009060355040613025553311530130603 55
040a130c44696769436572742049 6e633119301706035504 0b13107777772e646967
69636572742e636f6d3120301e060355040313174469676943657274204 76c6f6261
6c20526f6f74204341301e170d3036313131303030303030305a170d333131313130
3030303030305a3061310b3009060355040613025553311530130603550 40a130c44
696769436572742049 6e633119301706035504 0b13107777772e6469676963657274
2e636f6d3120301e060355040313174469676943657274204 76c6f62616c20526f6f
74204341308201223 00d06092a864886f70d01010105000382010f003082010a0282
010100e23be11172dea8a4d3a357aa50a28f0b7790c9a2a5ee12ce965b010920cc01
93a74e30b753f743c46900579de28d22dd870640008109cece1b83bfdfcd3b7146e2
d666c705b37627168f7b9e1e957deeb748a308dad6af7a0c3906657f4a5d1fbc17f8
abbeee28d7747f7a78995985686e5c23324bbf4ec0e85a6de370bf7710bffc01f685
d9a844105832a97518d5d1a2be47e2276af49a33f84908608bd45fb43a84bfa1aa4a
4c7d3ecf4f5f6c765ea04b37919edc22e66dce141a8e6acbfecdb3146417c75b299e
32bff2eefad30b42d4abb74132da0cd4eff881d5bb8d583fb51be84928a270da3104
ddf7b216f24c0a4e07a8ed4a3d5eb57fa390c3af270203010001a3633061300e0603
551d0f0101ff040403020186300f0603551d130101ff040530030101ff301d060355
1d0e0416041403de503556d14cbb66f0a3e21b1bc397b23dd155301f0603551d2304
183016801403de503556d14cbb66f0a3e21b1bc397b23dd155300d06092a864886f7
0d01010505000382010100cb9c37aa4813120afadd449c4f52b0f4dfae04f5797908
a32418fc4b2b84c02db9d5c7fef4c11f58cbb86d9c7a74e79829ab11b5e370a0a1cd
4c8899938c9170e2ab0f1cbe93a9ff63d5e40760d3a3bf9d5b09f1d58ee353f48e63
fa3fa7dbb466df6266d6d16e418df22db5ea774a9f9d58e22b59c04023ed2d288245
3e7954922698e08048a837eff0d6796016deace80ecd6eac4417382f49dae1453e2a
b93653cf3a5006f72ee8c4574 96c612118d504ad783c2c3a806ba7ebaf1514e9d88
9c1b9386ce2916c8aff64b977255730c01b24a3e1dce9df477cb5b424080530ec2db
d0bbf45bf50b9a9f3eb980112adc888c698345f8d0a3cc6e9d595956dde
```

17.1.5 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).

17.1.6 Cipher suite applicability

17.1.6.1 Cipher suite applicability accordingly to the modules

This section provides a list of cipher suites that are available on the series modules. The allowed cipher suites can be selected when <op_code>=2 (cipher suite) with:

- the <legacy_cs> parameter
- the <legacy_cs>=99 specifying <iana_b1> and <iana_b2> parameters
- the <legacy_cs>=100 specifying <iana_b1> and <iana_b2> parameters

For proper <legacy_cs> value, see the +USECPRF AT command.

The cipher suites marked with (D) are the default cipher suites that are proposed to the server when <op_code>=2 (cipher suite) and <legacy_cs>=0. The secure connection will be established if the server supports at least one of the proposed cipher suites.

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The available cipher suites are presented in the following list:

- (0x0041) TLS_RSA_WITH_CAMELLIA_128_CBC_SHA (D)
- (0x0045) TLS_DHE_RSA_WITH_CAMELLIA_128_CBC_SHA (D)
- (0x0084) TLS_RSA_WITH_CAMELLIA_256_CBC_SHA (D)
- (0x0088) TLS_DHE_RSA_WITH_CAMELLIA_256_CBC_SHA (D)
- (0x008A) TLS_PSK_WITH_RC4_128_SHA (D)
- (0x008E) TLS_DHE_PSK_WITH_RC4_128_SHA (D)
- (0x0092) TLS_RSA_PSK_WITH_RC4_128_SHA (D)
- (0x009C) TLS_RSA_WITH_AES_128_GCM_SHA256 (D)
- (0x009D) TLS_RSA_WITH_AES_256_GCM_SHA384 (D)
- (0x009E) TLS_DHE_RSA_WITH_AES_128_GCM_SHA256 (D)
- (0x009F) TLS_DHE_RSA_WITH_AES_256_GCM_SHA384 (D)
- (0x00BA) TLS_RSA_WITH_CAMELLIA_128_CBC_SHA256 (D)
- (0x00BE) TLS_DHE_RSA_WITH_CAMELLIA_128_CBC_SHA256 (D)
- (0x00C0) TLS_RSA_WITH_CAMELLIA_256_CBC_SHA256 (D)
- (0x00C4) TLS_DHE_RSA_WITH_CAMELLIA_256_CBC_SHA256 (D)
- (0xC002) TLS_ECDH_ECDSA_WITH_RC4_128_SHA (D)
- (0xC007) TLS_ECDHE_ECDSA_WITH_RC4_128_SHA (D)
- (0xC00C) TLS_ECDH_RSA_WITH_RC4_128_SHA (D)
- (0xC010) TLS_ECDHE_RSA_WITH_NULL_SHA (D)
- (0xC011) TLS_ECDHE_RSA_WITH_RC4_128_SHA (D)
- (0xC033) TLS_ECDHE_PSK_WITH_RC4_128_SHA (D)
- (0xC034) TLS_ECDHE_PSK_WITH_3DES_EDE_CBC_SHA (D)
- (0xC035) TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA (D)
- (0xC036) TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA (D)
- (0xC037) TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA256 (D)
- (0xC038) TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA384 (D)
- (0xC072) TLS_ECDHE_ECDSA_WITH_CAMELLIA_128_CBC_SHA256 (D)
- (0xC073) TLS_ECDHE_ECDSA_WITH_CAMELLIA_256_CBC_SHA384 (D)
- (0xC074) TLS_ECDH_ECDSA_WITH_CAMELLIA_128_CBC_SHA256 (D)
- (0xC075) TLS_ECDH_ECDSA_WITH_CAMELLIA_256_CBC_SHA384 (D)
- (0xC076) TLS_ECDHE_RSA_WITH_CAMELLIA_128_CBC_SHA256 (D)
- (0xC077) TLS_ECDHE_RSA_WITH_CAMELLIA_256_CBC_SHA384 (D)
- (0xC078) TLS_ECDH_RSA_WITH_CAMELLIA_128_CBC_SHA256 (D)
- (0xC079) TLS_ECDH_RSA_WITH_CAMELLIA_256_CBC_SHA384 (D)
- (0xC07A) TLS_RSA_WITH_CAMELLIA_128_GCM_SHA256 (D)
- (0xC07B) TLS_RSA_WITH_CAMELLIA_256_GCM_SHA384 (D)
- (0xC07C) TLS_DHE_RSA_WITH_CAMELLIA_128_GCM_SHA256 (D)
- (0xC07D) TLS_DHE_RSA_WITH_CAMELLIA_256_GCM_SHA384 (D)
- (0xC086) TLS_ECDHE_ECDSA_WITH_CAMELLIA_128_GCM_SHA256 (D)

- (0xC087) TLS_ECDHE_ECDSA_WITH_CAMELLIA_256_GCM_SHA384 (D)
- (0xC088) TLS_ECDH_ECDSA_WITH_CAMELLIA_128_GCM_SHA256 (D)
- (0xC089) TLS_ECDH_ECDSA_WITH_CAMELLIA_256_GCM_SHA384 (D)
- (0xC08A) TLS_ECDHE_RSA_WITH_CAMELLIA_128_GCM_SHA256 (D)
- (0xC08B) TLS_ECDHE_RSA_WITH_CAMELLIA_256_GCM_SHA384 (D)
- (0xC08C) TLS_ECDH_RSA_WITH_CAMELLIA_128_GCM_SHA256 (D)
- (0xC08D) TLS_ECDH_RSA_WITH_CAMELLIA_256_GCM_SHA384 (D)
- (0xC08E) TLS_PSK_WITH_CAMELLIA_128_GCM_SHA256 (D)
- (0xC08F) TLS_PSK_WITH_CAMELLIA_256_GCM_SHA384 (D)
- (0xC090) TLS_DHE_PSK_WITH_CAMELLIA_128_GCM_SHA256 (D)
- (0xC091) TLS_DHE_PSK_WITH_CAMELLIA_256_GCM_SHA384 (D)
- (0xC092) TLS_RSA_PSK_WITH_CAMELLIA_128_GCM_SHA256 (D)
- (0xC093) TLS_RSA_PSK_WITH_CAMELLIA_256_GCM_SHA384 (D)
- (0xC094) TLS_PSK_WITH_CAMELLIA_128_CBC_SHA256 (D)
- (0xC095) TLS_PSK_WITH_CAMELLIA_256_CBC_SHA384 (D)
- (0xC096) TLS_DHE_PSK_WITH_CAMELLIA_128_CBC_SHA256 (D)
- (0xC097) TLS_DHE_PSK_WITH_CAMELLIA_256_CBC_SHA384 (D)
- (0xC098) TLS_RSA_PSK_WITH_CAMELLIA_128_CBC_SHA256 (D)
- (0xC099) TLS_RSA_PSK_WITH_CAMELLIA_256_CBC_SHA384 (D)
- (0xC09A) TLS_ECDHE_PSK_WITH_CAMELLIA_128_CBC_SHA256 (D)
- (0xC09B) TLS_ECDHE_PSK_WITH_CAMELLIA_256_CBC_SHA384 (D)
- (0xC09C) TLS_RSA_WITH_AES_128_CCM (D)
- (0xC09D) TLS_RSA_WITH_AES_256_CCM (D)
- (0xC09E) TLS_DHE_RSA_WITH_AES_128_CCM (D)
- (0xC09F) TLS_DHE_RSA_WITH_AES_256_CCM (D)
- (0xC0A0) TLS_RSA_WITH_AES_128_CCM_8 (D)
- (0xC0A1) TLS_RSA_WITH_AES_256_CCM_8 (D)
- (0xC0A2) TLS_DHE_RSA_WITH_AES_128_CCM_8 (D)
- (0xC0A3) TLS_DHE_RSA_WITH_AES_256_CCM_8 (D)
- (0xC0A4) TLS_PSK_WITH_AES_128_CCM (D)
- (0xC0A5) TLS_PSK_WITH_AES_256_CCM (D)
- (0xC0A6) TLS_DHE_PSK_WITH_AES_128_CCM (D)
- (0xC0A7) TLS_DHE_PSK_WITH_AES_256_CCM (D)
- (0xC0A8) TLS_PSK_WITH_AES_128_CCM_8 (D)
- (0xC0A9) TLS_PSK_WITH_AES_256_CCM_8 (D)
- (0xC0AA) TLS_DHE_PSK_WITH_AES_128_CCM_8 (D)
- (0xC0AB) TLS_DHE_PSK_WITH_AES_256_CCM_8 (D)
- (0xC0AD) TLS_ECDHE_ECDSA_WITH_AES_256_CCM (D)
- (0xC0AE) TLS_ECDHE_ECDSA_WITH_AES_128_CCM (D)
- (0xC0AF) TLS_ECDHE_ECDSA_WITH_AES_256_CCM_8 (D)

18 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.

☞ SARA-N3
See +UPSD and +UPSDA AT commands for establishing a PSD connection.

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.

18.1 FTP service configuration +UFTP

+UFTP						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

18.1.1 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.

18.1.2 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			
Set	AT+UFTP=5,<timeout>[,[<linger_cmd>],[<linger_data>]]	OK	AT+UFTP=5,0,0,0 OK

Type	Syntax	Response	Example
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 control connection security			
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
FTP data connection security			
Set	AT+UFTP=12[,<FTP_secure>[,<USECMNG_profile>]]	OK	AT+UFTP=12,1,2 OK
Read	AT+UFTP?	+UFTP: 0,<IP_address> +UFTP: 1,<server_name> +UFTP: 2,<username> +UFTP: 4,<account> +UFTP: 5,<timeout>,<linger_cmd>,<linger_data> +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> +UFTP: 12,<FTP_secure>[,<USECMNG_profile>] OK	+UFTP: 0,"216.239.59.147" +UFTP: 1,"" +UFTP: 2,"username" +UFTP: 4,"account" +UFTP: 5,0,0,0 +UFTP: 6,0 +UFTP: 7,21 +UFTP: 8,0 +UFTP: 9,500 +UFTP: 10,1024 +UFTP: 11,13 +UFTP: 12,0 OK
Test	AT+UFTP=?	+UFTP: (list of supported <param_tag>s) OK	+UFTP: (0-11) OK

18.1.3 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 and linger time • 6: FTP mode

Parameter	Type	Description
		• 7: remote FTP server listening port • 8: control connection security • 9: timer trigger • 10: data length trigger • 11: character trigger • 12: data connection security Allowed values: • SARA-N3 - 0, 1, 2, 3, 5, 6, 7, 9, 10, 11
<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.
<linger_cmd>	Number	Linger time for command socket in seconds. The range goes from 0 to 120 s; 0 means linger time is not set. The default value is 60 s.
<linger_data>	Number	Linger time for data socket in seconds. The range goes from 0 to 120 s; 0 means linger time is not set. The default value is 60 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 of FTP client service: • 0 (default value): no SSL encryption • 1: enable SSL encryption of FTP (control connection or data connection). Only the explicit FTPS mode is supported.
<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.

18.1.4 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 AT+UFTPC=1 command (FTP login) will return a failure response via +UUFTPCR URC after an SSL timeout of 30 s.

SARA-N3

- <linger_cmd> and <linger_data> parameters are not supported.

18.2 FTP command +UFTPC

+UFTPC						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

18.2.1 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.

18.2.2 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,<filename>	OK	AT+UFTPC=2,"mytest" OK
Rename a file of FTP server			
Set	AT+UFTPC=3,<filename>,<new_filename>	OK	AT+UFTPC=3,"old_name","final_name" OK
Retrieve the file from the FTP server			
Set	AT+UFTPC=4,<remote_filename>,<local_filename>[,<retrieving_mode>]	OK	AT+UFTPC=4,"data.zip","data.zip" OK
Store the file on the FTP server			
Set	AT+UFTPC=5,<local_filename>,<remote_filename>[,<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_filename>[,<number_of_byte>]	OK	AT+UFTPC=6,"data.zip",30 OK
Send a file to the FTP server using the direct link mode			
Set	AT+UFTPC=7,<remote_filename>[,<number_of_byte>]	OK	AT+UFTPC=7,"data.zip",30 OK

Type	Syntax	Response	Example
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 filenames 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_filename>[,<fw_download_status>]	OK	AT+UFTPC=100,"data.zip" OK
URC		+UUFTPCR: 100,<stored_byte> / <total_byte>	+UUFTPCR: 100,202752 / 1103692
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

18.2.3 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 filenames in a specified directory. The URC +UUFTPCD returns the list of the filenames 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. During the download of the FOTA update file the +UUFTPCR: 100,<stored_byte> / <total_byte> URC (where supported) will provide the status of the download. At the end of the download file the +UUFTPCR: 100,<ftp_result>[,<md5_sum>] URC will provide the operation result. The <md5_sum> parameter will display the MD5 checksum of the downloaded file.
<filename>	String	Filename to be deleted/renamed from the FTP host. For the limit of the length of the string, see Command line.
<new_filename>	String	New filename. For the limit of the length of the string, see Command line.
<remote_filename>	String	Remote filename to be retrieved from the FTP host or stored in it. The maximum parameter length is 256 characters.
<local_filename>	String	Local filename (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.
<fw_download_status>	Number	Manages the firmware package download status: • if omitted trigger the firmware package download from an FTP server • 0: cancel the firmware package download from an FTP server • 1: resume the firmware package download from an FTP server
<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	Allowed values: • 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.
<stored_byte>	Number	Amount of stored bytes
<total_byte>	Number	Amount of total bytes of the FOTA update file to be stored
<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)

18.2.4 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-N3

- <op_code>=2, 3, 8-13 and 100 are not supported.
- <retrieving_mode> and <md5_sum> parameters are not supported.
- The file size shall not exceed 10 kB, when retrieving the file using <op_code>=4.

18.3 FTP error +UFTPER

+UFTPER						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error Appendix A.7.1

18.3.1 Description

This command retrieves the error class and code of the last FTP operation.

18.3.2 Syntax

Type	Syntax	Response	Example
Action	AT+UFTPER	+UFTPER: <error_class>,<error_code> OK	+UFTPER: 1,1 OK

18.3.3 Defined values

Parameter	Type	Description
<error_class>	Number	Value of error class. Values are listed in Appendix A.7.
<error_code>	Number	Value of class-specific error code (reply code if <error_class> is 0). The values are listed in Appendix A.7.1.

19 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.

☞ SARA-N3
See +UPSD and +UPSDA AT commands for establishing a PSD connection.

When these commands report an HTTP error, the error code can be queried using the +UHTTPER AT command.

19.1 HTTP control +UHTTP

+UHTTP						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

19.1.1 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>

19.1.2 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" OK
Username			

Type	Syntax	Response	Example
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 request timeout and TCP socket linger timer			
Set	AT+UHTTP=<profile_id>,7,<HTTP_timeout>[,<linger_timer>]	OK	AT+UHTTP=2,7,150,5 OK
Read	AT+UHTTP=<profile_id>,7	+UHTTP: <profile_id>,7,<HTTP_timeout>,<linger_timer> OK	AT+UHTTP=2,7 +UHTTP: 2,7,150,5 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

19.1.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<op_code>	Number	Allowed values: • 0: HTTP server IP address; • 1: HTTP server name; • 2: username • 3: password • 4: authentication type • 5: HTTP server port • 6: HTTP Secure option (SSL encryption) • 7: HTTP request timeout and TCP socket linger timer • 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 (e.g. "http.server.com"). The factory-programmed value is an empty text string. The maximum length is: • SARA-N3 - 128 characters
<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
<HTTP_timeout>	Number	HTTP request timeout in seconds (number); the range is 30 - 180. It is the timeout in seconds to be used for all the HTTP requests with the specified profile. The factory-programmed value is 180 s.
<linger_timer>	Number	TCP linger timer for socket close expressed in seconds (number).
<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 256 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 (:)

Parameter	Type	Description
<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.

19.1.4 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-N3

- <op_code>=7 (HTTP request timeout) and 9 (HTTP add custom request headers) are not supported.

19.2 HTTP command +UHTTPC

+UHTTPC						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

19.2.1 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.

19.2.2 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>,	OK	AT+UHTTPC=0,4,"/path/file.html","responseFilename","filesystemName",0

Type	Syntax	Response	Example
	<HTTP_content_type>[,<user_defined_content_type>]		OK
POST data command			
Set	AT+UHTTPC=<profile_id>,5,<path>,<filename>,<data>,<HTTP_content_type>[,<user_defined_content_type>]	OK	AT+UHTTPC=0,5,"/path/file.html","responseFilename","data",0 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

19.2.3 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: • SARA-N3 - 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

Parameter	Type	Description
<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.

19.2.4 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
```

- The response headers string (headers received in the HTTP response) must not exceed the maximum length of 255 bytes.

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- <http_command>=100 is not supported.

19.3 HTTP protocol error +UHTTPER

+UHTTPER						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error Appendix A.7

19.3.1 Description

Retrieves the error class and code of the latest HTTP operation on the specified HTTP profile.

19.3.2 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

19.3.3 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.7
<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.7.2

20 Ping

20.1 Ping command +UPING

+UPING						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error PING Error

20.1.1 Description

The ping command is the common method to know if a remote host is reachable on the internet.

The ping functionality is based on the ICMP protocol (Internet Control Message Protocol), it is part of the Internet Protocol Suite as defined in RFC 792 [163]. ICMP messages are typically generated in response to errors in IP datagrams or for diagnostic / routing purposes.

The ping command sends an ICMP echo request to the remote host and waits for its ICMP echo reply. If the echo reply packet is not received, it might mean that the remote host is not reachable.

The ping command could be used also to measure e.g. the RTT (Round Trip Time, the time needed by a packet to go to the remote host and come back) and the TTL (Time To Live, it is a value to understand how many gateway a packet has gone through).

The set command allows the user to execute a ping command from the module to a remote peer. The results of the ping command execution is notified by means of these URCs:

- **+UUPING**: it reports the +UPING command result when no error occurred.
- **+UUPINGER**: it is raised if an error is occurred while processing the +UPING command. The URC reports the code of occurred error (see Ping error codes to get the meanings of the error result codes).

⚠ Some network operators may disallow ICMP packets traffic on their network, this means that the +UPING command may not work.

⚠ Some remote hosts might not reply to ICMP echo request for security reasons (e.g. firewall settings).

⚠ Some remote hosts might not reply to ICMP echo request if the data size of the echo request is too big.

⚠ If a remote peer does not reply to an ICMP echo request, it does not mean that for sure the peer cannot be reached in another way.

20.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UPING=<remote_host>[,<retry_num>,<p_size>,<timeout>,<ttl>]	OK	AT+UPING="www.google.com" OK
Test	AT+UPING=?	+UPING: "remote_host",(list of supported <retry_num>),(list of supported <p_size>),(list of supported <timeout>),(list of supported <ttl>) OK	+UPING: "remote_host",(1-64),(4-1460),(10-60000),(1-255) OK
URC		+UUPING: <retry_num>,<p_size>,<remote_hostname>,<remote_ip>,<ttl>,<rtt>	+UUPING: 1,32,"www.l-google.com","72.14.234.104",55,768
URC		+UUPINGER: <error_code>	+UUPINGER: 12

20.1.3 Defined values

Parameter	Type	Description
<remote_host>	String	IP address (dotted decimal representation) or domain name of the remote host:

Parameter	Type	Description
		• Maximum length: 128 characters
<retry_num>	Number	Indicates how many times iterate the ping command: • Range: 1-64 • Default value: 4
<p_size>	Number	Size in bytes of the echo packet payload: • SARA-N3 - The range goes from 16 to 1460. The default value is 16.
<timeout>	Number	The maximum time in milliseconds to wait for an echo reply response: • Range: 10-60000 • Default value: 5000
<ttl>	Number	The value of TTL to be set for the outgoing echo request packet. In the URC it provides the TTL value received in the incoming packet: • Range: 1-255 • Default value: 32
<remote_hostname>	String	String representing the domain name (if available) of the remote host. It this information is not available, it will be an empty string (i.e. "").
<remote_ip>	String	String representing the remote host IP address in dotted decimal form.
<rtt>	Number	RTT value, the time elapsed in milliseconds before receiving the echo reply response from the remote host.
<error_code>	Number	The error occurred while processing the +UPING command. See Ping error codes for the list of the allowed error result codes.

20.1.4 Notes

- If the +UUPING URC reports <rtt> = -1 the timeout is elapsed (no response received).
- If the first +UUPING URC reports <rtt> = -2 the TTL used in the ping request is too low.
- Some network operators may return an ICMP time exceeded message when the remote host is not reachable. In these cases the first +UUPING URC reports <rtt> = -1 and the subsequent +UUPING URC report <rtt> = -2.

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- The first +UUPING URC reporting <rtt> = -2 is not supported. As a consequence a TTL too low hint is not available.
- The <remote_hostname> parameter is not returned in the +UUPING URC.

20.2 IP network connectivity testing to a remote host +NPING

+NPING						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

20.2.1 Description

Sends an ICMP packet to the specified host address.

The set command initiates the sending of a PING packet to the specified address. This will either cause a packet to be returned if the remote system is connected and responding to PING packets, or no response will be received. Only a ping attempt is tried. If none of the packets receive a response within the timeout period, an error result code will be raised.

If a response is received, the +NPING URC will be issued. If no response is received the +NPINGERR URC will be issued providing the error cause.

20.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+NPING=<remote_addr>[,<p_size>[,<timeout>]]	OK	AT+NPING="192.168.1.1" OK
URC		+NPING: <retry_num>,<remote_addr>,<ttl>,<rtt>	+NPING: 1,"192.168.1.1",20,50

Type	Syntax	Response	Example
URC		+NPINGERR: <err>	+NPINGERR: 1

20.2.3 Defined values

Parameter	Type	Description
<remote_addr>	String	Address of system sending the message in IPv4 format. IP addresses can be specified in decimal, octal or hexadecimal notation.
<p_size>	Number	Size of echo packet payload in range 8-1460 bytes, the default value is 8 bytes.
<timeout>	Number	Maximum time to wait for an echo reply response in range 10-60000 ms, the default value is 10000 ms.
<retry_num>	Number	Number of packets sent before a response is received.
<ttl>	Number	TTL in the response packet.
<rtt>	Number	RTT value, the time elapsed in milliseconds before receiving the echo reply response from the remote host.
<err>	Number	Provides some information about the ping request failure: • 1: no response from remote host within timeout period • 2: failed to send ping request

21 Location Services

The Location Services (LCS) reference model allows an LCS Client (which may or may not reside in a Target UE) to interact with an LCS server in order to obtain location information for one or more target UEs. Such information is obtained via a positioning function between the LCS server and the Target UE. See 3GPP TS 22.071 [119].

LCS can be invoked by the network (e.g. during an emergency call) or by the user through the AT commands described in this section. The position of the device is calculated either by network based on the GNSS measurements reported by the device, or by the device itself. To speed up such measurements, a location server provides the mobile with GNSS assistance data, that otherwise should have been downloaded from the satellites e.g. rough location, GPS satellites to look for, Doppler frequencies, etc. This allows fast position fixes, increases sensitivity and reduces module power consumption.

Generally two modes of A-GPS (Assisted GPS) can be distinguished:

- **MS-Assisted**: only pseudo-range values are measured by the GPS system and returned to the network; the position estimation is done within the network and can be reported to the device if it has started the location request;
- **MS-Based**: the network provides aiding for fast satellite acquisition to the GPS through the cellular control plane, i.e. via signalling messages. The position estimate is done by the device's GPS system and returned to the network or used locally if the device has started the location request.

Standalone poitioning means that no assistance is involved: GPS will work autonomously.

The LCS feature is linked to the GNSS architecture, but there is no correlation between LCS AT commands and GNSS AT commands. Since they use the same resource, in case of collisions LCS services have higher priority.

The implementation of the LCS AT commands follows the 3GPP standard defined by 3GPP TS 27.007 [60].

☞ If the LCS feature is disabled an error result code will be provided after the issuing of the LCS AT commands.

21.1 Mobile originated location request +CMOLR

+CMOLR						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

21.1.1 Description

Initiates/terminates a mobile originated location request (MO-LR) and configures the +CMOLRN URC.

The URC reporting provides the location information in the format of NMEA strings <NMEA-string>.

Additional information about positioning can be found in 3GPP TS 25.305 [109]. If positioning data cannot be provided at the expiring of timeout defined by the <timeout> parameter, the +CMOLRE URC is provided. See the Appendix A.9 for possible <err> values.

The <hor-acc-set>, <hor-acc>, <ver-req>, <ver-acc-set>, <ver-acc> and <vel-req> parameters can be used to request a specific accuracy of the MO-LR response.

The parameters <hor-acc> and <ver-acc> are only applicable if, respectively, <hor-acc-set> and <ver-acc-set> are set to 1. In addition, <ver-acc> is applicable only if <ver-req> is set to 1.

☞ It is not allowed to start multiple requests (every request must either have completed, having generated a URC, or be terminated with +CMOLR=0).

☞ Every request can be terminated only from the AT interface on which it was initiated.

☞ The URC +UUGIND=0,256 (meaning "GPS ownership lost") indicates the successful start up of an already activated GPS device.

21.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+CMOLR=<enable>[,<method>[,<hor-acc-set>[,<hor-acc>[,<ver-req>[,<ver-acc-set>[,<ver-acc>[,<vel-req>[,<rep-mode>[,<timeout>[,<interval>[,<shape-rep>[,<plane>[,<NMEA-rep>[,<third-party-address>[,<resp-time-category>]]]]]]]]]]]]]]]]	OK	AT+CMOLR=1 OK
Read	AT+CMOLR?	+CMOLR: <enable>,<method>,<hor-acc-set>,[<hor-acc>],<ver-req>,[<ver-acc-set>],[<ver-acc>],<vel-req>,<rep-mode>,<timeout>,[<interval>],<shape-rep>,[<plane>],[<NMEA-rep>],[<third-party-address>],<resp-time-category> OK	+CMOLR: 0,0,0,,0,,,0,0,0,,,0,"","",0 OK
Test	AT+CMOLR=?	+CMOLR: (list of supported <enable>s),(list of supported <method>s),(list of supported <hor-acc-set>s),(list of supported <hor-acc>s),(list of supported <ver-req>s),(list of supported <ver-acc-set>s),(list of supported <ver-acc>s),(list of supported <vel-req>s),(list of supported <rep-mode>s),(list of supported <timeout>s),(list of supported <interval>s),(list of supported <shape-rep>s),(list of supported <plane>s),(list of supported <resp-time-category>s) OK	+CMOLR: (0,1),(0,1,4,5),(0,1),(0-127),(0,1),(0,1),(0-127),(0-4),(0),(1-65535),(1-65535),(),0,(0,1) OK
URC		+CMOLRN: <NMEA-string>	+CMOLRN: "$GPRMC,235947.000,V,0000.0000,N,00000.0000,E,,,041299,,*1D"

21.1.3 Defined values

Parameter	Type	Description
<enable>	Number	Configures the reporting location as a result of a MO-LR. Allowed values: • 0: reporting and positioning disabled. At boot time the reporting is disabled. • 1: enable the NMEA strings reporting through +CMOLRN URC Lack of data when timeout occurs is indicated by +CMOLRE URC
<method>	Number	Sets the positioning type. Only one positioning type can be enabled at any given time. Allowed values for MO-LR: • 0 (default value): unassisted GPS. Autonomous GPS only, no use of assistance data • 1: Assisted GPS (see Chapter 21.1.4) • 4: basic self location (the network determines the position technology) • 5: transfer to third party. The parameters <shape-rep> and <NMEA-rep> are irrelevant (any values are accepted and disregarded). The third party address is given in the parameter <third-party-address> (see Chapter 21.1.4)
<hor-acc-set>	Number	Horizontal accuracy presence: • 0 (default value): not set/specified • 1: set in parameter <hor-acc>
<hor-acc>	Number	Requested accuracy as horizontal uncertainty exponent (see the 3GPP TS 23.032 [110] subclause 6.2). The value range is 0-127. The default value is 127, which means that the uncertainty radius is 10 x [(1.1)127 - 1] ~ 1800 km.
<ver-req>	Number	Vertical coordinate (altitude) request flag: • 0 (default value): not requested; a 2D location fix is acceptable. The parameters <ver-acc-set> and <ver-acc> do not apply

Parameter	Type	Description
		• 1: requested; a 3D location fix is required
<ver-acc-set>	Number	Vertical accuracy presence: • 0 (default value): not set/specified • 1: set in parameter <ver-acc>
<ver-acc>	Number	Requested accuracy as vertical uncertainty exponent (see the 3GPP TS 23.032 [110] subclause 6.4). The value range is 0-127. The default value is 127, which means that the uncertainty radius is 10 x [(1.1)127 - 1] ~ 1800 km.
<vel-req>	Number	Requested velocity type (see the 3GPP TS 23.032 [110] subclause 8.6): • 0 (default value): velocity not requested • 1: horizontal velocity requested • 2: horizontal velocity and vertical velocity requested • 3: horizontal velocity with uncertainty requested • 4: horizontal velocity with uncertainty and vertical velocity with uncertainty requested
<rep-mode>	Number	Reporting mode. The <timeout> parameter specifies the timeout for the MO-LR response request. Allowed value: • 0: single report
<timeout>	Number	Indicates how long the MS will wait for a response after a MO-LR. The value range is in seconds from 1 to 65535. For GNSS measurements, the allowed values are 1, 2, 4, 8, 16, 32, 64 and 128 (default value). All other values are truncated to these figures.
<interval>	Number	This parameter is ignored.
<shape-rep>	Number	Ignored.
<plane>	Number	The parameter specifies which communication mode is used for MO-LR. Allowed value: • 0 (default value): control plane
<NMEA-rep>	String	Specifies possible restrictions in supported NMEA strings. The supported NMEA strings are specified as a comma separated values inside one string. If the parameter is omitted or an empty string is given, no restrictions apply and all NMEA strings are supported. The default value is that all strings are supported. (Example: "$GPRMC, $GPGSA,$GPGSV")
<third-party-address>	String	The parameter is applicable to reporting to third party only, and specifies the address to the third party. This parameter is mandatory when <method> value is set to 5, otherwise it is ignored
<NMEA-string>	String	String type in UTF-8. This parameter provides an NMEA-string as defined in IEC 61162 [192]. This parameter shall not be subject to conventional character conversion as per +CSCS The NMEA string is enclosed in double quotes, without the trailing <CR><LF> characters
<resp-time-category>	Number	Response time category of a location request. Allowed values are: • 0: low delay • 1 (default value): delay tolerant

21.1.4 Notes

- For the methods that require assistance data, the assistance data obtained from the network is used for a UE-based GPS location procedure
- If <method>=5 (Transfer to third party) the lack of data at each timeout is not indicated by +CMOLRE URC if reporting to third party is specified

21.2 Mobile terminated location request notification +CMTLR

+CMTLR						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

21.2.1 Description

Configures the Mobile Terminated Location Request (MT-LR) notifications to the TE by an unsolicited result code (URC) through the parameter <subscribe>. It is possible to enable notification of MT-LR performed over the control plane. Relevant location request parameters are provided in the +CMTLR URC. This URC is reported upon arrival of a Mobile Terminated Location Request. To differentiate multiple requests, every request is given a different <handle-id>. This parameter is used when allowing or denying location disclosure with +CMTLRA.

21.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+CMTLR=<subscribe>	OK	AT+CMTLR=1 OK
Read	AT+CMTLR?	+CMTLR: <subscribe> OK	+CMTLR: 1 OK
Test	AT+CMTLR=?	+CMTLR: (list of supported <subscribe>s) OK	+CMTLR: (0-1) OK
URC		+CMTLR: <handle-id>,<notification-type>,<location-type>,[<client-external-id>],[<client-name>][,<plane>]	

21.2.3 Defined values

Parameter	Type	Description
<subscribe>	Number	Configures the subscription for MT-LR notifications: • 0: reporting and positioning notifications disabled • 1: notifications of MT-LR over control plane subscribed
<handle-id>	Number	ID associated with each MT-LR used to distinguish specific request in case of multiple requests. The value range is 1-255
<notification-type>	Number	Information about the user's privacy: • 0: the subscription may stipulate that positioning the user by a third party is allowed and the network may choose to inform the user as a matter of courtesy • 1: locating the user is allowed if the user ignores the notification • 2: locating the user is forbidden if the user ignores the notification
<location-type>	Number	Indicates what type of the location is requested: • 0: current location • 1: current or last known location • 2: initial location
<client-external-id>	String	Indicates the external client where the location information is sent to (if required)
<client-name>	String	The string identifying the external client requesting the user's location
<plane>	Number	The parameter specifies whether the MT-LR came over control plane: • 0: control plane

21.3 Mobile terminated location request disclosure allowance +CMTLRA

+CMTLRA						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	+CME Error

21.3.1 Description

Allows or disallows the disclosure of the location of the TE as a result of a former MT-LR.

21.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+CMTLRA=<allow>,<handle_id>	OK	AT+CMTLRA=1,1 OK
Test	AT+CMTLRA=?	+CMTLRA: (list of supported <allow>s),(list of supported <handle_id>s) OK	+CMTLRA: (0,1),(1-255) OK

21.3.3 Defined values

Parameter	Type	Description
<allow>	Number	Configures the allowance for location disclosure: • 0: location disclosure allowed • 1: location disclosure not allowed
<handle_id>	Number	ID associated with each MT-LR used to distinguish specific request in case of multiple requests. The value is given in +CMTLR. The value range is 1-255

21.3.4 Notes

- No error result code is reported if an invalid <handle_id> is used, as long as it is in the range 1-255

21.4 Report mobile originated location request error +CMOLRE

+CMOLRE						
Modules	SARA-N3					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	+CME Error

21.4.1 Description

Configures the verbose format of the result code +CMOLRE: <err> as an indication of an error relating to the functionality for the mobile originated location request (MO-LR) error reporting format. When enabled, the MT related verbose error cause is given.

21.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+CMOLRE=[<verbose_mode_enable>]	OK	AT+CMOLRE=1 OK
Read	AT+CMOLRE?	+CMOLRE: <verbose_mode_enable> OK	+CMOLRE: 1 OK
Test	AT+CMOLRE=?	+CMOLRE: (list of supported <verbose_mode_enable>s) OK	+CMOLRE: (0,1) OK
URC		+CMOLRE: <err>	If <verbose_mode_enable>=0

Type	Syntax	Response	Example
			+CMOLRE: 2
			If <verbose_mode_enable>=1
			+CMOLRE: Not enough satellites

21.4.3 Defined values

Parameter	Type	Description
<verbose_mode_enable>	Number	• 0 (default value): disabled. The error code is in expressed in numeric format • 1: enabled. The error code is presented with verbose text strings
<err>	Number or string	Error numeric code or textual description. See the appendix Appendix A.9

22 Datagram messages

These proprietary commands are used to communicate with OceanConnect NB-IoT platform. OceanConnect is an IoT ecosystem network infrastructure. It provides the necessary queuing function so that devices in the Internet can communicate with IoT entities.

Messages wrapped in LWM2M (Light Weight Machine to Machine) packets on top of the CoAP (Constrained Application Protocol) are transported over UDP sockets. Messages are queued on the module and are sent in order. Messages can be received by either polling the +NMGR AT command or by turning on the +NNMI URC.

☞ LWM2M is an application layer communication protocol for the constrained IoT devices and is a lightweight, secure and compact protocol as well as efficient resource data model.

☞ Constrained Application Protocol is a specialized web transfer protocol for use with constrained nodes and constrained networks in the IoT.

☞ The +NCDP AT command configures the module for communication with OceanConnect NB-IoT platform.

22.1 Configure OceanConnect server settings +NCDP

+NCDP						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

22.1.1 Description

Configures and reads the IP address and port of the OceanConnect server. The internal network IP address of the OceanConnect server is specific of the intended network configuration.

22.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+NCDP=<IPv4_address>[,<port>]	OK	AT+NCDP="10.105.7.75",5683 OK
Read	AT+NCDP?	+NCDP: <IPv4_address>,<port> OK	+NCDP: "192.168.160.1",5683 OK

22.1.3 Defined values

Parameter	Type	Description
<IPv4_address>	String	OceanConnect destination IPv4 address. IP addresses can be specified in decimal, octal or hexadecimal notation.
<port>	Number	OceanConnect destination port number: • If <port>= 0 is provided, the default port (5683) will be used. • If no port is specified the previously set port will be used. • If no port is specified and no port was previously set, the default port will be used.

22.1.4 Notes

SARA-N2

- Put the MT to the minimum cellular functionality (AT+CFUN=0) before issuing this command.
- The changes are effective after the module reboot.

22.2 Get message +NMGR

+NMGR						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

22.2.1 Description

Returns the oldest buffered message and deletes the messages from the buffer. If there are no messages then no information text response will be given.

If new message indications (by means of +NNMI=1 AT command) is set then the received messages will not be available via this AT command.

22.2.2 Syntax

Type	Syntax	Response	Example
Action	AT+NMGR	<length>,<data> OK	3,"AA11BB" OK

22.2.3 Defined values

Parameter	Type	Description
<length>	Number	Number of bytes of the data in range 0-512
<data>	String	Data to be transmitted in hexadecimal format

22.3 Send message +NMGS

+NMGS						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

22.3.1 Description

Sends a message from the terminal to the network via the OceanConnect server.

22.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+NMGS=<length>,<data>	OK	AT+NMGS=3,"AA11BB" OK

22.3.3 Defined values

Parameter	Type	Description
<length>	Number	Number of bytes of the data in range 0-512
<data>	String	Data to be transmitted in hexadecimal format

22.4 New message indications +NNMI

+NNMI						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

22.4.1 Description

Sets or gets whether new message indications are sent. New message indications can be sent when the module receives a downstream message.

If the indications are enabled, all currently buffered messages will be indicated by means of a URC.

22.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+NNMI=<indication>	+NNMI: OK OK	AT+NNMI=1 +NNMI: OK OK
Read	AT+NNMI?	+NNMI: <indication> OK	+NNMI: 2 OK
URC		**<indication>=1** +NNMI: <length>,<data>	**<indication>=1** +NNMI: 5,"48656C6C6F"
		<indication>=2 +NNMI	**<indication>=2** +NNMI

22.4.3 Defined values

Parameter	Type	Description
<indication>	Number	Allowed values: • 0 (default value): indications disabled • 1: indications enabled including the received message • 2: only the indications are enabled; retrieve the message by means of +NMGR AT command
<length>	Number	Number of bytes of the data in range 0-512
<data>	String	Data to be transmitted in hexadecimal format

22.5 Query received messages +NQMGR

+NQMGR						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

22.5.1 Description

Queries the status of the received downstream messages.

Messages are dropped by the module if the host does not read them out of the buffer fast enough. When messages are dropped the oldest messages are dropped first.

22.5.2 Syntax

Type	Syntax	Response	Example
Action	AT+NQMGR	BUFFERED=<buffered>,RECEIVED=<received>,DROPPED=<dropped> OK	BUFFERED=3,RECEIVED=34,DROPPED=0 OK

22.5.3 Defined values

Parameter	Type	Description
<buffered>	Number	The number of messages waiting to be read in the downstream buffer
<received>	Number	Total number of messages received by the module since the module boot
<dropped>	Number	Number of messages dropped by the module since the module boot

22.6 Query sent messages +NQMGS

+NQMGS						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

22.6.1 Description

Returns the accumulated status of all the upstream messages sent to the OceanConnect server since last boot up.

22.6.2 Syntax

Type	Syntax	Response	Example
Action	AT+NQMGS	PENDING=<pending>,SENT=<sent>,ERROR=<error> OK	PENDING=3,SENT=34,ERROR=0 OK

22.6.3 Defined values

Parameter	Type	Description
<pending>	Number	Number of messages waiting to be sent in the upstream buffer (if a network connection is not available)
<sent>	Number	Total number of messages sent by the module since the module power-on
<error>	Number	Number of messages not sent due to errors, since the module power-on

22.7 Send message indications +NSMI

+NSMI						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

22.7.1 Description

Enables and disables indications when an upstream message is sent.

If indications are turned on, the +NSMI URC will be issued when the datagram has been successfully sent and acknowledged by the network.

22.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+NSMI=<indication>	OK	AT+NSMI=1 OK
Read	AT+NSMI?	+NSMI: <indication> OK	+NSMI: 1 OK
URC		+NSMI: <status>	+NSMI: "SENT"

22.7.3 Defined values

Parameter	Type	Description
<indication>	Number	• 0 (default value): indications disabled • 1: indications enabled
<status>	String	Allowed values: • "SENT" • "DISCARDED"

22.8 Message registration status +NMSTATUS

+NMSTATUS						
Modules	SARA-N2					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

22.8.1 Description

Provides the registeration status when the module is connected to the OceanConnect server.

22.8.2 Syntax

Type	Syntax	Response	Example
Read	AT+NMSTATUS?	+NMSTATUS: <registration_status> OK	+NMSTATUS: "REGISTERED" OK
Test	AT+NMSTATUS=?	list of supported <registration_status>s> OK	"UNINITIALISED" "MISSING_CONFIG" "INIT_FAILED" "INIITIALISED" "REGISTERING" "REREGISTERING" "REGISTERED" "REREGISTERED" "MO_DATA_ENABLED" "NO_UE_IP" "MEMORY_ERROR" "COAP_ERROR" "MSG_SEND_FAILED" "REJECTED_BY_SERVER" "TIMEOUT_AND_RETRYING" "TIMEOUT_AND_FAILED" OK

22.8.3 Defined values

Parameter	Type	Description
<registration_status>	String	Current registration status. Allowed values: • "UNINITIALISED" • "MISSING_CONFIG" • "INIT_FAILED" • "INITALISED" • "REGISTERING" • "REREGISTERING" • "REGISTERED" • "REREGISTERED" • "SEND_ENABLED" • "NO_UE_IP" • "MEMORY_ERROR" • "COAP_ERROR" • "MSG_SEND_FAILED" • "REJECTED_BY_SERVER" • "TIMEOUT_AND_RETRYING" • "TIMEOUT_AND_FAILED"

23 Constrained Application Protocol (CoAP)

23.1 Introduction

The Constrained Application Protocol (CoAP) is a datagram-based client/server application protocol for devices on the constrained network (e.g. low overhead, low-power), designed to easily translate to HTTP for simplified integration with the web. CoAP clients can use the GET, PUT, POST and DELETE methods using requests and responses with a CoAP server.

The CoAP defines the application level Quality of Service (QoS), where requests and response messages may be marked as:

- **"Confirmable" (CON)**: the messages must be acknowledged by the receiver if successfully received.
- **"Non-confirmable" (NON)**: the messages are "fire and forget".

Supported components are:

- **CoAP-AT**: it can be used to send or receive messages (by means of +UCOAPC command) via CoAP.

23.1.1 SARA-N2 CoAP components

This module series supports the following list of components:

- **OceanConnect**: confirmable and non-confirmable messages are supported
- **CoAP-AT**: it can be used to send or receive only confirmable messages (by means of +UCOAPC command) via CoAP over the NB-IoT platform. Only confirmable messages are supported
- **FOTA**: the Firmware over-the-air (FOTA) component uses the CoAP context to download a FW update package from a dedicated FOTA server. For more details, see FOTA examples. Only confirmable messages are supported
- **SELF-REG**: The self-registration component will access to the CoAP context only at the module boot time. After that, the CoAP context shall be available as mutually exclusive between other components. Only confirmable messages are supported

The component can be configured by the +USELCP AT command.

The access to the CoAP context will be multiplexed between the FOTA component and the OceanConnect/ CoAP-AT.

☞ Switching the CoAP context is not allowed if it is already acquired by the self-registration component.

☞ The default IP address depends on the server type:
- FOTA server: "52.8.254.248"
- China Telecom (CTCC): "42.99.2.15"
- China Unicom (CUCC): "47.93.238.105"

23.2 CoAP profile configuration +UCOAP

+UCOAP						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

23.2.1 Description

Configures, reads and resets the current profile parameters of the CoAP client. A set command for each <op_code> parameter must be issued to set each CoAP client profile parameter (CoAP server address, CoAP URI, CoAP PDU option mask).

To store in the NVM the configured CoAP client profile parameters issue the AT+UCOAP=6,<profile_number> command where the <profile_number> parameter is the profile number.

To initiate a TCP session, instead of UDP session, in CoAP, provide the "coap+tcp" scheme by means of the <COAP_URI> parameter.

To initiate the secure session in CoAP, provide the "coaps" or "coaps+tcp" scheme by means of the <COAP_URI> parameter. Issue the AT+UCOAP=8,<USECMNG_profile> command to configure a CoAP secure session; the USECMNG profile number is set by means of the <USECMNG_profile> parameter.

☞ SARA-N2
TCP, TLS and DTLS connection are not supported.

☞ SARA-N3
TCP and DTLS connection are not supported.
Issue the AT+UCOAP=9,<rai_flag> command to configure the release assistance indication (RAI). The <rai_flag>=1 and non-confirmable (NON) message type (for more details, see <PDU_option> parameter) are mutually exclusive. Similarly, the <rai_flag>=2 and confirmable (CON) message type (for more details, see <PDU_option> parameter) are mutually exclusive.

Up to four profiles can be stored in the NVM and only one can be loaded at a time. The loaded profile will be considered as the current profile and only this one can be stored in the NVM on the requested profile location.

The read command (AT+UCOAP=7) returns the parameter settings for all four profiles. If the profile is not defined, then the "+UCOAP: INVALID PROFILE NUMBER <profile_number>" will be returned in the information text response to the read command.

☞ SARA-N3
Parameter <COAP_server_IP_address> is not supported and can be provided as URI-HOST in <COAP_URI>.

23.2.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UCOAP=<op_code>,<param_val>[,<param_val1>]	OK	AT+UCOAP=1,"coap://10.17.4.27:3456/ublox/testuri?reference=0" OK
Read	AT+UCOAP?	+UCOAP: <param_name>[,<param_val>] [[..] +UCOAP: <param_name>[,<param_val>] OK	+UCOAP: "DST_IP_ADDRESS","134.102.218.18" +UCOAP: "PORT",5683 +UCOAP: "URI_STR","coap://coap.me/test" +UCOAP: "OPT_MASK",23 +UCOAP: "PROFILE_NUM",2 +UCOAP: "STATUS FLAG",1 +UCOAP: "USECMNG PROFILE" +UCOAP: "RAI FLAG",0 OK
CoAP server IP address port			
Set	AT+UCOAP=0,<COAP_server_IP_address>[,<COAP_port>]	OK	AT+UCOAP=0,"192.168.10.25","2481" OK
CoAP URI			
Set	AT+UCOAP=1,<COAP_URI>	OK	AT+UCOAP=1,"coap://10.17.4.27:3456/ublox/testuri?reference=0" OK
CoAP PDU option mask			
Set	AT+UCOAP=2,<PDU_option>[,<value>]	OK	AT+UCOAP=2,0,1 OK
Current profile number			
Set	AT+UCOAP=3,<profile_number>	OK	AT+UCOAP=3,0 OK
Current profile valid flag			

Type	Syntax	Response	Example
Set	AT+UCOAP=4,<valid_flag>	OK	AT+UCOAP=4,0 OK
Restore profile			
Set	AT+UCOAP=5,<profile_number>	OK	AT+UCOAP=5,0 OK
Store profile			
Set	AT+UCOAP=6,<profile_number>	OK	AT+UCOAP=6,0 OK
Read the stored profiles			
Read	AT+UCOAP=7	+UCOAP: <param_name>,<param_val> [[..] +UCOAP: <param_name>,<param_val>] OK	AT+UCOAP=7 +UCOAP: INVALID PROFILE NUMBER 0 +UCOAP: INVALID PROFILE NUMBER 1 +UCOAP: "DST_IP_ADDRESS","10.56.9.34" +UCOAP: "PORT",3456 +UCOAP: "URI_STR","coap://10.56.9.34:3456/ublox/testuri" +UCOAP: "OPT_MASK",7 +UCOAP: "PROFILE_NUM",2 +UCOAP: "STATUS FLAG",1 +UCOAP: "USECMNG PROFILE" +UCOAP: "RAI FLAG",0 +UCOAP: INVALID PROFILE NUMBER 3 OK
Select USECMNG profile			
Set	AT+UCOAP=8,<USECMNG_profile>	OK	AT+UCOAP=8,0 OK
RAI configuration			
Set	AT+UCOAP=9,<rai_flag>	OK	AT+UCOAP=9,0 OK
Test	AT+UCOAP=?	+UCOAP: (list of supported <op_code>s) OK	+UCOAP: (0-9) OK

23.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	Specific parameter in profile. Allowed values are: • 0: CoAP server address configuration • 1: CoAP URI configuration • 2: CoAP PDU option mask configuration • 3: current profile number • 4: current profile valid • 5: restore profile from the NVM • 6: store profile to the NVM • 7: read all profiles from the NVM • 8: CoAP secure option (SSL encryption) • 9: release assistance indication (RAI)
<COAP_server_IP_address>	String	Remote CoAP server IP address in IPv4 format. For IP address format reference see the IP addressing.

Parameter	Type	Description
<COAP_port>	String	Remote CoAP server port; the default CoAP port is 5683, in case of secure option the default port is 5684.
<COAP_URI>	String	URI scheme supported are: • UDP connection: "coap://"URI_HOST[":"URI_PORT] [URI_PATH] ["?"URI_QUERY] • DTLS connection: "coaps://"URI_HOST[":"URI_PORT] [URI_PATH] ["?"URI_QUERY] URI limitations are: • SARA-N2 - The maximum supported length of the URI is 200 characters, where URI_PATH and URI_QUERY options are limited to 40 characters each. • SARA-N3 - The maximum supported length of the URI is 469 characters, where URI_PATH and URI_QUERY options are limited to 100 characters each.
<PDU_option>	Number	PDU option to be added in PDU header. Allowed values are: • 0: URI_HOST • 1: URI_PORT • 2: URI_PATH • 3: URI_QUERY • 4: CONTENT_FORMAT (CONTENT_FORMAT option in the PDU by means of the +UCOAPC AT command) • 5: NON_Message. If it is enabled (see the <value> parameter) then the message type will be non-confirmable, otherwise it will be confirmable
<value>	Number	Allowed values are: • 0 (default value): clear the corresponding option flag • 1: set the corresponding option flag
<profile_number>	Number	Profile number to be used: • 0: profile 0 • 1: profile 1 • 2: profile 2 • 3: profile 3
<valid_flag>	Number	Sets the current profile as valid or invalid: • 0: invalid profile • 1: valid profile
<USECMNG_profile>	Number	Defines the USECMNG profile which specifies the SSL/TLS properties to be used for an SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used
<rai_flag>	Number	Sets the RAI flag. Allowed values: • 0: RAI disabled • 1: release the connection after the uplink data is sent. It can not be selected with confirmable message type. • 2: release the connection after the first data is received in downlink. It can not be selected with non-confirmable message type.
<param_name>	String	Verbose description for the specific parameter, provided with their numeric values for each profile. Supported values: • "DST_IP_ADDRESS" • "PORT" • "URI_STR" • "OPT_MASK" • "PROFILE_NUM" • "STATUS FLAG" • "USECMNG PROFILE" • "RAI FLAG"
<param_val>	String/ Number	Type and supported content depend on the related <op_code> parameter; details are given above.
<param_val1>	String/ Number	Optional parameter; type and supported content depend on the related <op_code> parameter; details are given above.

23.2.4 Notes

- No profiles are defined by factory-programmed setting.

SARA-N2

- <PDU_option>=5 (NON_Message) is not supported.

- <op_code>=8 (CoAP secure option) and 9 (release assistance indication) are not supported.
- <PDU_option>, <value>, <profile_number>, <valid_flag>, <USECMNG_profile> and <rai_flag> parameters are accepted as string format.
- <op_code>=1 (CoAP URI configuration) does not support DTLS, TCP and TLS connection.

SARA-N3

- <op_code>=0 (CoAP server address configuration) is not supported.
- The <COAP_server_IP_address> and <COAP_port> parameters are not returned while reading CoAP profile.
- <op_code>=1 (CoAP URI configuration) does not support TCP and TLS connection.

23.3 CoAP command +UCOAPC

+UCOAPC						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

23.3.1 Description

Triggers the CoAP action with the <coap_command> parameter:

- **GET request**: it can be used to get the requested payload. If the payload is larger than the maximum limit (the limit is imposed by the server), the block-wise transfer will be triggered automatically (if supported by the server);
- **PUT or POST requests**: this can be used to send some payload. If the payload is larger than 512 bytes, then it can be sent via block-wise transfer by dividing the payload in blocks up to 512 bytes.

The final result code indicates if sending the command request to the CoAP process was successful or not. The +UCOAPCR (CoAP command result) URC returns to the user the final result of the CoAP command previously sent with +UCOAPC. As well, the +UCOAPCD CoAP unsolicited data URC provides the data requested by the user and received from the CoAP server.

☞ SARA-N3
The <identifier> parameter is returned with the payload in the URC to format the payload accordingly.

☞ The payload size in downlink is dependent upon the data packeting scheme of the CoAP server.

☞ For more details, see the RFC 7252 [181].

23.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCOAPC=<coap_command>[,<payload>,<identifier>[,<block_number>,<more_block>]]	OK	AT+UCOAPC=1 OK
Test	AT+UCOAPC=?	+UCOAPC: (list of supported <coap_command>s) OK	+UCOAPC: (1,4) OK
URC		+UCOAPCD: <response_code>,[<identifier>,][<payload>],<more_block>[,<block_number>,<block_size>][,<urc_left>]	+UCOAPCD: 2,0,"34746E5F31",0
URC		+UCOAPCR: <coap_command>,<coap_result>	+UCOAPCR: 2,1

23.3.3 Defined values

Parameter	Type	Description
<coap_command>	Number	CoAP action. Allowed values: • 1: GET request to the CoAP server; optional parameters are not allowed • 2: DELETE request to the CoAP server; optional parameters are not allowed • 3: PUT request to the CoAP server

Parameter	Type	Description
		• 4: POST request to the CoAP server
<payload>	String	Hexadecimal payload to be sent or received. The maximum size in uplink is 512 bytes. For PUT (<coap_command>=3) and POST (<coap_command>=4) commands, if <more_block>=1 (more blocks available), allowed length values for payload are 8, 16, 32, 64, 128, 256, 512 bytes. For more details, see RFC 7959 [185].
<identifier>	Number	CoAP Content-Type identifier. Allowed values: • 0: text / plain • 1: application / link format • 2: application / xml • 3: application / octet stream • 4: application / rdf xml • 5: application / exi • 6: application / json • 7: application / cbor
<block_number>	Number	Indicates the block number being requested or provided, starting from 0.
<more_block>	Number	Indicates that the data in the message is the last block or more blocks are available: • 0: last block • 1: more blocks available
<response_code>	Number	Numeric code added in the response from the server. Allowed values: • 0: empty message • 2: success • 4: client error • 5: server error
<block_size>	Number	Size of data to be acknowledged by the server. The maximum size in uplink is 512 bytes.
<urc_left>	Number	Indicates the number of remaining URCs that will be displayed for a data block, when the payload is too long to be displayed in a single URC and therefore it is split in multiple URCs.
<coap_result>	Number	Indicates the result of last CoAP command: • 0: fail • 1: success

23.3.4 Notes

SARA-N2

- The <block_number>, <more_block>, <block_size> and <response_code> parameters are not supported by SARA-N200-02B-00, SARA-N201-02B-00, SARA-N210-02B-00, SARA-N211-02X-00, SARA-N280-02B-00.
- The <identifier> and <urc_left> parameters are not returned in the URC.
- For PUT (<coap_command>=3) and POST (<coap_command>=4), the <payload> size must be 512 bytes if <more_block> is set.
- The +UCOAPCR URC is not supported.

SARA-N3

- The <urc_left> parameter is not returned in the URC.
- For PUT (<coap_command>=3) and POST (<coap_command>=4), the <payload> size must be 512 bytes if <more_block> is set.

23.4 CoAP component selection +USELCP

+USELCP						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

23.4.1 Description

Selects the component which can access the CoAP context. A valid IP address shall be set (by means of the +UCOAPS AT command) before selecting the FOTA component.

A valid profile shall be configured and activated (by means of the +UCOAP AT command) before selecting the CoAP-AT component.

☞ It is not possible to set the <comp_code> parameter to 0 or 1 if the <transfer_status> parameter is equal to 2 in the last +UFOTAS URC.

23.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+USELCP=<comp_code>	OK	AT+USELCP=1 OK
Read	AT+USELCP?	+USELCP: <comp_code> OK	+USELCP: 1 OK

23.4.3 Defined values

Parameter	Type	Description
<comp_code>	Number	Indicates the component which can access the CoAP context: • 0: OceanConnect • 1: CoAP-AT • 2: FOTA (Firmware update Over The Air) • 3: SELF-REG. This value is read only and cannot be selected in the set command

23.5 CoAP server configuration +UCOAPS

+UCOAPS						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

23.5.1 Description

Configures the IP address and port of the FOTA server and self-registration (specifically for CTCC and CUCC MNO).

The read command returns the IP address and port for all the configured servers. It will return empty if any of the servers are not set.

23.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCOAPS=<ser_type>,<ip_address>[,<port>]	OK	AT+UCOAPS=0,"192.168.160.1",5683 OK
Read	AT+UCOAPS?	+UCOAPS: <ser_type>,<ip_address>,<port> [[..] +UCOAPS: <ser_type>,<ip_address>,<port>] OK	+UCOAPS: 0,"192.168.160.1",5683 +UCOAPS: 1,"192.168.27.8",5645 +UCOAPS: 2 OK

23.5.3 Defined values

Parameter	Type	Description
<ser_type>	Number	Server type. Allowed values: • 0: FOTA server • 1: self-registration for CTCC • 2: self-registration for CUCC
<ip_address>	String	Remote server IP address expressed in IPv4 format. For IP address format reference see the IP addressing.
<port>	Number	Remote server port; the default CoAP port is 5683.

23.6 FOTA poll timer configuration +UFOTAPT

+UFOTAPT						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

23.6.1 Description

Configures the poll timer value for the FOTA component. This timer represents the time during which the FOTA engine will remain in the "POLL_TIMER_RUN" state. When the timer expires, the FOTA engine moves to the "POLL_TIMER_EXPIRE" state.

23.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+UFOTAPT=<timer_res>	OK	AT+UFOTAPT=2 OK
Read	AT+UFOTAPT?	+UFOTAPT: <timer_res>,<hrs_left> OK	+UFOTAPT: 1 OK

23.6.3 Defined values

Parameter	Type	Description
<timer_res>	Number	Configure the poll timer value, allowed values: • 0 (factory-programmed value): immediate • 1: 1 hour • 2: 24 hours (1 day) • 3: 168 hours (7 days) • 4: 720 hours (30 days)
<hrs_left>	Number	Hours left in poll timer expiry

23.7 Firmware transfer +UCOAPFWT

+UCOAPFWT						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

23.7.1 Description

Downloads the firmware update package to be used during the FOTA procedure. Issue the command only if the <transfer_status> parameter is 3 in the last +UFOTAS URC.

The update process is fault tolerant, even if the power supply is suddenly removed. At the end of a successful installation, the module will be rebooted and the data stored in the NVM are set to the factory-programmed values of the new firmware version.

☞ Define a CoAP context (by means of the AT+USELCP=2 command) before issuing this command.

23.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCOAPFWT=<block_count>	OK	AT+UCOAPFWT=0 OK

23.7.3 Defined values

Parameter	Type	Description
<block_count>	Number	Indicates the number of blocks to be transferred against each set command:

Parameter	Type	Description
		• 0: transfer all blocks mentioned in +UFOTAS URC • 1-65535: transfer given number of blocks. If given number of blocks are greater than remaining block in +UFOTAS URC, then remaining block count will be transferred

23.8 FOTA status +UFOTAS

+UFOTAS						
Modules	SARA-N200-02B SARA-N201-02B SARA-N210-02B SARA-N211 SARA-N280-02B					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

23.8.1 Description

Returns the current status of the FOTA process. The action command checks the availability of the firmware update file. The +UFOTAS URC will be issued in either case; if the firmware update package is not available then the state <transfer_status>=0 will be issued again. The +UFOTAS URC is issued at each change of the <transfer_status> parameter value.

☞ Set the COAP context to FOTA (by setting <comp_code>=2 in the +USELCP AT command) before issuing this command.

23.8.2 Syntax

Type	Syntax	Response	Example
Action	AT+UFOTAS	OK	OK
Read	AT+UFOTAS?	+UFOTAS: <blk_rm>,<transfer_status> OK	+UFOTAS: 1487,1 OK
URC		+UFOTAS: <blk_rm>,<transfer_status>	+UFOTAS: 1487,1

23.8.3 Defined values

Parameter	Type	Description
<blk_rm>	Number	Status of remaining number of blocks: • 0: no update is available • 1-65535: current block number could be in this range
<transfer_status>	Number	FOTA process status: • 0: no update is available (the POLL timer is running) • 1: the POLL timer is expired, the module can query the firmware update • 2: transferring <block_count> mentioned in +UCOAPFWT command • 3: pending transfer, some blocks left to be transferred and no transfer in progress • 4: package validation • 5: package installation

23.8.4 Examples

Table 25 reports an example of an AT commands sequence for the FOTA process.

Command	Response	Description
AT+UCOAPS=0,"52.8.254.248", 5683	OK	Configure the IP address and port for the FOTA server.
AT+USELCP=2	OK	The COAP context is acquired by the FOTA component.
AT+UFOTAS?	+UFOTAS: 0,0 OK	The POLL timer is running; a time after which the UE qualifies to query the firmware update to the server. ☞ The +UFOTAS URC will be issued on expiry of that timer.
	+UFOTAS: 0,1	The POLL timer has expired; the UE qualifies to query the firmware update to the server.

Command	Response	Description
AT+UFOTAS	OK	Issue the action command to check whether a firmware update is available or not.
	+UFOTAS: 133,3	The URC notifies that the firmware update package has 133 remaining blocks, and its transfer is pending.
AT+UCOAPFWT=0	OK	Transfer all blocks available in the firmware update package mentioned in the previous URC.
	+UFOTAS: 133,2	The URC notifies that the transfer of 133 blocks of firmware update package has been started. ☞ If the UE reboots in this state, it will resume in transfer pending state(<transfer_status>=3).
	+UFOTAS: 0,4	The URC notifies that the firmware package has downloaded successfully and the validation process is started.
	+UFOTAS: 0,5	The URC notifies that the firmware package validation is completed successfully and the installation process is started.
	REBOOTING	An automatic reboot is issued after that the installation process is completed.
		After the module reboot the UE will resume in <transfer_status>=1 state, so the user needs to query the firmware update as follows.
	+UFOTAS: 0,1	The UE qualifies to query the firmware update.
AT+UFOTAS	OK	Issue the action command to check the update package availability.
		If the UE's current firmware matches with the latest firmware on the server, then the UE will resume in <transfer_status>=0 state. Otherwise the update process will be started again, as the last update was not successful.
	+UFOTAS: 0,0	The POLL timer is running.

Table 25: FOTA process examples

23.9 CoAP error reporting +UCOAPER

+UCOAPER						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error Appendix A.7

23.9.1 Description

Returns the error code of the latest CoAP operation.

23.9.2 Syntax

Type	Syntax	Response	Example
Action	AT+UCOAPER	+UCOAPER: <error_class>,<error_code> OK	AT+UCOAPER +UCOAPER: 15,4 OK

23.9.3 Defined values

Parameter	Type	Description
<error_class>	Number	List of the allowed values is available in listed in Appendix A.7.
<error_code>	Number	Value of CoAP specific error code, the allowed <error_code> values are listed in Appendix A.7.6.

24 MQTT

24.1 Introduction

☞ MQTT AT commands are implemented according to MQTT version 3.1.1. For a more detailed overview on MQTT protocol, see MQTT version 3.1.1 - OASIS standard [201].

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). 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.

A PSD connection must be activated before using MQTT AT commands.

☞ SARA-N3
See +UPSD and +UPSDA AT commands for establishing a PSD connection.

24.2 MQTT profile configuration +UMQTT

+UMQTT						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	+UMQTTNV	No	-	+CME 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.

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

Type	Syntax	Response	Example
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 and linger time			
Set	AT+UMQTT=10,<timeout>[,<linger_time>]	+UMQTT: 10,<result> OK	AT+UMQTT=10,3600,20 +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 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: 0,"352848080012186"

Type	Syntax	Response	Example
		+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,<wm_length>,<will_message> +UMQTT: 10,<timeout>,<linger_time> +UMQTT: 11,<MQTT_secure>[,<USECMNG_profile>] OK	+UMQTT: 2,"",1883 +UMQTT: 3,"",1883 +UMQTT: 4,"" +UMQTT: 6,0 +UMQTT: 7,0 +UMQTT: 8,"" +UMQTT: 9,0,"" +UMQTT: 10,0,10 +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 last will QoS value • 7: MQTT last will retain • 8: MQTT last will topic • 9: MQTT last will message • 10: MQTT inactivity timeout period and linger time • 11: MQTT secure • 12: MQTT clean session • 14: MQTT terse/verbose mode; the set command is not supported Allowed values: • SARA-N3 - 0, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12
<result>	Number	Allowed values: • 0: failure • 1: success
<client_id>	String	Client identifier for the MQTT session. • SARA-N3 - The maximum length is 256 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. • SARA-N3 - 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-N3 - The maximum length is 255 characters. ☞ SARA-N3 On SARA-N310-00X-00 the maximum length is 64 characters.
<password>	String	Password for the MQTT login procedure. The default value is an empty string: • SARA-N3 - The maximum length is 255 characters. ☞ SARA-N3 On SARA-N310-00X-00 the maximum length is 32 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).
<linger_time>	Number	Linger time expressed in seconds. The range goes from 0 to 120 s; 0 means linger time is not set. The default value is 10 s.
<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 default value is an empty string. • SARA-N3 - The maximum length is 255 characters.
<will_message>	String	Last will message: string of characters (ASCII or hexadecimal octets). • SARA-N3 - The maximum length is 255 characters. In case of hexadecimal data, the number of characters must be even (one hexadecimal octet is composed of 2 characters).
<hex_mode>	Number	Allowed values: • 0 (default value): ASCII input for <will_message> • 1: hexadecimal input for <will_message>
<wm_length>	Number	Two meanings: • ASCII input: number of ASCII characters in <will_message> • Hexadecimal input: number of octets 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-N3

- The set command does not provide the +UMQTT: <op_code>,<result> information text response: only the final result code is issued.
- The +UUMQTT URC is not supported.
- See the Appendix A.1 for the allowed error result codes.
- <op_code>=2 (MQTT server name) and <op_code>=3 (MQTT IP address) are equivalent, when broker connection is established the server name is transformed into the IP address.
- The <hex_mode> and <wm_length> parameters are not supported.
- The <linger_time> is not supported.

24.3 Save/Restore MQTT profile from NVM +UMQTTNV

+UMQTTNV						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

24.3.1 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.

☞ SARA-N3
The set command does not provide the information text response: only the final result code is issued.

24.3.2 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

24.3.3 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

24.4 MQTT command +UMQTTC

+UMQTTC						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 120 s	+CME Error

24.4.1 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.

24.4.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UMQTTC=<op_code>[,<param1>[,<param2>][,<param3>][,<param4>][,<param5>]]	OK	AT+UMQTTC=1 OK
URC		+UUMQTTC: <op_code>,<param1>[,<param2>,<param3>]	+UUMQTTC: 4,0,2,"sensor/heat/#"
MQTT logout			
Set	AT+UMQTTC=0	OK	AT+UMQTTC=0 OK
URC		+UUMQTTC: 0,<logout_result>	+UUMQTTC: 0,1
MQTT login			
Set	AT+UMQTTC=1	OK	AT+UMQTTC=1 OK
URC		+UUMQTTC: 1,<MQTT_result>	+UUMQTTC: 1,1
MQTT publish to a topic			
Set	AT+UMQTTC=2,<QoS>,<retain>,[<hex_mode>],<topic_name>,<pub_msg>	OK	AT+UMQTTC=2,0,0,0,"sensor/heat/SD/bldg5/DelMarConfRm","23 degrees Celsius" OK AT+UMQTTC=2,0,0,1,"sensor/heat/SD/bldg5/DelMarConfRm","32332064656772656573204365 6C73697573" OK
URC		+UUMQTTC: 2,<MQTT_result>	+UUMQTTC: 2,1
MQTT publish a file to a topic			
Set	AT+UMQTTC=3,<QoS>,<retain>,<topic_name>,<filename>	OK	AT+UMQTTC=3,0,0,"home/u-blox","msg.txt" OK
URC		+UUMQTTC: 3,<MQTT_result>	+UUMQTTC: 3,1
MQTT subscribe to the specified topic filter			
Set	AT+UMQTTC=4,<max_QoS>,<topic_filter>	OK	AT+UMQTTC=4,0,"sensor/heat/#" OK
URC		**In case of success** +UUMQTTC: 4,1,<QoS>,<topic_name> **In case of failure** +UUMQTTC: 4,0	+UUMQTTC: 4,1,0,"sensor/heat/#"
MQTT unsubscribe from the specified topic filter			
Set	AT+UMQTTC=5,<topic_filter>	OK	AT+UMQTTC=5,"sensor/heat/#" OK
URC		+UUMQTTC: 5,<MQTT_result>	+UUMQTTC: 5,1
MQTT read message			
Set	AT+UMQTTC=6[,<one_message>]	+UMQTTC: 6,<QoS>,<topic_msg_length>,<topic_length>,<topic_name>,<read_msg_length>,<read_msg> OK	AT+UMQTTC=6,1 +UMQTTC: 6,0,31,13,"sensor/heat/#",18,"23 degrees Celsius" OK
URC		+UUMQTTC: 6,<num_unread_msgs>,<memory_full>	+UUMQTTC: 6,3,0

Type	Syntax	Response	Example
		If an error occurs while receiving a publish message +UUMQTTC: 6,0	
Ping MQTT broker			
Set	AT+UMQTTC=8,<ping_ON_OFF>	OK	AT+UMQTTC=8,1 OK
Publish a binary message to a topic			
Set	AT+UMQTTC=9,<QoS>,<retain>,<topic_name>,<pub_msg_length> After the ">" prompt <pub_msg_length> bytes of data are entered	><pub_bin_message> OK	AT+UMQTTC=9,1,0,"u-blox/test",33 >AABB--> execute this \nand "this" OK
URC		+UUMQTTC: 9,<MQTT_result>	+UUMQTTC: 9,1
Test	AT+UMQTTC=?	+UMQTT: (list of supported <op_codes>s) OK	+UMQTTC: (0-9) OK

24.4.3 Defined values

Parameter	Type	Description
<op_code>	Number	MQTT command request. • 0: logs out/disconnects from MQTT server. The 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 • 9: publish a message in binary mode. It is used for publishing any binary data Allowed values: • SARA-N3 - 0, 1, 2, 3, 4, 5, 6, 8
<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 • 6-255: reserved for future use
<logout_result>	Number	Result of an MQTT command request: • 0: fail; for more details, see the +UMQTTER AT command • 1: success Result of an unsolicited notification for an MQTT session interruption caused by: • 100: timeout, the MQTT broker released the connection. • 101: lost network connection. • 102: protocol violation in receiving an MQTT message.
<QoS>	Number	Quality of service: • 0 (default value): at most once delivery • 1: at least once delivery • 2: exactly once delivery

Parameter	Type	Description
<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 <pub_msg>/<message> • 1: hexadecimal input for <pub_msg>/<message>
<pub_msg>	String	ASCII or hexadecimal data. • SARA-N3 - The maximum parameter length is 256 characters if <hex_mode>=0 or 128 octets if <hex_mode>=1.
<message>	String	ASCII or hexadecimal data. The maximum length is 256 characters. 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.
<filename>	String	Filename containing the message to be published. • SARA-N3 - The maximum parameter length is 256 characters and the maximum file content is 5120 characters.
<max_QoS>	Number	Maximum QoS level at which the MQTT broker can send messages to the MT. For more details, see MQTT version 3.1.1 - OASIS standard [201]. • 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. • SARA-N3 - The maximum length is 256 characters.
<topic_name>	String	Indicates the topic to which the given MQTT message was published. • SARA-N3 - The maximum length is 256 characters.
<reason>	Number	Result of an MQTT subscribe request: • 0-2: success • 128: failure Allowed values: • SARA-N3 - 0, 128
<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> for <op_code>=6 (MQTT read message)
<read_msg_length>	Number	Specifies the number of octets in <read_msg>
<read_msg>	String	Message received from MQTT server. • SARA-N3 - The maximum length is 2048 octets.
<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>.
<memory_full>	Number	Indicates the message memory status. Allowed values: • 0: message memory is available • 1: message memory is full

Parameter	Type	Description
<pub_msg_length>	Number	Specifies the number of octets in <pub_bin_message>, the maximum length is 1024 octets.
<pub_bin_message>	String	Data bytes to be published.

24.4.4 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.

24.5 MQTT error +UMQTTER

+UMQTTER						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error MQTT Error

24.5.1 Description

Retrieves the error class and code of the last MQTT operation that provided an error.

24.5.2 Syntax

Type	Syntax	Response	Example
Action	AT+UMQTTER	+UMQTTER: <error_code1>,<error_code2> OK	AT+UMQTTER +UMQTTER: 1,1 OK

24.5.3 Defined values

Parameter	Type	Description
<error_code1>	Number	• SARA-N3 - Value of error class. Values are listed in Internet suite error classes.
<error_code2>	Number	• SARA-N3 - Value of class-specific error code. The values are listed in MQTT class error codes.

25 MQTT-SN

25.1 Introduction

☞ MQTT-SN AT commands are implemented according to MQTT-SN protocol specification version 1.2. For a more detailed overview of the MQTT-SN protocol, see MQTT-SN version 1.2 - standard [202].

The Message Queuing Telemetry Transport for Sensor Network (MQTT-SN) is a lightweight messaging protocol, which is an optimized version of the MQTT IoT communications protocol. MQTT-SN is optimized for low-bandwidth, high-link failures, and low-cost communication environments. It is specifically designed for low overhead mobile devices with constrained resources of storage and management. u-blox cellular modules can be configured to operate as an MQTT-SN client.

To publish or subscribe, the MQTT-SN client must first establish a UDP connection to a MQTT-SN gateway and register itself.

The MQTT-SN 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-SN 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-SN specification states that topic filters starting with either wildcard will not match any topic name that starts with "$".

The MQTT-SN protocol also specifies a Quality of Service (QoS) level to be applied to message transactions:

- **-1**: send and forget (value valid only for publish messages)
- **0** (default setting): at most once delivery
- **1**: at least once delivery
- **2**: exactly once delivery

The MQTT-SN protocol also allows an MQTT-SN client to create a will message, which the MQTT-SN remote server will store and only publish (to the topic name specified as the will topic name) when the MQTT-SN client gets disconnected from the MQTT-SN server, but not if the MQTT-SN client explicitly sends a disconnect command.

A PSD connection must be activated before using MQTT-SN AT commands.

☞ SARA-N3
See +UPSD and +UPSDA AT commands for establishing a PSD connection.

25.2 MQTT-SN profile configuration +UMQTTSN

+UMQTTSN						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	+UMQTTSNNV	No	-	+CME Error

25.2.1 Description

Configures or reads the parameter value of an MQTT-SN client profile. Issue a set command for each <op_code> parameter to set all of the parameters in an MQTT-SN client profile.

25.2.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UMQTTSN=<op_code>,<param1>[,<param2>]	OK	AT+UMQTTSN=12,1 OK
MQTT-SN unique client ID			
Set	AT+UMQTTSN=0,<client_id>	OK	AT+UMQTTSN=0,"352753090041680" OK
MQTT-SN server name			
Set	AT+UMQTTSN=1,<server_name>[,<server_port>]	OK	AT+UMQTTSN=1,"www.testMQTTSNbroker.com" OK
MQTT-SN server IP address			
Set	AT+UMQTTSN=2,<IP_address>[,<server_port>]	OK	AT+UMQTTSN=2,"192.168.1.0",1883 OK
MQTT-SN gateway radius			
Set	AT+UMQTTSN=3,<radius>	OK	AT+UMQTTSN=3,1 OK
Last will QoS			
Set	AT+UMQTTSN=4,<will_QoS>	OK	AT+UMQTTSN=4,1 OK
Last will retain			
Set	AT+UMQTTSN=5,<will_retain>	OK	AT+UMQTTSN=5,1 OK
Last will topic			
Set	AT+UMQTTSN=6,<will_topic>	OK	AT+UMQTTSN=6,"u-blox/publish" OK
Last will message			
Set	AT+UMQTTSN=7,<will_message>	OK	AT+UMQTTSN=7,"Unrequested disconnect." OK
MQTT-SN connection duration			
Set	AT+UMQTTSN=8,<duration>	OK	AT+UMQTTSN=8,20 OK
MQTT-SN secure option			
Set	AT+UMQTTSN=9,<secure>[,<USECMNG_profile>]	OK	AT+UMQTTSN=9,1 OK
MQTT-SN clean session			
Set	AT+UMQTTSN=10,<clean_session>	OK	AT+UMQTTSN=10,1 OK
Read	AT+UMQTTSN?	+UMQTTSN: 0,<client_id> +UMQTTSN: 1,<server_name>,<server_port> +UMQTTSN: 2,IP_address>,<server_port> +UMQTTSN: 3,<radius> +UMQTTSN: 4,<will_QoS> +UMQTTSN: 5,<will_retain> +UMQTTSN: 6,<will_topic> +UMQTTSN: 7,<will_message> +UMQTTSN: 8,<duration>	+UMQTTSN: 0,"352753090041680" +UMQTTSN: 1,"www.commercialmqttbroker.com",1884 +UMQTTSN: 2,"192.168.1.0",1884 +UMQTTSN: 3,1 +UMQTTSN: 4,1 +UMQTTSN: 5,1 +UMQTTSN: 6,"u-blox/publish" +UMQTTSN: 7,"unrequested disconnect"

Type	Syntax	Response	Example
		+UMQTTSN: 9,<secure>[,<USECMNG_profile>] +UMQTTSN: 10,<clean_session> OK	+UMQTTSN: 8,20 +UMQTTSN: 9,1,1 +UMQTTSN: 10,1 OK
Test	AT+UMQTTSN=?	+UMQTTSN: (list of supported <op_code>s) OK	+UMQTTSN: (0-2,4-9) OK

25.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	MQTT-SN parameter: • 0: MQTT-SN unique client id • 1: MQTT-SN server name • 2: MQTT-SN IP address • 3: MQTT-SN radius • 4: MQTT-SN last will QoS • 5: MQTT-SN last will retain • 6: MQTT-SN last will topic • 7: MQTT-SN last will message • 8: MQTT-SN connection duration • 9: MQTT-SN secure • 10: MQTT-SN clean session
<client_id>	String	Client identifier for the MQTT-SN session. The maximum length is 256 characters and the default value is the IMEI of the MT. ☞ SARA-N3 On SARA-N310-00X-00 the maximum length is 23 characters.
<server_name>	String	Remote server name. The maximum length is 128 characters. The default value is an empty string.
<server_port>	Number	MQTT-SN server port. The range goes from 1 to 65535. The default value is 1884.
<IP_address>	String	Remote server IP address. The default value is an empty string. For IP address format reference, see the IP addressing.
<radius>	Number	The broadcast radius of this message.
<will_QoS>	Number	MQTT-SN 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-SN gateway • 1: the last will message will be retained by the MQTT-SN gateway
<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 in ASCII format. The maximum length is 256 characters. The default value is an empty string.
<duration>	Number	Indicates the duration of the keep alive timer, expressed in seconds. According to the MQTT-SN version 1.2 - standard [202], an MQTT-SN server must disconnect a client if it receives nothing from the client within 1.5x the keep alive duration. The allowed values are: • SARA-N3 -0, 30-65535 (corresponding to 18 hours, 12 minutes and 15 seconds). The default value is 0, which indicates no timeout. ☞ SARA-N3 On SARA-N310-00X-00 the allowed values are 0-65535. The default value is 30. The special value 0 indicates no timeout.
<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 disconnections by both the MQTT-SN client and the MQTT-SN server • 1 (default value): indicates that disconnections clean all session state information

Parameter	Type	Description
<secure>	Number	Enables / disables the secure option of the MQTT-SN service: • 0: (default value): no DTLS encryption • 1: enable the MQTT-SN DTLS encryption
<USECMNG_profile>	Number	USECMNG profile. Defines the USECMNG profile which specifies the SSL/TLS/DTLS properties to be used for the SSL/TLS/DTLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see +USECMNG AT command description). The parameter is omitted in the information text response to the read command if <secure>=0.
<param1>	Number / String	Type and supported content depend on the related <op_code> parameter (details are given above). <param1> is compulsory parameter in set command.
<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.

25.2.4 Notes

- <op_code>=1 (server name) and <op_code>=2 (IP address) are equivalent, when the broker connection is established the server name is transformed into the IP address.

25.3 Save/Restore MQTT-SN profile from NVM +UMQTTSNNV

+UMQTTSNNV						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

25.3.1 Description

Either saves all of the MQTT-SN client profile parameters to NVM (non-volatile memory) or sets all of the MQTT-SN 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 +UMQTTSN AT command.

25.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMQTTSNNV=<NVM_mode>	OK	AT+UMQTTSNNV=2 OK
Test	AT+UMQTTSNNV=?	+UMQTTSNNV: (list of <NVM_mode>s) OK	+UMQTTSNNV: (0-2) OK

25.3.3 Defined values

Parameter	Type	Description
<NVM_mode>	Number	Operation to set or save the MQTT-SN client profile parameters as follows: • 0: restore MQTT-SN client profile parameters to the factory-programmed setting • 1: set MQTT-SN client profile parameters to values previously stored in the NVM • 2: store current MQTT-SN client profile parameters to the NVM

25.4 MQTT-SN command +UMQTTSNC

+UMQTTSNC						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

25.4.1 Description

Triggers the MQTT-SN actions corresponding to the <op_code> parameter. The final result code indicates if sending the command request to the MQTT-SN process was successful or not.

The +UUMQTTSNC URC provides the result of the requested action from the MQTT-SN gateway. In addition, the +UUMQTTSNC URC also provides the notification that unread messages are available from the MQTT-SN gateway. The +UUMQTTSNC URC is by default enabled.

☞ SARA-N3
The <login_result> parameter is not returned in the +UUMQTTSNC URC, when the MQTT-SN gateway is not reachable.

25.4.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UMQTTSNC=<op_code>[,<param1>[,<param2>[,[<param3>],[<param4>,<param5>,<param6>]]]]	[+UMQTTSNC: <op_code>,<param1>[,<param2>,<param3>,<param4>,<param5>,<param6>]] OK	AT+UMQTTSNC=9 +UMQTTSNC: 9,1,"sensor/heat/SD/bldg5/DelMarConfRm",0,0,17 OK
URC		+UUMQTTSNC: <op_code>[,<param1>[,<param2>[,<param3>[,<param4>[,<param5>]]]]]	+UUMQTTSNC: 5,0,2,7,"sensor/heat/SD"
MQTT-SN disconnection			
Set	AT+UMQTTSNC=0[,<duration>]	OK	AT+UMQTTSNC=0 OK
URC		+UUMQTTSNC: 0,<MQTTSN_result>	+UUMQTTSNC: 0,1
MQTT-SN connection			
Set	AT+UMQTTSNC=1	OK	AT+UMQTTSNC=1 OK
URC		+UUMQTTSNC: 1,<MQTTSN_result>[,<login_result>]	+UUMQTTSNC: 1,1,0
MQTT-SN registration			
Set	AT+UMQTTSNC=2,<topic_name>	OK	AT+UMQTTSNC=2,"sensor/heat/SD" OK
URC		+UUMQTTSNC: 2,<MQTTSN_result>[,<topic_id>]	+UUMQTTSNC: 2,1
MQTT-SN search gateway			
Set	AT+UMQTTSNC=3	OK	AT+UMQTTSNC=3 OK
URC		+UUMQTTSNC: 3,<MQTTSN_result>[,<gateway_id>]	+UUMQTTSNC: 3,1
MQTT-SN publish			
Set	AT+UMQTTSNC=4,<QoS>,<retain>,[<hex_mode>],<topic_type>,<topic>,<message>	OK	AT+UMQTTSNC=4,0,0,,0,"sensor/heat/SD/bldg5/DelMarConfRm","23 degrees Celsius" OK
URC		**Only if <QoS>=1 or 2**	+UUMQTTSNC: 4,1,0

Type	Syntax	Response	Example
		+UUMQTTSNC: 4,<MQTTSN_result>[,<publish_result>]	
MQTT-SN subscription			
Set	AT+UMQTTSNC=5,<max_QoS>,<topic_type>,<topic>	OK	AT+UMQTTSNC=5,0,0,"sensor/heat/SD" OK
URC		+UUMQTTSNC: 5,<MQTTSN_result>[,<sub_result>,<g_QoS>[,<topic_id_sub>]]	+UUMQTTSNC: 5,1,0,2,7
MQTT-SN unsubscribe			
Set	AT+UMQTTSNC=6,<topic_type>,<topic>	OK	AT+UMQTTSNC=6,0,"sensor/heat/SD" OK
URC		+UUMQTTSNC: 6,<MQTTSN_result>	+UUMQTTSNC: 6,1
MQTT-SN will topic update			
Set	AT+UMQTTSNC=7,<will_QoS>,<will_retain>,<will_topic>	OK	AT+UMQTTSNC=7,1,0,"sensor/heat/SD/room" OK
URC		+UUMQTTSNC: 7,<MQTTSN_result>	+UUMQTTSNC: 7,1
MQTT-SN will message update			
Set	AT+UMQTTSNC=8,<will_message>	OK	AT+UMQTTSNC=8,"25 degree Celsius" OK
URC		+UUMQTTSNC: 8,<MQTTSN_result>	+UUMQTTSNC: 8,1
MQTT-SN read last received message			
Set	AT+UMQTTSNC=9	+UMQTTSNC: 9,<num_unread_msgs>[,<topic_id>,<QoS>,<retain>,<msg_length>,<rcv_message>] OK	AT+UMQTTSNC=9 +UMQTTSNC: 9,0,"sensor/heat/SD/bldg5/DelMarConfRm",0,0,17,"25 Degree Celcius" OK
URC		+UUMQTTSNC: 9,<num_unread_msgs>,<topic_name>,<QoS>,<retain>,<msg_length>	+UUMQTTSNC: 9,1,"sensor/heat/SD/bldg5/DelMarConfRm",0,0,17
MQTT-SN ping			
Set	AT+UMQTTSNC=10	OK	AT+UMQTTSNC=10 OK
URC		+UUMQTTSNC: 10,<MQTTSN_result>	+UUMQTTSNC: 10,1
Test	AT+UMQTTSNC=?	+UMQTTSN: (list of supported <op_codes>s) OK	+UMQTTSNC: (0-10) OK

25.4.3 Defined values

Parameter	Type	Description
<op_code>	Number	MQTT-SN command request. Allowed values: • 0: logs out/disconnects from the MQTT-SN server. The will message will not be sent • 1: logs in/connects to the MQTT-SN server • 2: register message to request a topic ID against a normal topic name from the gateway • 3: search gateway message; broadcasted by a client when it searches for a gateway • 4: publish a message to a specific topic to the gateway • 5: subscribe to a topic

Parameter	Type	Description
		• 6: unsubscribe to a topic.This should exactly match the topic filter used during the Subscribe • 7: update the will topic name stored in the gateway/server • 8: update the will message stored in the gateway/server • 9: read all unread messages received from the gateway • 10: ping the MQTT-SN gateway • 11: publish a message from a file to a specific topic to the gateway
<duration>	Number	Indicates the value of the sleep timer in seconds; the default value is 0.
<MQTTSN_result>	Number	Result of a MQTT-SN command request: • 0: fail; for more details, see the +UMQTTSNER AT command • 1: success
<login_result>	Number	Result of a MQTT-SN login request. Allowed values: • 0: connection accepted • 1: rejected due to a congestion • 2: rejected due to an invalid topic ID • 3: rejected because not supported • 4-255: reserved for future use
<logout_result>	Number	Result of an MQTT-SN command request: • 0: fail; for more details, see the +UMQTTSNER AT command • 1: success Result of an unsolicited notification for an MQTT-SN session interruption caused by: • 100: timeout, the MQTT-SN gateway released the connection. • 101: lost network connection.
<topic_name>	String	Indicates the topic name to request a topic ID value from the gateway.
<topic_id>	Number	Indicates the topic ID value to be used in the publish messages.
<gateway_id>	Number	Indicates the gateway ID.
<QoS>	Number	Quality of service: • 0: at most once delivery • 1: at least once delivery • 2: exactly once delivery • 3: special publish QoS of 3. It is also known as QoS-1 (see MQTT-SN introduction)
<retain>	Number	Whether or not the message will be retained across disconnections. Allowed values: • 0: 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: hexadecimal input for <message>
<topic_type>	Number	Indicates the type of the topic contained in the topic field: • 0: normal • 1: predefined • 2: short
<topic>	String	Contains the topic ID value or the short/normal topic name for which the data is published.
<message>	String	ASCII or hexadecimal data. The maximum length is: • SARA-N3 - 256 characters if <hex_mode>=0 or 512 octets if <hex_mode>=1.
<publish_result>	Number	Result of a MQTT-SN publish request. Allowed values: • 0: accepted • 1: rejected due to an invalid topic ID • 2: rejected due to congestion
<max_QoS>	Number	Maximum requested QoS level for this topic: • 0: at most once delivery • 1: at least once delivery • 2: exactly once delivery
<sub_result>	Number	Result of a MQTT-SN subscription request. Allowed values: • 0: accepted • 1: rejected due to an invalid topic ID • 2: rejected due to congestion

Parameter	Type	Description
<g_QoS>	Number	Indicates the granted QoS level.
<topic_id_sub>	Number	Indicates the topic ID when sending publish messages from the gateway to the client. Not relevant in case of subscriptions to a short topic name or a topic name which contains wildcard characters.
<will_QoS>	Number	Indicates the last will QoS level. Allowed values: • 0: 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 disconnections: • 0: the last will message will not be retained by the MQTT-SN gateway • 1: the last will message will be retained by the MQTT-SN gateway
<will_topic>	String	Indicates the will topic name. Setting it as an empty string will delete <will_topic> and <will_message> stored in the gateway/server.
<will_message>	String	Will message.
<num_unread_msgs>	Number	Indicates the number of unread received messages.
<msg_length>	Number	Specifies the number of octets in <message>.
<rcv_message>	String	ASCII 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.
<topic_length>	Number	Topic length
<topic_msg_length>	Number	Sum of topic and message length
<one_message>	Number	Allowed values: • 0: read all received messages • 1: read only one message
<ping_ON_OFF>	Number	Allowed values: • 0 (default value): ping disabled • 1: ping enabled; the MT will ping the MQTT-SN gateway. The ping is issued when the MQTT-SN keep alive period expires. See AT+UMQTT=8,<duration>
<paramx>	Number / String	Type and supported content depend on the related <op_code> parameter (details are given above).
<filename>	String	File name containing the payload of the message to be published. The maximum parameter length is 250 characters and the maximum file content is 1017 characters.

25.4.4 Notes

SARA-N3

- The <op_code>=11 (publish a file to a topic) is not supported.

25.5 MQTT-SN error +UMQTTSNER

+UMQTTSNER						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error MQTT-SN error

25.5.1 Description

Retrieves the error class and code of the last MQTT-SN operation that provided an error.

25.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMQTTSNER	+UMQTTSNER: <error_class>, <error_code> OK	AT+UMQTTSNER +UMQTTSNER: 14,1 OK

25.5.3 Defined values

Parameter	Type	Description
<error_class>	Number	Value of error class. Values are listed in Internet suite error classes.
<error_code>	Number	Value of class-specific error code. The values are listed in MQTT-SN class error codes.

26 Lightweight M2M

26.1 LwM2M Objects management

26.1.1 Introduction

26.1.1.1 SARA-N3 object management

LwM2M is based on client-server communication model. For u-blox cellular modules, a client instance is added supporting all the four interfaces defined between LwM2M client and LwM2M server:

- Bootstrap
- Client registration
- Device management and service enablement
- Information reporting

For more details on LwM2M client and LwM2M server interfaces and operations, see Lightweight Machine to Machine Technical Specification [200].

Supported LwM2M objects for u-blox LwM2M client are classified into two types:

- **Internal objects** and their associated resources are instantiated internally in the LwM2M client on boot up. LwM2M server operations on these objects are handled internally by the LwM2M client and the user is not notified via URC. See Table 26 for the internal objects supported by LwM2M client.
- **External objects** are added by the user to the LwM2M client. All associated resources are to be hosted by external host. u-blox only maintains a list of these objects in the LwM2M client and that list is not persistent across module reboot. LwM2M server operations on these objects are handled by means of +ULWM2MDM and +ULWM2MIR AT commands.

Object ID	Object name	Resource ID description
0	Security	• Hidden: manufacturer specific
1	Server	• 0: short server ID • 1: lifetime • 7: binding mode • 8: registration update trigger
2	Access control	• 0: object ID • 1: object instance ID • 3: ACL • 4: access control owner
3	Device	• 0: manufacturer • 1: model number • 2: serial number • 3: firmware version • 4: reboot • 13: current time • 17: device type • 18: hardware version • 19: software version
4	Connectivity monitoring	• 0: network bearer • 1: available network bearer • 2: radio signal strength • 3: link quality • 4: IP addresses • 7: APN • 8: cell ID • 9: SMNC • 10: SMCC

Table 26: LwM2M internal object list

When these commands report a LwM2M error, the error code can be queried using the +ULWM2MER AT command.

26.1.2 LwM2M client profile configuration +ULWM2MCC

+ULWM2MCC						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

26.1.2.1 Description

Configures and manages the LwM2M client profile. The LwM2M client supports one profile that is stored in the NVM by means of <op_code>=8.

☞ To make the new profile setting effective, delete the previous client and create the new LwM2M client by means of the +ULWM2MSC AT command.

26.1.2.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+ULWM2MCC=<op_code>[,<param1>[,<param2>[,<param3>]]]	OK	AT+ULWM2MCC=0,1 OK
Client endpoint name			
Set	AT+ULWM2MCC=0,<client_ep>	OK	AT+ULWM2MCC=0,0 OK
Local UDP port			
Set	AT+ULWM2MCC=1,<udp_listen>	OK	AT+ULWM2MCC=1,5683 OK
Server address			
Set	AT+ULWM2MCC=2,<hostname>[,<remote_port>]	OK	AT+ULWM2MCC=2,"leshan.com",5683 OK
Client active time			
Set	AT+ULWM2MCC=3,<client_life_time>	OK	AT+ULWM2MCC=3,1000 OK
Bootstrap mode			
Set	AT+ULWM2MCC=4,<bs_mode>	OK	AT+ULWM2MCC=4,1 OK
Client security generic syntax			
Set	AT+ULWM2MCC=5,<en_sec>[,<psk_id>,<psk_key>]	OK	AT+ULWM2MCC=5,0 OK
Client security disabling			
Set	AT+ULWM2MCC=5,0	OK	AT+ULWM2MCC=5,0 OK
Client security with PSK			
Set	AT+ULWM2MCC=5,1,<psk_id>,<psk_key>	OK	AT+ULWM2MCC=5,1,"004402090064507","d83bd183512023c913951cb6de08a133" OK
Command timeout			
Set	AT+ULWM2MCC=6,<cmd_timeout>	OK	AT+ULWM2MCC=6,10 OK
Binding mode			
Set	AT+ULWM2MCC=7,<bd_mode>	OK	AT+ULWM2MCC=7,1 OK

Type	Syntax	Response	Example
Store client profile			
Set	AT+ULWM2MCC=8	OK	AT+ULWM2MCC=8 OK
Device type			
Set	AT+ULWM2MCC=9,<device_type>	OK	AT+ULWM2MCC=9,"NB-IoT" OK
Read	AT+ULWM2MCC?	+ULWM2MCC: 0,<client_ep> +ULWM2MCC: 1,<udp_listen> +ULWM2MCC: 2,<hostname>,<remote_port> +ULWM2MCC: 3,<client_life_time> +ULWM2MCC: 4,<bs_mode> +ULWM2MCC: 5,<en_sec>[,<psk_id>[,<psk_key>]] +ULWM2MCC: 6,<cmd_timeout> +ULWM2MCC: 7,<bd_mode> +ULWM2MCC: 9,<device_type> OK	+ULWM2MCC: 0,"352753090041680" +ULWM2MCC: 1,5683 +ULWM2MCC: 2,"leshan.com",5683 +ULWM2MCC: 3,1000 +ULWM2MCC: 4,1 +ULWM2MCC: 5,1,"352753090041680","3031323334" +ULWM2MCC: 6,10 +ULWM2MCC: 7,1 +ULWM2MCC: 9,"NB-IoT" OK
Test	AT+ULWM2MCC=?	+ULWM2MCC: (list of supported <op_code>s) OK	+ULWM2MCC: (0-9) OK

26.1.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	Indicates the type of parameter(s) to be loaded into the client profile. Allowed values: • 0: select the endpoint client name format as described in OMA specifications [198] • 1: set the local UDP listen port • 2: set the LwM2M bootstrap server or LwM2M server address • 3: set the client active time • 4: set the bootstrap mode • 5: set the LwM2M client security mode • 6: set the command timeout value • 7: set the binding mode • 8: store the client profile setting into the NVM • 9: set the device type
<client_ep>	Number	Configures which type endpoint name format is to be selected for the client communication with server. For more details, see the Lightweight Machine to Machine technical specification [200]. Allowed values: • 0 (factory-programmed value): IMEI of the UE • 1: UUID of the UE • 2: IMEI-IMSI of the UE
<udp_listen>	Number	UDP listen port for downlink operations. The range goes from 1 to 65535. The factory-programmed value is 5683.
<hostname>	String	Hostname of the LwM2M bootstrap server (when <bs_mode>=1) or LwM2M server (when <bs_mode>=0). The maximum length is 128 characters. The factory-programmed value is the empty string.
<remote_port>	Number	Remote port of the LwM2M bootstrap server (when <bs_mode>=1) or LwM2M server (when <bs_mode>=0). The range goes from 1 to 65535. The default and factory-programmed value is 5683.
<client_life_time>	Number	Indicates the expected lifetime of the registration. The LwM2M client initiates the update operation internally within this timeout and notifies via +UULWM2MOPR: 9 URC (see the +ULWM2MOBJ AT command). The range goes from 20 s to 86400 s, the factory-programmed value is 0 s and it means no client timeout.

Parameter	Type	Description
<bd_mode>	Number	Indicates current binding and queue mode of the LwM2M client. For more details, see the Lightweight Machine to Machine technical specification [200] subclause 5.3.1.1. Allowed values: • 0: (U mode) UDP mode without queue • 1 (factory-programmed value): (UQ mode) UDP mode with queue
<bs_mode>	Number	Select the bootstrap mode of the client: • 0 (factory-programmed value): bootstrap disabled • 1: client initiated bootstrap mode
<en_sec>	Number	Enables or disables the DTLS. Allowed values: • 0 (factory-programmed value): DTLS disabled • 1: DTLS enabled with PSK
<psk_id>	String	PSK ID in character string format. The maximum length is 32. The factory-programmed value is the empty string.
<psk_key>	String	PSK key in hexadecimal format. The maximum length of the string is 64. The factory-programmed value is the empty string.
<cmd_timeout>	Number	Indicates in seconds the expected time of response from the LwM2M server. The +UULWM2MOPR: 18 URC (see the +ULWM2MOBJ AT command) is returned after timeout. The range goes from 5 to 60, the factory-programmed value is 5.
<device_type>	String	Type of the device. The maximum length of the string is 64 characters. The factory-programmed value is the "NB-IoT".
<param1>	Number	Content depends on the related <op_code> (see above)
<param2>	Number	Content depends on the related <op_code> or <en_sec> (see above)
<param3>	Number	Content depends on the related <en_sec> (see above)

26.1.3 Object management +ULWM2MOBJ

+ULWM2MOBJ						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

26.1.3.1 Description

Adds or removes LwM2M external object(s). The set command can be issued to update the internal database even the LwM2M client is in registered or deregistered state.

When the LwM2M client is in deregistered state, the internal database is shared with LwM2M server at the time of registration. In registered state, the registration update operation is immediately performed with the LwM2M server.

The final result of update operation will be returned by means of the +UULWM2MOPR URC, only when the LwM2M client is in registered state.

☞ All the external objects are removed when the LwM2M client is deleted via +ULWM2MSC AT command.

26.1.3.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+ULWM2MOBJ=<op_code>[,<param1>]	OK	AT+ULWM2MOBJ=1,"3303:3.0:0:1/3304:2.0:10:11" OK
Remove LwM2M object(s)			
Set	AT+ULWM2MOBJ=0[,<obj_id_list>]	OK	AT+ULWM2MOBJ=0,"3303/3304" OK
Add LwM2M object(s)			
Set	AT+ULWM2MOBJ=1,<obj_inst_str>	OK	AT+ULWM2MOBJ=1,"3303:3.0:0:1/3304:2.0:10:11" OK
Read	AT+ULWM2MOBJ?	+ULWM2MOBJ: <obj_inst_str>	+ULWM2MOBJ: "3303:0:1/3304:2.0:10:11"

Type	Syntax	Response	Example
			OK
Test	AT+ULWM2MOBJ=?	+ULWM2MOBJ: (list of supported <op_code>s) OK	+ULWM2MOBJ: (0-1) OK
URC		+UULWM2MOPR: <op_result>[, <ssid>]	+UULWM2MOPR: 11

26.1.3.3 Defined values

Parameter	Type	Description
<op_code>	Number	Allowed values: • 0: remove the LwM2M object • 1: add the LwM2M object/object instance
<obj_inst_str>	String	The list of LwM2M objects/object instances to be added. This string has to be constructed in the following format: "<obj_id>:[<obj_ver>]:<inst_id1>:<inst_idn>/<obj_idn>:[<obj_vern>]:<inst_id1>:<inst_idn>" where: • <obj_id>: object ID • <obj_ver>: object version • <inst_id>: instance ID For multiple object addition: each object, object version and instance ID string is to be separated by "/". The maximum number of supported LwM2M objects is 10 and each object can have maximum of 10 instances. The maximum length is 1024 characters. ☞ The <obj_ver> is internally set to "1.0" for all the objects.
<obj_id_list>	String	The list of objects to be removed. This string has to be constructed in the following format: "<obj_id1>/<obj_idn>" where: • <obj_id> is the object ID For multiple object removal: each object ID must be separated by "/". All the instances of the corresponding object (indicated in <obj_id>) will be removed. The maximum length is 1024 characters.. ☞ If <obj_id_list> parameter is omitted, the command will remove all the LwM2M objects.
<op_result>	Number	Operation result code: • 0: idle • 1: bootstrap started • 2: bootstrap successful • 3: bootstrap failed • 4: connect message send pass • 5: connect message send fail • 6: registration successful • 7: registration failed • 8: registration timeout • 9: client life time timeout • 10: client halted • 11: update successful • 12: update failed • 13: update timeout • 14: response failed • 15: notify failed • 16: deregistration successful • 17: deregistration failed • 18: command timeout
<ssid>	Number	Short server ID of the LwM2M server. Only returned in +UULWM2MOPR URC, in case of successful operation.
<param1>	Number	Content depends on the related <op_code> (see above)

26.1.4 LwM2M client operations +ULWM2MSC

+ULWM2MSC						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

26.1.4.1 Description

Triggers the LwM2M client operations corresponding to the <op_code> parameter. Following LwM2M client operations are supported:

- Create: it allocates and initializes all the resources for the LwM2M client, specified in LwM2M client profile configuration +ULWM2MCC AT command.
- Register: it initiates a register operation with LwM2M server / LwM2M bootstrap server.
- Deregister: it initiates a deregister operation with LwM2M server.
- Delete: it removes all the resources allocated for the LwM2M client.

LwM2M client operations are dependent on the current status of the LwM2M client, where the read command returns the LwM2M client's current status.

The final result of register and deregister operations will be returned by means of the +UULWM2MOPR URCs (see the +ULWM2MOBJ AT command).

The registration mode can be set to bootstrap enabled or bootstrap disabled by means of +ULWM2MCC AT command:

- **Bootstrap disabled:** LwM2M client skips the bootstrap mode and directly registers to the LwM2M server using LwM2M client profile.
- **Bootstrap enabled:** LwM2M client registers to the LwM2M bootstrap server, so the LwM2M bootstrap server can add LwM2M server objects and ACL (Access Control List) objects to the LwM2M client. On successful bootstrap operation, the LwM2M client automatically registers with each LwM2M server added during bootstrap mode. If no LwM2M server was added during bootstrap mode, the LwM2M client will stop after bootstrap mode is finished. If LwM2M bootstrap server is secured then LwM2M server must be secured also and vice versa.

☞ In bootstrap mode, maximum of five and at least one instance of the LwM2M server object can be added.

☞ When bootstrap is disabled, only one instance of the LwM2M server object will be initialized in create operation.

26.1.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MSC=<sc_code>	OK	AT+ULWM2MSC=1 OK
Read	AT+ULWM2MSC?	+ULWM2MSC: <client_status>	+ULWM2MSC: 1 OK
Test	AT+ULWM2MSC=?	+ULWM2MSC: (list of supported <sc_code>s) OK	+ULWM2MSC: (0-3) OK

26.1.4.3 Defined values

Parameter	Type	Description
<sc_code>	Number	Allowed values: • 0: create LwM2M client, allowed only when LwM2M client is in deleted state • 1: register LwM2M client, allowed only when LwM2M client is in created state • 2: deregister LwM2M client, allowed only when LwM2M client is in registered state • 3: delete LwM2M client, allowed only when LwM2M client is in deregistered state If sequence of operations is not followed (e.g. creating a LwM2M client when it is not in deleted state), an error result code is returned.
<client_status>	Number	LwM2M client status: • 0: created • 1: deleted

Parameter	Type	Description
		• 2: deregistered • 3: registered

26.1.5 LwM2M client "update" operation +ULWM2MUC

+ULWM2MUC						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

26.1.5.1 Description

Triggers the "update" operation on the "client-registration" interface. For more details, see Lightweight Machine to Machine technical specification [200].

If set command is provided only with <ssid>, a complete "update" operation is performed. The complete "update" process includes the update of following resources and objects:

- Lifetime: the lifetime value set and stored in LwM2M client profile by means of +ULWM2MCC AT command
- Binding mode: the binding mode value set and stored in LwM2M client profile by means of +ULWM2MCC AT command
- External objects and object instances created using +ULWM2MOBJ AT command
- Internal objects and object instances described in LwM2M internal object list

The final result of the set command will be returned to the user by means of the +UULWM2MOPR URC (see the +ULWM2MOBJ AT command).

26.1.5.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+ULWM2MUC=<ssid>[,<op_code>,<param_val>]	OK	AT+ULWM2MUC=1 OK
Send complete update message			
Set	AT+ULWM2MUC=<ssid>	OK	AT+ULWM2MUC=1 OK
Update lifetime resource			
Set	AT+ULWM2MUC=<ssid>,0,<client_life_time>	OK	AT+ULWM2MUC=1,0,30 OK
Update binding mode resource			
Set	AT+ULWM2MUC=<ssid>,1,<bd_mode>	OK	AT+ULWM2MUC=1,1,1 OK
Test	AT+ULWM2MUC=?	+ULWM2MUC: (list of supported <op_code>s) OK	+ULWM2MUC: (0-1) OK

26.1.5.3 Defined values

Parameter	Type	Description
<ssid>	Number	Short server ID of the LwM2M server.
<op_code>	Number	Defines the update to be performed: • 0: update lifetime resource. • 1: update binding mode resource.
<client_life_time>	Number	Indicates the expected lifetime of the registration. The LwM2M client initiates the update operation internally within this timeout and notifies via +UULWM2MOPR: 9 URC (see the +ULWM2MOBJ. The range goes from 20 s to 86400 s, the factory-programmed value is 0 s and it means no client timeout.
<bd_mode>	Number	Indicates current binding and Queue mode of the LwM2M Client. For more details, see the Lightweight Machine to Machine technical specification [200] subclause 5.3.1.1. Allowed values: • 0: (U mode) UDP mode without queue

Parameter	Type	Description
		• 1 (default value): (UQ mode) UDP mode with queue
<param_val>	Number	Content depends on the related <op_code> (see above)

26.1.6 LwM2M device management operations +ULWM2MDM

+ULWM2MDM						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

26.1.6.1 Description

Handles the device management and service enablement interface operations on external objects. For more details, see the Lightweight Machine to Machine technical specification [200].

All the operations are initiated by LwM2M server and will be reported by the +UULWM2MDM URC. The set command can be issued in response to the operation requested by LwM2M server. Response to the create and delete requests is sent internally to the LwM2M server.

☞ Response to the requested operation should be provided in time that is half of the retransmission time of CoAP packet set in LwM2M server.

☞ For internal objects, response to the requested operation is handled internally by the LwM2M client.

26.1.6.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+ULWM2MDM=<op_code>,<resp_code>[,<param1>,<param2>]	OK	AT+ULWM2MDM=0,132 OK
URC		+UULWM2MDM:<op_code>,<param3>,<param4>[,<param5>[,<param6>,<param7>[,<param8>]]]	+UULWM2MDM: 0,1,"/3/0/0",11542
Read operation			
Set	AT+ULWM2MDM=0,<resp_code>[,<resp_format>,<content>]	OK	AT+ULWM2MDM=0,69,40, "3C2F333E0B706D696E3D3130 2C3C0F332F303E2C203C0 F332F302F313E2C203C2F332F30 2F323E2C003C2F332F30 2F333E2C203C2F332F30 2F343E2C203C2F332F30 2F363E2C3C2F332F30 2F373E2C3C2F332F30 2F383E2C3C2F332F30 2F31313E2C3C2F332F302F31363E" OK
URC		+UULWM2MDM: 0,<ssid>,<res_path>,<resp_format>	+UULWM2MDM: 0,1,"/3/0/0",11542
Discover operation			
Set	AT+ULWM2MDM=1,<resp_code>[,<resp_format>,<content>]	OK	AT+ULWM2MDM=1,69,40, "3C2F333E0B706D696E3D3130 2C3C0F332F303E2C203C0 F332F302F313E2C203C2F332F30 2F323E2C003C2F332F30 2F333E2C203C2F332F30 2F343E2C203C2F332F30 2F363E2C3C2F332F30 2F373E2C3C2F332F30 2F383E2C3C2F332F30 2F31313E2C3C2F332F302F31363E" OK
URC		+UULWM2MDM: 1,<ssid>,<res_path>,<resp_format>	+UULWM2MDM: 1,"/3",40

Type	Syntax	Response	Example
Write operation			
Set	AT+ULWM2MDM=2,<resp_code>	OK	AT+ULWM2MDM=2,68 OK
URC		+UULWM2MDM: 2,<ssid>,<res_path>,<resp_format>,<length>,<content>,<write_type>	+UULWM2MDM: 2,1,"3306/1/5750",11542,12,"E31676373030",0
Write-attribute operation			
Set	AT+ULWM2MDM=3,<resp_code>	OK	AT+ULWM2MDM=3,68 OK
URC		+UULWM2MDM: 3,<ssid>,<res_path>,<resp_format>,<length>,<content>	+UULWM2MDM: 3,1,"3306",40,11,"gt=45&st=10"
Execute operation			
Set	AT+ULWM2MDM=4,<resp_code>	OK	AT+ULWM2MDM=4,68 OK
URC		+UULWM2MDM: 4,<ssid>,<res_path>,<resp_format>,<length>,<content>	+UULWM2MDM: 4,1,"3305/1/5605",11542,0,""
Create operation			
URC		+UULWM2MDM: 5,<ssid>,<res_path>,<resp_format>,<length>,<content>	+UULWM2MDM: 5,1,"/3306/2",11542,50,"080216E116DA00E116DB00E116DC00E116DD30E31676323530"
Delete operation			
URC		+UULWM2MDM: 6,<ssid>,<res_path>	+UULWM2MDM: 6,1,"3305/1"
Test	AT+ULWM2MDM=?	+ULWM2MDM: (list of supported <op_code>s) OK	+ULWM2MDM: (0-6) OK

26.1.6.3 Defined values

Parameter	Type	Description
<op_code>	Number	Operation codes of the device management and service enablement interface operations being performed: • 0: read • 1: discover • 2: write • 3: write-attribute • 4: execute • 5: create • 6: delete
<resp_format>	Number	Content format requested by LwM2M server: • 0: plain text • 40: core link param • 42: opaque • 11542: TLV • 11543: JSON
<res_path>	String	Resource path targeted for the current operation. Allowed format: • /{Object ID}/{Object Instance ID}/{Resource ID} • /{Object ID}/{Object Instance ID} • /{Object ID} For more details, see Lightweight Machine to Machine Technical Specification [200].
<resp_code>	Number	Response code is sent to server in response to the operation initiated by the server and indicated by the +UULWM2MDM URC. Allowed values: • 65: 2.01 created • 66: 2.02 deleted • 68: 2.04 changed

Parameter	Type	Description
		• 69: 2.05 content • 128: 4.00 bad request • 129: 4.01 unauthorized • 130: 4.02 bad option • 131: 4.03 forbidden • 132: 4.04 not found • 133: 4.05 method not allowed • 134: 4.06 not acceptable • 140: 4.12 precondition failed • 141: 4.13 request entity too large • 143: 4.15 unsupported content format
<length>	Number	Length of <content> parameter to be received from LwM2M server.
<content>	String	Hexadecimal string content to be sent or received. The content must be compiled in the format of specified <resp_format> and then convert it into hexadecimal string before sending and vice versa in case of content in URC. The maximum size in uplink is 1024 bytes.
<write_type>	String	Type of write operation performed by LwM2M server: • 0: replace • 1: update
<param1>,<param2>	String	Content depends on the related <op_code> for set command syntax (see above)
<param3>,..., <param8>	String	Content depends on the related <op_code> for URC syntax (see above)

26.1.7 LwM2M information reporting +ULWM2MIR

+ULWM2MIR						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

26.1.7.1 Description

Handles the information reporting interface, which includes "Observe", "Notify" and "Cancel observation" operations. The +UULWM2MIR URC will be received when the LwM2M server initiates the "Observe" operation on an external object, object instance or resource. Set command is used to "Notify" the response to the "Observe" operation.

Regular updates can be sent via notify operation according to the attributes requested by server under "Write-attribute" operation (see +ULWM2MDM AT command). LwM2M server does not expect immediate response on "Observe" operation upon object or object instance level.

☞ Response to the "Observe" operation on single resource should be provided in time that is half of the retransmission time of CoAP packet set in LwM2M server.

☞ "Observe" operation is not supported for internal objects.

26.1.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MIR=<ssid>,<token_id>,<resp_code>[,<resp_format>,<content>]	OK	AT+ULWM2MIR=1,"19285F5942508E72",69,11543,"7B22026E223A222F333330332F302F222C2065223A5B7B226E223A2235363031220C2276223A397D2C7B226E223A2023063032222C2276223A38307D2C7B220E223A2235363033222C2276223A300D2C7B226E223A2235363034222C2206223A3130307D2C7B226E223A2235073030222C2276223A34397D2C7B220

Type	Syntax	Response	Example
			E223A22353730 31222C227376223A20 43656C227D5D7D" OK
Observe operation			
URC		+UULWM2MIR: <mode>,<ssid>,<res_path>,<token_id>,<resp_format>	+UULWM2MIR: 0,1,"3303/0", "59599862CF4B407B",11543
Cancel observation indication			
URC		+UULWM2MIR: <mode>,<ssid>,<res_path>	+UULWM2MIR: 1,1,"3303/0"

26.1.7.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 0: observe operation • 1: cancel observe operation
<ssid>	Number	Short server ID of LwM2M server. If short server ID is not listed in current database, an error result code is returned.
<token_id>	Number	Token ID of the CoAP message sent from LwM2M server for "observe" operation. Whenever user/external host has to send "notify" packet against resource which has been subscribed by LwM2M server, same <token_id> will be used which was reported in "observe" operation URC.
<res_path>	String	Resource path targeted for the current operation. Allowed format: • /{Object ID}/{Object Instance ID}/{Resource ID} • /{Object ID}/{Object Instance ID} • /{Object ID} For more details, see Lightweight Machine to Machine Technical Specification [200].
<resp_format>	Number	Content format requested by LwM2M server. Allowed values: • 0: plain text • 40: core link param • 42: opaque • 11542: TLV • 11543: JSON
<resp_code>	Number	Response code is sent to server in response to the operation initiated by the LwM2M server and indicated by the +UULWM2MIR URC. Allowed values: • 65: 2.01 created • 66: 2.02 deleted • 68: 2.04 changed • 69: 2.05 content • 128: 4.00 bad request • 129: 4.01 unauthorized • 130: 4.02 bad option • 131: 4.03 forbidden • 132: 4.04 not found • 133: 4.05 method not allowed (used internally) • 134: 4.06 not acceptable • 140: 4.12 precondition failed • 141: 4.13 request entity too large • 143: 4.15 unsupported content format
<content>	String	Hexadecimal string content to be sent. The content must be compiled in the format of specified <resp_format> and then convert it into hex string before sending the response. The maximum size is 1024 bytes.

26.1.8 LwM2M error codes +ULWM2MER

+ULWM2MER						
Modules	SARA-N3					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error LWM2M Error

26.1.8.1 Description

Retrieves the error codes of last LwM2M operation that resulted in error.

26.1.8.2 Syntax

Type	Syntax	Response	Example
Action	AT+ULWM2MER	+ULWM2MER: <error_class>, <error_code> OK	+ULWM2MER: 16,1 OK

26.1.8.3 Defined values

Parameter	Type	Description
<error_class>	Number	Value of error class is available in listed in Appendix A.7.
<error_code>	Number	Value of class-specific error codes, the allowed values are listed in Appendix A.7.7.

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
6	PH-FSIM PIN required
7	PH-FSIM PUK 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	Not attached to network due to MT functionality restrictions
54	Modem not allowed - MT restricted to emergency calls only
55	Operation not allowed because of MT functionality restrictions
56	Fixed dial number only allowed - called number is not a fixed dial number
57	Temporarily out of service due to other MT usage
100	Unknown
103	Illegal MS
106	Illegal ME
107	GPRS services not allowed
108	GPRS and non GPRS services not allowed

Numeric error code	Description
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
125	Not authorized for this CSG
126	Insufficient resources
127	Missing or unknown APN
128	Unknown PDP address or PDP type
129	User authentication failed
130	Request rejected by Serving GW or PDN GW
131	Request rejected, unspecified
132	Service option not supported
133	Requested service option not subscribed
134	Service option temporarily out of order
135	NS-api already used
137	EPS QoS not accepted
138	Network failure
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
147	PTI mismatch
148	Unspecified GPRS error
149	PDP authentication failure
150	Invalid mobile class
153	ESM information not received
154	PDN connection does not exist
155	Multiple PDN connections for a given APN not allowed
156	User Busy
159	Uplink Busy/ Flow Control
160	Bearer handling not supported
165	Maximum number of EPS bearers reached
166	Requested APN not supported in current RAT and PLMN combination
168	Network failure
169	IMSI unknown in VLR
170	Congestion
171	Last PDN disconnection not allowed
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
177	Operator determined barring
178	Maximum number of PDP contexts reached
179	Requested APN not supported in current RAT and PLMN combination
180	Request rejected, bearer control mode violation
181	Invalid PTI value
189	Semantically incorrect message
190	Invalid mandatory IE
191	Message type non existent

Numeric error code	Description
192	Message type not compatible
193	IE non existent
194	Conditional IE error
195	Message not compatible
197	Protocol error unspecified
254	Invalid error mapping
255	Internal error
262	SIM blocked
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
512	Required parameter not configured
513	Module not registered
514	AT internal error
515	Active PDP context identifier
516	Incorrect state for the command
517	Invalid PDP context identifier
520	Deactivate the last active PDP context identifier
521	Undefined PDP context identifier
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
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)

Numeric error code	Description
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
1056	Collision with network initiated request
1057	Bearer capability not authorized
1058	Bearer capability not presently available
1059	Unsupported QCI value
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
1112	APN restriction value incompatible with active EPS bearer context
1127	Interworking, unspecified
1142	Network Error
1143	Invalid EPS bearer identity
1149	Last PDN disconnection not allowed
1243	Emm Error Unspecified
1244	Esm Error 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
1531	IPv6 only allowed

Numeric error code	Description
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
1614	TAC value not allowed
1615	OTP failure
1616	Wrong Check Digit
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

Numeric error code	Description
1648	FFS user provided a NULL parameter instead of a suitable buffer
1649	FFS timeout
1650	Command line too long
1660	Call barred - Fixed dialing numbers only
1670	SEC remote object wrong state
1671	SEC ROT not personalized
1672	SEC loss of connectivity
1673	SEC service not authorized
1674	SEC FW package installation required
1675	SEC FW package not valid
1676	SEC resource not available
1677	SEC data not available
1678	SEC timeout
1679	SEC data inconsistent or unsupported
1680	SEC pspk lock pending
1681	SEC C2C already paired
1682	SEC C2C channels consumed
1683	SEC C2C pairing not present
1684	SEC busy
1685	SEC connection failed due to a DNS resolution error
1686	SEC RoT has been restored and a resync operation is pending
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
1800	No ongoing call
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

Numeric error code	Description
2000	Command timeout
3000	Command aborted
4000	APN configuration mismatch
4001	IP type configuration mismatch
5000	FOTA package download state or name mismatch
5001	FOTA package data corrupted
5002	FOTA memory is in use

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
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

Numeric error code	Description
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
304	Invalid PDU mode parameter
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
322	memory full
330	SMSC address unknown
331	no network service
332	network timeout
340	no +CNMA acknowledgement expected
350	Unassigned (unallocated) number
351	Operator determined barring
352	Call barred
353	ME failure
354	Short message transfer rejected
355	Number changed
356	Destination out of order
357	Unidentified subscriber
358	Facility rejected
359	Unknown subscriber
364	Requested facility not subscribed
365	Requested facility not implemented
368	Invalid mandatory information
369	Message type non-existent or not implemented
370	Message not compatible with short message protocol state
371	Information element non-existent or not implemented
372	Protocol error, unspecified
373	Interworking, unspecified
360	Network out of order
361	Temporary failure
362	Congestion
363	Resources unavailable, unspecified
366	Invalid short message transfer reference value
367	Invalid message, unspecified
500	unknown error
512	Relay Protocol Acknowledgement

Numeric error code	Description
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
543	FDN check failed
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
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

Numeric error code	Description
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
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

Numeric error code	Description
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	Lower 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
681	User abort
682	Unable to store
683	Invalid status
684	Invalid address string
685	Invalid length
686	Invalid PDU string
687	Invalid parameter
688	Invalid string length
689	Invalid text string
690	Timer expired

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-N3 final result codes from command syntax

Syntax error resulting from the +UFWINSTALL command:

Numeric error code	Verbose description	Description
4	+CME ERROR: not supported	One of the following cases: • Wrong serial port number • Wrong baud rate • Number of parameters not allowed • Filename too long
1624	+CME ERROR: FFS file not found	The delta file is not stored in the module FS or the filename is wrong

A.3.1.1 SARA-N3 final result codes from end of update procedure

☞ SARA-N3
No error codes are generated.

A.4 FOAT error result codes

See +UFWUPD command description.

A.4.1 SARA-N3 error result codes

No error codes are generated.

A.5 Dynamic DNS unsolicited indication codes

The following table lists the available values of <error_code> parameter of the last Dynamic DNS update provided through +UUDYNDNS URC (for more details, see the +UDYNDNS AT command description).

Numeric error code	Description
0	Success
1	Data connection lost while performing update
2	Cannot update dynamic DNS because a private IP address has been assigned to the module
3	Connection to dynamic DNS server failed
4	Error occurred sending data to dynamic DNS server
5	Error occurred reading response from dynamic DNS server
6	Timeout while waiting response from dynamic DNS server
7	Dynamic DNS server closed connection unexpectedly
8	Unexpected response from dynamic DNS server
9	Dynamic DNS response seems to be incomplete
10	Update has been delayed in order to respect DNS update protocol timing specification
40	Dynamic DNS protocol specific: good (TZO code 200)
41	Dynamic DNS protocol specific: nochg (TZO code 304)
42	Dynamic DNS protocol specific: notfqdn
43	Dynamic DNS protocol specific: nohost
44	Dynamic DNS protocol specific: numhost
45	Dynamic DNS protocol specific: badauth (TZO code 401)
46	Dynamic DNS protocol specific: badagent (TZO code 405)
47	Dynamic DNS protocol specific: !donator
48	Dynamic DNS protocol specific: abuse
49	Dynamic DNS protocol specific: dnserr
50	Dynamic DNS protocol specific: 911
51	Dynamic DNS protocol specific: badsys
52	Dynamic DNS protocol specific: !yours
53	Dynamic DNS protocol specific: TZO code 403
54	Dynamic DNS protocol specific: TZO code 407
55	Dynamic DNS protocol specific: TZO code 414
56	Dynamic DNS protocol specific: TZO code 415
57	Dynamic DNS protocol specific: TZO code 480
100-108	Internal errors

☞ The meaning of dynamic DNS protocol specific codes depends on the provider used; see the provider documentation.

☞ Errors 45, 46, 53, 54 and 56 trigger a client self deactivation when the provider is TZO.com.

☞ Errors 42, 43, 44, 46, 48, 51 and 52 trigger a client self deactivation when the selected provider is DynDNS.org or DynDNS.it or No-IP.org or DynamicDNS.org.

A.6 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
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	+USOCO, +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

Numeric error code	Description	Resulting from the following commands
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
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.7 Internet suite error classes

The following table lists all allowed error classes that can be provided by the <error_class> parameter for these AT error commands:

- SARA-N3 - +UFTPER, +UHTTPER, +UMQTTER, +UMQTTSNER, +UCOAPER that provide the error of the last FTP, HTTP, MQTT, MQTT-SN, COAP operation.

<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.7.1	+UFTPC, +UFTP

<error_class>	Description	<error_codes>	Resulting from the following commands
3	HTTP Protocol error class	See the Appendix A.7.2	+UHTTP, +UHTTPC
4	Flash File System error class	See the Appendix A.7.3	+UFTPC, +UFTPER, +UHTTPC
5	DNS error class		+UFTPC, +UHTTPC, +USMTPC
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.7.1	+UFTPC, +UFTP
10	Wrong HTTP API usage (e.g. missing/null parameters)	See the Appendix A.7.2	+UHTTP, +UHTTPC
11	Syntax error in high layer Protocol (wrong/missing/ corrupted data)		+UFTPC, +UHTTPC, +USMTPC
12	Unspecified error	0	All
13	MQTT error class	See the Appendix A.7.4	+UMQTT, +UMQTTC, +UMQTTWTOPIC, +UMQTTWMSG
14	MQTT-SN error class	See the Appendix A.7.5	+UMQTTSN, +UMQTTSNC
15	CoAP error class	See the Appendix A.7.6	+UCOAP, +UCOAPC
16	LWM2M error class	See the Appendix A.7.7	+ULWM2MCC, +ULWM2MOBJ, +ULWM2MSC, +ULWM2MUC, +ULWM2MDM, +ULWM2MIR

A.7.1 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 +UFTP, +UFTPC AT 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	Filename 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

Numeric error code	Description
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
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

Numeric error code	Description
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
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 [164] and RFC 2428 [165].

A.7.2 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 +UHTTP and +UHTTPC AT 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 filename
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

Numeric error code	Description
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
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.7.3 File system class error codes

☞ SARA-N3
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

Numeric error code	Description
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.7.4 MQTT error codes

A.7.4.1 SARA-N3 MQTT class error codes

The following table lists the available values of <error_code> parameter of the last MQTT operation provided through the +UMQTTER AT command.

Numeric error code	Description
0	Operation performed with success
1	Memory failure
2	Invalid parameter
3	Invalid parameter range
4-8	Internal error
9	Invalid client identifier
10	Client identifier length out of range
11	Syntax error in client identifier
12	Invalid broker
13	Broker length out of range
14	Broker port out of range
15	Invalid username or password
16	Username length out of range
17	Password length out of range
18	Keep alive time out of range
19	Security mode out of range
20	Wrong Security Manager Profile
21	Security Manager Profile out of range
22	Invalid topic
23	Topic length out of range
24	Missing message or filename
25	Cannot get file size
26	File size out of range
27	Cannot open file
28	Cannot read file
29	QOS out of range
30	Retain out of range
31	Wrong will message length
32	Wrong publish message length
33	Timeout error
34	No Network service
35	Broker not connected
36	Broker connection refused
37	Broker connection refused, wrong protocol version
38	Broker connection refused, identifier rejected
39	Broker connection refused, server unavailable
40	Broker connection refused, bad user name or password
41	Broker connection refused, not authorized
42	MQTT client out of buffer
43	MQTT client malformed remaining length
44	MQTT client packet type mismatch
45	MQTT client packet Id mismatch

Numeric error code	Description
46	MQTT client invalid internal state
47	MQTT client TLS connect error
48	MQTT client STDIN Wake error
49	Incoming message cannot be saved
50	PSD or CSD connection not established
51	Error in callback
52	Malformed packet

A.7.5 SARA-N3 MQTT-SN class error codes

The following table lists the available values of <error_code> parameter of the last MQTT-SN operation provided through the +UMQTTSNER AT command.

A.7.5.1 SARA-N3 MQTT-SN error codes

Numeric error code	Description
0	Operation performed with success
1	Memory failure
2	Invalid parameter
3	Invalid parameter range
4	Invalid context
5	Invalid handler
8	Cannot set secure socket
9	Invalid client identifier
10	Client identifier length out of range
11	Syntax error in client identifier
12	Invalid Gateway
13	Gateway length out of range
14	Gateway port out of range
18	Keep alive time out of range
19	Security mode out of range
20	Wrong Security Manager Profile
21	Security Manager Profile out of range
22	Invalid topic
23	Topic length out of range
29	QOS out of range
30	Retain out of range
31	Will message out of range
32	Publish message out of range
33	Timeout error
34	No Network service
35	Gateway not connected
42	MQTT client out of buffer
46	MQTT client invalid internal state
49	Incoming message cannot be saved
50	Radius out of range
51	Module not registered
52	Invalid topic type

A.7.6 CoAP error codes

The following table lists the available values of <error_code> parameter of the last CoAP operation provided through +UCOAPER (for more details see, the +UCOAP and +UCOAPC AT commands description).

Numeric error code	Description
0	No error
1	Internal error
2	Invalid input

Numeric error code	Description
3	Invalid 2nd parameter
4	Invalid 3rd parameter
5	Parameter count incomplete
6	Parameter count exceeded
7	Op code invalid
8	Server URI missing
9	Server URI invalid
10	Server URI length exceeded
11	Option mask invalid
12	Option mask value invalid
13	Profile no invalid
14	Valid flag incorrect
15	Profile not found
16	CoAP operation invalid
17	Current profile invalid
18	CoAP URI host option missing
19	CoAP URI query missing
20	Payload missing
21	Payload invalid
22	Payload length exceeded
23	Content format invalid
24	Block count invalid
25	More block invalid
26	Payload length incomplete with more block
27	Module not registered
28	NW timeout
29	RAI flag invalid
30	RAI-1 is not allowed with CON message type
31	RAI-2 is not allowed with NON message type
32	CoAP URI path length exceeded
33	CoAP URI query length exceeded
34	CoAP URI host length exceeded

A.7.7 LWM2M error codes

The following table lists the available values of <error_code> parameter of the last LWM2M operation provided through +ULWM2MER(for more details, see the +ULWM2MCC, +ULWM2MOBJ, +ULWM2MSC, +ULWM2MUC, +ULWM2MDM and +ULWM2MIR AT commands description).

Numeric error code	Description
0	No error
1	Internal error
2	Invalid <op_code> parameter value
3	Invalid parameter count
4	Invalid client endpoint
5	Invalid UDP port
6	Invalid server address
7	Invalid server address length
8	Empty server address
9	Invalid remote port
10	Invalid client active time
11	Invalid bootstrap mode
12	Invalid security mode
13	Invalid PSK id
14	Invalid PSK id length
15	Invalid PSK key

Numeric error code	Description
16	Invalid PSK key length
17	Invalid command timeout
18	Invalid binding mode
19	Memory error
20	Invalid device type
21	Invalid device type length
22	Invalid string parameter
23	Invalid object id
24	Invalid string parameter length
25	Invalid instance id
26	Invalid instance count
27	Invalid client state
28	Invalid server SSID
29	Invalid response code
30	Invalid response format
31	Invalid content
32	Invalid content length
33	Invalid token id
34	Invalid token id length
35	Module not registered
36	Socket create failed
37	Socket bind failed
38	Client busy

A.8 Ping error result codes

The following table lists the available values of <error_code> parameter of the last ping operation provided through +UUPINGER URC (for more details, see the +UPING AT command description).

Numeric error code	Description
0	Success (no error)
1 - 6	Internal error (ping level)
7	Empty remote host
8	Cannot resolve host
9	Unsupported IP version (RFU)
10	Invalid IPv4 address
11	Invalid IPv6 address (RFU)
12	Remote host too long
13	Invalid payload size
14	Invalid TTL value
15	Invalid timeout value
16	Invalid retries number
17	PSD or CSD connection not established
100 - 105	Internal error (ICMP level)
106	Error creating socket for ICMP
107	Error settings socket options for ICMP
108	Cannot end ICMP packet
109	Read for ICMP packet failed
110	Received unexpected ICMP packet
111-115	Internal error (socket level)

A.9 Mobile termination error result codes

The command +CMOLRE (see subclause 9.1a of 3GPP TS 27.007 [60]) configures the <err> parameter in numeric or verbose format.

Numeric error code	Description
0	Method not supported
1	Additional assistance data required
2	Not enough satellites
3	UE busy[2]
4	Network error
5	Failed to open internet connection, too many connections[3]
6	Failed to open internet connection, too many users[3]
7	Failure due to handover
8	Internet connection failure[3]
9	Memory error
10	Timeout
255	Unknown error

[2] There is already one ongoing positioning session and the UE does not support multiple simultaneous sessions

[3] Only applicable to SUPL-based transactions. Currently SUPL is not supported

B Appendix: AT Commands List

	AT command	Datagram messages								
		+NCDP	+NMGR	+NMGS	+NMSTATUS	+NNMI	+NQMGR	+NQMGS	+NSMI	
SARA	N200-01B / N201-01B N210-01B / N280-01B	•	•	•	•	•	•	•	•	
	N200-02B / N201-02B N210-02B / N211-02X N280-02B	•	•	•	•	•	•	•	•	
	N310-00X									

	AT command	File System					
		+UDELFILE	+UDWNFILE	+ULSTFILE	+URDBLOCK	+URDFILE	
SARA	N200-01B / N201-01B						
	N210-01B / N280-01B						
	N200-02B / N201-02B						
	N210-02B / N211-02X						
	N280-02B						
	N310-00X	•	•	•	•	•	

	AT command	General commands														
		+CCID	+CGMI	+CGMM	+CGMR	+CGSN	+CIMI	+CLAC	+CSCS	+GMI	+GMM	+GMR	+GSN	+NVSETRELEASEVERSION	I	
SARA	N200-01B / N201-01B N210-01B / N280-01B	•	•	•	•	•	•	•							•	
	N200-02B / N201-02B N210-02B / N211-02X N280-02B	•	•	•	•	•	•	•							•	
	N310-00X	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

	AT command	GPIO interface			
		+UGPIOC	+UGPIOR	+UGPIOW	
SARA	N200-01B / N201-01B N210-01B / N280-01B	•			
	N200-02B / N201-02B N210-02B / N211-02X N280-02B	•			
	N310-00X	•	•	•	

	AT command	Internet suite										
		+NPING	+UDNSRN	+UDYNDNS	+UFTP	+UFTPC	+UFTPER	+UHTTP	+UHTTPC	+UHTTPER	+UPING	
SARA	N200-01B / N201-01B N210-01B / N280-01B	•										
	N200-02B / N201-02B N210-02B / N211-02X N280-02B	•										
	N310-00X		•	•	•	•	•	•	•	•	•	

AT command		Device and data security		
		+USECMNG	+USECPRF	
SARA	N200-01B / N201-01B N210-01B / N280-01B			
	N200-02B / N201-02B N210-02B / N211-02X N280-02B			
	N310-00X	•	•	

	AT command	Localization features				
		+CMOLR	+CMOLRE	+CMTLR	+CMTLRA	
SARA	N200-01B / N201-01B					
	N210-01B / N280-01B					
	N200-02B / N201-02B					
	N210-02B / N211-02X					
	N280-02B					
	N310-00X	•	•	•	•	

	AT command	Mobile equipment control and status															
		+CALA	+CALD	+CCLK	+CEER	+CFUN	+CIND	+CMEE	+CMER	+CPWROFF	+CSGT	+CTZR	+CTZU	+NCONFIG	+NRB	+NUESTATS	
SARA	N200-01B / N201-01B N210-01B / N280-01B			•	•	•		•				•	•	•	•	•	
	N200-02B / N201-02B N210-02B / N211-02X N280-02B			•	•	•		•				•	•	•	•	•	
	N310-00X	•	•	•		•	•	•	•	•	•	•	•		•	•	

	AT command	Network service																						
		+CCIOTOPT	+CEDRXRDP	+CEDRXS	+CESQ	+CFGCIOT	+COPS	+CPOL	+CRCES	+CREG	+CSCON	+CSQ	+NBAND	+NCSEARFCN	+NEARFCN	+NPOWERCLASS	+NPTWEDRXS	+NVSETRRCRLSTIMER10	+NVSETRSRPOFFSET	+UBANDSEL	+UDOPN	+UECLS	+UJAD	+UMNOCONF
SARA	N200-01B / N201-01B N210-01B / N280-01B		•	•			•				•	•	•		•	•	•							
	N200-02B / N201-02B N210-02B / N211-02X N280-02B		•	•			•				•	•	•	•	•	•	•							•
	N310-00X	•	•	•	•	•	•	•	•	•	•	•				•		•	•	•	•	•	•	

	AT command	Network service		
		+URPM	+URPMCONF	
SARA	N200-01B / N201-01B N210-01B / N280-01B			
	N200-02B / N201-02B N210-02B / N211-02X N280-02B			
	N310-00X	•	•	

	AT command	Packet switched data services																						
		+CEREG	+CFGDFTPDN	+CGACT	+CGAPNRC	+CGATT	+CGAUTH	+CGCMOD	+CGCONTRDP	+CGDATA	+CGDCONT	+CGDEL	+CGEREP	+CGPADDR	+CIPCA	+UAUTHREQ	+UDCONF=75	+UDCONF=76	+UGCNTRD	+UGCNTSET	+UPSD	+UPSDA	D*	
SARA	N200-01B / N201-01B N210-01B / N280-01B	•		•	•	•					•			•	•									
	N200-02B / N201-02B N210-02B / N211-02X N280-02B	•		•	•	•	•				•			•	•									
	N310-00X	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

	AT command	Device lock					
		+CLCK	+CPIN	+CPWD	+NPIN	+UPINCNT	
SARA	N200-01B / N201-01B						
	N210-01B / N280-01B						
	N200-02B / N201-02B						
	N210-02B / N211-02X				•		
	N280-02B						
	N310-00X	•	•	•		•	

	AT command	Serial interface																
		&F	&K	&V	&W	+ICF	+IPR	+NATSPEED	E	O	Q	S2	S3	S4	S5	V	Z	
SARA	N200-01B / N201-01B N210-01B / N280-01B							•										
	N200-02B / N201-02B N210-02B / N211-02X N280-02B							•										
	N310-00X	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	

	AT command	Short Messages Service																	
		+CMGC	+CMGD	+CMGF	+CMGL	+CMGR	+CMGS	+CMGW	+CMSS	+CNMA	+CNMI	+CPMS	+CRTDCP	+CSCA	+CSDH	+CSMP	+CSMS	+CSODCP	
SARA	N200-01B / N201-01B N210-01B / N280-01B	•					•			•			•	•			•	•	
	N200-02B / N201-02B N210-02B / N211-02X N280-02B	•					•			•			•	•			•	•	
	N310-00X		•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	

	AT command	SIM functionalities						
		+CCHC	+CCHO	+CGLA	+CRSM	+CRSML	+CSIM	
SARA	N200-01B / N201-01B							
	N210-01B / N280-01B							
	N200-02B / N201-02B							
	N210-02B / N211-02X							
	N280-02B							
	N310-00X	•	•	•	•	•	•	

	AT command	System features															
		+CSCLK	+NFWUPD	+NLOGLEVEL	+UADC	+UANTR	+UDCONF=0	+UFACTORY	+UFOTA	+UFOTACONF	+UFOTASTAT	+UFWINSTALL	+UFWUPD	+ULGASP	+URING	+UTEST	
SARA	N200-01B / N201-01B			•											•	•	
	N210-01B / N280-01B																
	N200-02B / N201-02B																
	N210-02B / N211-02X		•	•											•	•	
	N280-02B																
	N310-00X	•			•	•	•	•	•	•	•	•	•	•	•	•	

	AT command	Power management				
		+CPSMS	+NPSMR	+NVSETPM	+NVSETPM2IDLETIME	
SARA	N200-01B / N201-01B N210-01B / N280-01B	•	•			
	N200-02B / N201-02B N210-02B / N211-02X N280-02B	•	•			
	N310-00X	•	•	•	•	

	AT command	Internet protocol transport layer																						
		+NSOCL	+NSOCR	+NSONMI	+NSORF	+NSOST	+NSOSTF	+UDCONF=1	+UDCONF=2	+UDCONF=3	+UDCONF=5	+UDCONF=6	+UDCONF=7	+USOAO	+USOCL	+USOCO	+USOCR	+USOCTL	+USODL	+USOER	+USOGO	+USOLI	+USORD	+USORF
SARA	N200-01B / N201-01B N210-01B / N280-01B	•	•	•	•	•	•																	
	N200-02B / N201-02B N210-02B / N211-02X N280-02B	•	•	•	•	•	•																	
	N310-00X						•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

	AT command	Internet protocol transport layer				
		+USOSEC	+USOSO	+USOST	+USOWR	
SARA	N200-01B / N201-01B					
	N210-01B / N280-01B					
	N200-02B / N201-02B					
	N210-02B / N211-02X					
	N280-02B					
	N310-00X	•	•	•	•	

	AT command	MQTT								
		+UMQTT	+UMQTTC	+UMQTTER	+UMQTTNV	+UMQTTSN	+UMQTTSNC	+UMQTTSNER	+UMQTTSNNV	
SARA	N200-01B / N201-01B									
	N210-01B / N280-01B									
	N200-02B / N201-02B									
	N210-02B / N211-02X									
	N280-02B									
	N310-00X	•	•	•	•	•	•	•	•	

	AT command	CoAP								
		+UCOAP	+UCOAPC	+UCOAPER	+UCOAPFWT	+UCOAPS	+UFOTAPT	+UFOTAS	+USELCP	
SARA	N200-01B / N201-01B									
	N210-01B / N280-01B									
	N200-02B / N201-02B									
	N210-02B / N211-02X	•	•		•	•	•	•	•	
	N280-02B									
	N310-00X	•	•	•						

	AT command	Lightweight M2M							
		+ULWM2MCC	+ULWM2MDM	+ULWM2MER	+ULWM2MIR	+ULWM2MOBJ	+ULWM2MSC	+ULWM2MUC	
SARA	N200-01B / N201-01B								
	N210-01B / N280-01B								
	N200-02B / N201-02B								
	N210-02B / N211-02X								
	N280-02B								
	N310-00X	•	•	•	•	•	•	•	

B.1 Parameters stored in profiles

The parameter settings of some commands can be stored in the profiles available in the memory module.

☞ SARA-N3
To store, display, reset to default value the available profile, see the AT&W, AT&V, and ATZ commands description.

☞ SARA-N3
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.

☞ SARA-N2
The module does not store the AT commands setting in the profiles.

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
&K	Flow control status	No	• SARA-N3 - 0 (DTE flow control disabled)
+CMEE	Mobile termination error reporting	Yes	• SARA-N2 / SARA-N3 - The command settings is not stored in the personal profile
+CMGF	Preferred message format	Yes	0 (format of messages in PDU mode)
+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)
+COPS	Operator selection	Yes	• SARA-N2 / SARA-N3 - The command setting is not stored in the personal profile
+CPMS	Preferred message storage	No	• SARA-N3 - <mem1>, <mem2> and <mem3> are set to "SM", "SM" and "ME"
+CREG	Network registration status reporting	Yes	• SARA-N3 - The command settings is not stored in the personal profile
+CSCA	Service center address	No	• SARA-N3 - "" <sca>, 0 <tosca> • SARA-N2 - The command setting is stored in the NVM.
+CSMP	Select message service	No	• SARA-N3 - 17 <fo>, 167 <vp>, 0 <pid>, 0 <dcs>
+CSCLK	Low clock mode setting	No	2 (low clock mode automatically enabled)
+CSCS	Select character set configuration	No	• SARA-N3 - "PCCP936" (Chinese character set)
+CSMS	Select message service	No	• SARA-N3 - 0 <service> • SARA-N2 - The command setting is stored in the NVM.
+ICF	DTE-DCE character framing	No	• SARA-N3 - 3, 1 (framing format: 8 data 1 stop, no parity)
+IPR	Baud rate	No	• SARA-N3 - 0 (autobauding enabled)
E	Echo status	No	1 (echo enabled)

AT command	Description	AT interface configuration sharing	Factory-programmed value / Remarks
Q	Result code suppression	No	0 (DCE transmits result codes)
S2	Escape character selection	No	43 (043 corresponds the '+' character)
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)
V	DCE response format	No	1 (Verbose response text)

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
E	Echo status	• SARA-N3 - The command setting is stored in the personal profile.
+CALA	Alarm	No alarms are stored
+CCIOTOPT	CIoT optimization configuration	• SARA-N3 - 0 (+CCIOTOPTI URC reporting disabled), 3 (control plane CIoT EPS optimization and user plane CIoT EPS optimization supported), 1 (preference for control plane CIoT EPS optimization)
+CCLK	Clock	• SARA-N2 - "04/01/01,00:00:00+00" • SARA-N3 - "17/01/01,12:40:43+20"
+CEDRXS	eDRX setting	0 (use of eDRX disabled)
+CFGCIOT	CIOT parameter configuration	1 (NonIP enabled), 1 (CP CIoT enabled), 2 (UP CIoT supported, not optimized), 1 (ERwoPDN supported, not optimized), 1 (SmsWithoutCombinedAttach supported), 0 (APN Rate Control not supported), 1 (ePCO supported), 0 (CP back-off not supported), 1 (roam supported), 0 (NAS RAI not supported)
+CFGDFTPDN	Default PDP type configuration	1 (IP)
+CGDCONT	PDP context definition	• SARA-N3 - for <cid>=1: <PDP_type>="IP", "" (blank APN), "0.0.0.0" (PDP address), 0 (PDP data compression off), 0 (PDP header compression off), 0 (PDP context to be activated with the value for the low priority indicator configured in the MT)
+CIPCA	Initial PDP context activation	• SARA-N3 - 1 (always activate), 0 (EPS attach with PDN connection) • SARA-N2 - The setting is not persistent
+CPMS	Preferred message storage	• SARA-N3 - The command setting is stored in the personal profile
+CPSMS	Power Saving Mode setting	• SARA-N3 - <mode>=1 (PSM enabled), <Requested_Periodic_TAU>="01000101", <Requested_Active_Time>= "00000000"
+CSCA	Service center address setting	• SARA-N2 - "" (service center address undefined), "0" (service center address type undefined) • SARA-N3 - The command setting is stored in the personal profile
+CSCON	Connection status signalling	• SARA-N2 - The command setting is not stored in NVM • SARA-N3 - 0 (URC disabled)
+CSCS	Select character set configuration	• SARA-N3 - The command setting is stored in the personal profile
+CSGT	Set greeting text	Greeting text is empty

AT command	Description	Factory-programmed value / Comment
+CSMS	Message service configuration	• SARA-N2 - 0 (phase 2) • SARA-N3 - The command setting is stored in the personal profile
+CTZR	Time zone reporting	• SARA-N3 - 0 (disable the time zone change event reporting) • SARA-N2 - The command setting is not stored in NVM
+CTZU	Automatic time zone update	• SARA-N2 / SARA-N3 - 1 (automatic time zone via NITZ enabled)
+IPR	Baud rate	• SARA-N3 - The command setting is stored in the personal profile
+NATSPEED	Configure AT UART baud rate	9600 b/s (AT UART baud rate), 2 (sample earlier), 1 (1 stop bit)
+NCDP	Configure OceanConnect server settings	"" (IPv4 address empty), 5683 (port)
+NCONFIG	UE configuration	• SARA-N2 o "AUTOCONNECT","TRUE" o "CR_0354_0338_SCRAMBLING","TRUE" o "CR_0859_SI_AVOID","TRUE" o "COMBINE_ATTACH","FALSE" o "CELL_RESELECTION","FALSE" o "ENABLE_BIP","FALSE" o "NAS_SIM_POWER_SAVING_ENABLE","TRUE" o "RLF_UPDATE","FALSE" • SARA-N3 o "AUTOCONNECT","TRUE" o "CR_0354_0338_SCRAMBLING","TRUE"
+NPOWERCLASS	Power class configuration	3 (power class)
+NVSETPM	Power mode setting	0 (UE does not enter PM1 / PM2 / PM3)
+NVSETPM2IDLETIME	PM2 idle time configuration	19531 (PM2 idle time set to 19531 s)
+NVSETRELEASEVERSION	Switch release version	0 (release 13)
+NVSETRRCRLSTIMER10	Set RRC connection release waiting time	0 (RRC connection release waiting time set to 1 s)
+NVSETRSRPOFFSET	Set RSRP offset	50 (RSRP offset of 0)
+UAUTHREQ	Configure the authentication parameters of a PDP/ EPSbearer	• SARA-N3 - 0 (no authentication), "" (no username), "" (no password)
+UCOAP	CoAP profile configuration	Empty profile
+UCOAPS	CoAP server configuration	• CTCC:<COAP_URI> - "coap://zzhc.vnet.cn:5683/nb" • CUCC:<COAP_URI> - "coap://114.255.193.236:5683/"
+UDCONF=75	PDP IP configuration when roaming	• SARA-N3 - <cid>: 0 and <PDP_IP_conf>: 0
+UDCONF=76	Disable data when roaming	• SARA-N3 - <cid>: 0 and <Data_Flag>: 0
+UDYNDNS	Dynamic DNS	0 (Client disabled), 0 (TZO.com as dynamic DNS service provider), "" (Domain name empty), "" (Username empty), "" (Password empty)
+UECLS	Coverage enhancement levels setting	• SARA-N3 - 0 (no coverage enhancement in the serving cell)
+UFACTORY	Restore factory configuration	0 (no FS factory restore), 0 (no NVM factory restore)
+UFOTACONF	uFOTA configuration	1 (module registration to uFOTA server enabled), 604800 (7 days as timer for the periodic connection to the uFOTA server)
+UFOTAPT	FOTA poll timer configuration	0 (poll timer set to immediate)
+UFOTASTAT	FOTA reporting	• SARA-N3 - 1 (FOTA downloading state URC enabled)
+UGPIOC	GPIO functionality setting	• SARA-N2 - CTS: 255 • SARA-N3 - RI: 18, RTS: 20, CTS: 20, GPIO1: 255, GPIO2: 255, GPIO3: 255, GPIO4: 255, GPIO5: 7
+UJAD	Smart jamming detection	• SARA-N3 - 0 (smart jamming detection disabled)
+ULGASP	Last gasp configuration	• SARA-N3

AT command	Description	Factory-programmed value / Comment
		o <GPIO_mode>: 0 (disabled) o <text>: "" o <msg_format>: 0 (text) o <tel_number>: "" (empty) 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 <tx_count>: 1 (number of times to transmit the Last Gasp message) o <shutdown>: 0 (shutdown disabled)
+ULWM2MCC	LwM2M client profile configuration	0 (IMEI of the UE), 5683 (UDP listen port), "" (hostname), 5683 (remote port), 0 (no client timeout), 0 (bootstrap disabled), 0 (DTLS disabled), "" (psk id), "" (PSK key), 5 (command timeout in seconds), 1 (UDP mode with queue), "NB-IoT" (device type)
+ULWM2MUC	LwM2M client configuration	0 (no client timeout), 0 (bootstrap disabled)
+UMNOCONF	MNO configuration	• SARA-N2 / SARA-N3 - 0 (regulatory configuration)
+UPSD	Packet switched data	• SARA-N3 - The command setting is not stored in the NVM
+URING	RING line handling	0 (feature disabled (RING line is only asserted on incoming call and incoming SMS))
+URPM	RPM activation	• SARA-N3 - 0 (Radio Policy Manager deactivated)
+URPMCONF	Radio Policy Manager (RPM) configuration	<PLMN> empty, i.e. no PLMNs available
+USOAO	Socket Always On	• 0,0 (Feature disable) • 1,0 (PSD profile: 0) • 2,0 (Client Mode) • 3,"" (Empty) • 4,2000 (Default port: 2000) • 5,6 (TCP socket) • 20+i,"" (Empty)
+UTEST	End user test	Antenna dynamic tuner control: 0 (disabled)

B.3 Saving AT commands configuration

The following procedure can be used to store the AT commands configuration for the AT commands listed in Appendix B.1:

- SARA-N3 - Write the run-time configuration of the AT commands listed in Appendix B.1 to the RAM profile mirror by means of the AT&W command (e.g. AT&W0)

The following procedure can be used to store the AT commands configuration for the AT commands listed in Appendix B.2:

- SARA-N3 - The module suddenly stores the run-time configuration of the commands listed in Appendix B.2, no further action is required.
- SARA-N2 - The module must enter in any of the following mode:
  - o Enable the Power Saving Mode (PSM) by means of the +CPSMS AT command
  - o Reboot the module reboot by means of the +NRB AT command

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

Category	Estimated maximum time to get response	Commands
Data connection commands	Up to 3 min	+CGATT, +CGDATA, +UPSDA
Network commands	• SARA-N2 - Up to 3 min • SARA-N3 - Up to 20 min	+COPS
Operator name	Up to 1 s	+UDOPN
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, +CMGC, +CMGL, +CMSS, +CMGS
SIM management	< 10 s	+CMGW, +CMGR, +CPIN, +CPOL, +CRSM, +CSCA, +CSMP
PDP context activation	< 150 s	+CGACT
PDP context deactivation	< 40 s	+CGACT
Restore configuration	< 5 s	+UFACTORY
End user test (antenna dynamic tuner control)	Up to 1 s	+UTEST
GPIO commands	< 10 s	+UGPIOC, +UGPIOR, +UGPIOW
Internet suite (socket connect)	• SARA-N3 - < 120 s	+USOCO
Internet suite (socket connect with SSL)	• SARA-N3 - < 1 s	+USOSEC
Internet suite (socket write)	• SARA-N3 - < 120 s	+USOWR
Internet suite (UDP socket write)	• SARA-N3 - < 10 s	+USOST
Internet suite (socket closure)	• SARA-N3 - < 120 s	+USOCL
Internet suite	• SARA-N3 - < 1 s	+USODL, +USOLI, +USORD, +USORF
Resolve name/IP number through DNS	• SARA-N3 - < 120 s	+UDNSRN
Last gasp configuration	< 10 s	+ULGASP
MNO configuration	< 3 min	+UMNOCONF
MQTT command	• SARA-N3 - immediate	+UMQTTC
Firmware update	• SARA-N3 - < 20 s	+UFWUPD

C Appendix: glossary

Abbreviation	Definition
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
DM	Device Management
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
e-CDRX	Extended Connected Mode DRX
eDRX	Extended Discontinuous Reception
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}

Abbreviation	Definition
EPD	Escape Prompt Delay
EPS	Evolved Packet System
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
IMS	IP Multimedia Subsystem
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
LwM2M	Lightweight M2M
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
MSC	Modem Status Command
MSD	Minimum Set of Data (eCall related)
MSIN	Mobile Subscriber Identification Number

Abbreviation	Definition
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
RI	Ring Indicator
RNDIS	Remote Network Driver Interface Specification
RRC	Radio resource control
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

Abbreviation	Definition
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 documentation

1. TOBY-L4 series data sheet, UBX-16009856
2. TOBY-L4 series system integration manual, UBX-16024839
3. TOBY-L2 series data sheet, UBX-13004573
4. MPCI-L2 series data sheet, UBX-13004749
5. TOBY-L2 / MPCI-L2 series system integration manual, UBX-13004618
6. LARA-R2 series data sheet, UBX-16005783
7. LARA-R2 series system integration manual, UBX-16010573
8. TOBY-R2 series data sheet, UBX-16005785
9. TOBY-R2 series system integration manual, UBX-16010572
10. SARA-R5 series data sheet, UBX-19016638
11. SARA-R5 series system integration manual, UBX-19041356
12. SARA-R5 series application development guide, UBX-20009652
13. SARA-R5 series Internet applications development guide, UBX-20032566
14. SARA-R4 series data sheet, UBX-16024152
15. SARA-R4 series system integration manual, UBX-16029218
16. SARA-R4 series application development guide, UBX-18019856
17. SARA-R42 application development guide, UBX-20050829
18. SARA-U2 series data sheet, UBX-13005287
19. LISA-U2 series data sheet, UBX-13001734
20. LISA-U1 series data sheet, UBX-13002048
21. LISA-U1 / LISA-U2 series system integration manual, UBX-13001118
22. SARA-G450 data sheet, UBX-18006165
23. SARA-G450 system integration manual, UBX-18046432
24. SARA-G3 series data sheet, UBX-13000993
25. SARA-G3 / SARA-U2 series system integration manual, UBX-13000995
26. LEON-G1 series data sheet, UBX-13004887
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32. SARA-N3 series application development guide, UBX-19026709
33. TOBY-R2 / LARA-R2 "03B" audio application note, UBX-20036864
34. AT commands examples application note, UBX-13001820
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36. u-blox firmware update application note, UBX-13001845
37. GNSS implementation application note, UBX-13001849
38. End user test application note, UBX-13001922
39. Wi-Fi / cellular integration application note, UBX-14003264
40. LTE initial default bearer application note, UBX-20015573
41. eCall / ERA GLONASS Implementation in u-blox cellular modules, UBX-13001924
42. TOBY-L4 series extended audio application note, UBX-17065359
43. TOBY-L4 uCPU series Audio CSD API application note, UBX-18067601
44. TOBY-L4 series eCall implementation in u-blox cellular modules application note, UBX-18019819
45. TOBY-L2 series audio application note, UBX-15015834
46. TOBY-L2 series networking modes application note, UBX-14000479
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48. SARA-U2 audio application note, UBX-14002981
49. SARA-U2 series audio extended tuning application note, UBX-17012797
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51. SARA-G450 audio interface application note, UBX-20028599

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53. SARA-G3 audio application note, UBX-13001793
54. LEON-G1 audio application note, UBX-13001890
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56. SARA-R4 / SARA-R5 series positioning implementation application note, UBX-20012413
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58. LwM2M objects and commands application note, UBX-18068860
59. IoT Security-as-a-Service application note, UBX-20013561
60. 3GPP TS 27.007 - Technical Specification Group Core Network and Terminals; AT command set for User Equipment (UE)
61. 3GPP TS 22.004 - General on supplementary services
62. 3GPP TS 22.030 - Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Man-Machine Interface (MMI) of the User Equipment (UE)
63. 3GPP TS 22.090 - Unstructured Supplementary Service Data (USSD); Stage 1
64. 3GPP TS 23.038 - Alphabets and language-specific information
65. 3GPP TS 23.040 - Technical realization of Short Message Service (SMS)
66. 3GPP TS 23.041 - Technical realization of Cell Broadcast Service (CBS)
67. 3GPP TS 23.060 - Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description
68. 3GPP TS 24.007 - Mobile radio interface signalling layer 3; General aspects
69. 3GPP TS 24.008 - Mobile radio interface layer 3 specification
70. 3GPP TS 24.011 - Point-to-point (PP) Short Message Service (SMS) support on mobile radio interface
71. 3GPP TS 27.005 - Technical Specification Group Terminals; Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE-DCE) interface for Short Message Services (SMS) and Cell Broadcast Service (CBS)
72. 3GPP TS 27.060 - Technical Specification Group Core Network; Packet Domain; Mobile Station (MS) supporting Packet Switched Services
73. 3GPP TS 51.011 - Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface
74. 3GPP TS 31.102 - Characteristics of the Universal Subscriber Identity Module (USIM) application
75. 3GPP TS 05.08 - Radio subsystem link control
76. 3GPP TS 22.087 - User-to-User Signalling (UUS)
77. 3GPP TS 22.022 - Personalisation of Mobile Equipment (ME)
78. 3GPP TS 22.082 - Call Forwarding (CF) supplementary services
79. 3GPP TS 22.083 - Call Waiting (CW) and Call Holding (HOLD)
80. 3GPP TS 22.081 - Line identification Supplementary Services- Stage 1
81. 3GPP TS 23.081 - Line identification supplementary services- Stage 2
82. 3GPP TS 22.086 - Advice of Charge (AoC) Supplementary Services
83. 3GPP TS 22.024 - Description of Charge Advice Information (CAI)
84. 3GPP TS 22.085 - Closed User Group (CUG) Supplementary Services
85. 3GPP TS 22.096 - Name identification supplementary services
86. 3GPP TS 04.18 - Mobile radio interface layer 3 specification; Radio Resource Control (RRC) protocol
87. 3GPP TS 05.02 - Multiplexing and Multiple Access on the Radio Path
88. 3GPP TS 51.014 - Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface
89. 3GPP TS 27.010 V3.4.0 - Terminal Equipment to User Equipment (TE-UE) multiplexer protocol (Release 1999)
90. 3GPP TS 22.060 - General Packet Radio Service (GPRS); Service description; Stage 1
91. 3GPP TS 25.306 - UE Radio Access capabilities
92. 3GPP TS 22.002 - Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN)
93. 3GPP TS 22.067 - enhanced Multi Level Precedence and Pre-emption service (eMLPP); Stage 1
94. 3GPP TS 23.972 - Circuit switched multimedia telephony
95. 3GPP TS 24.615 Communication Waiting (CW) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol Specification

96. 3GPP TS 25.101 - User Equipment (UE) radio transmission and reception (FDD)
97. 3GPP TS 23.122 - NAS Functions related to Mobile Station (MS) in idle mode
98. 3GPP TS 45.005 - Radio transmission and reception
99. 3GPP TS 23.014 Support of Dual Tone Multi-Frequency (DTMF) signalling V11.0.0 (2012-09)
100. 3GPP TS 26.267 V12.0.0 (2012-12) eCall Data Transfer; In-band modem solution; General description (Release 12)
101. 3GPP TS 51.010-1 Mobile Station (MS) conformance specification; Part 1: Conformance specification
102. 3GPP TS 51.010-2 Mobile Station (MS) conformance specification; Part 2: Protocol Implementation Conformance Statement (PICS) proforma specification
103. 3GPP TS 34.121-2 User Equipment (UE) conformance specification; Radio transmission and reception (FDD); Part 2: Implementation Conformance Statement (ICS)
104. 3GPP TS 24.301 Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3
105. 3GPP TS 44.060 General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol
106. 3GPP TS 23.221 Architectural requirements
107. 3GPP TS 23.203 Policy and charging control architecture
108. 3GPP TS 31.101 UICC-terminal interface; Physical and logical characteristics
109. 3GPP TS 25.305 User Equipment (UE) positioning in Universal Terrestrial Radio Access Network (UTRAN); Stage 2
110. 3GPP TS 23.032: Universal Geographical Area Description (GAD)
111. 3GPP TS 25.331 Radio Resource Control (RRC); Protocol specification
112. 3GPP TS 36.101 Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception
113. 3GPP TS 24.173 IMS Multimedia telephony communication service and supplementary services; Stage 3
114. 3GPP TS 24.341 Support of SMS over IP networks; Stage 3
115. 3GPP TS 24.229 IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3
116. 3GPP TS 36.306 Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities
117. 3GPP TS 36.133 Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management
118. 3GPP TS 25.133 Requirements for support of radio resource management (FDD)
119. 3GPP TS 22.071 Location Services (LCS); Service description
120. 3GPP TS 36.331 Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 10)
121. 3GPP TS 24.167 3GPP IMS Management Object (MO); Stage 3
122. 3GPP TS 26.201 Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; Frame structure
123. 3GPP TS 24.216 Communication Continuity Management Object (MO)
124. 3GPP TS 36.521-2 - Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment conformance specification; Radio transmission and reception; Part 2: Implementation Conformance Statement (ICS)
125. 3GPP TS 36.523-2 - Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment conformance specification; Part 2: Implementation Conformance Statement (ICS)
126. 3GPP TS 23.003 Numbering, addressing and identification
127. 3GPP TS 31.111 Universal Subscriber Identity Module (USIM) Application Toolkit (USAT)
128. 3GPP TS 22.084 MultiParty (MPTY) supplementary service; Stage 1
129. 3GPP TS 24.607 Originating Identification Presentation (OIP) and Originating Identification Restriction (OIR) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification
130. 3GPP TS 24.608 Terminating Identification Presentation (TIP) and Terminating Identification Restriction (TIR) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification
131. 3GPP TS 36.213 Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures
132. 3GPP TS 36.212 Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding
133. 3GPP TS 24.166 - 3GPP IP Multimedia Subsystem (IMS) conferencing Management Object (MO)
134. 3GPP TS 29.061 - Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)

135. 3GPP TS 24.303 - Mobility management based on Dual-Stack Mobile IPv6; Stage 3

136. 3GPP TS 24.327 - Mobility between 3GPP Wireless Local Area Network (WLAN) interworking (I-WLAN) and 3GPP systems; General Packet Radio System (GPRS) and 3GPP I-WLAN aspects; Stage 3

137. 3GPP TS 25.367 - Mobility procedures for Home Node B (HNB); Overall description; Stage 2

138. 3GPP TS 25.304 - User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode

139. 3GPP TS 36.304 - Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode

140. 3GPP TS 45.008 - GSM/EDGE Radio Access Network; Radio subsystem link control

141. 3GPP TS 25.401 - Universal Mobile Telecommunications System (UMTS); UTRAN Overall Description

142. 3GPP TS 24.237 - Technical Specification Group Core Network and Terminals; IP Multimedia (IM) Core Network (CN) subsystem IP Multimedia Subsystem (IMS) Service Continuity; Stage 3

143. 3GPP TS 36.211 - Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation

144. 3GPP TS 23.682 - Architecture enhancements to facilitate communications with packet data networks and applications

145. 3GPP TS 23.401 - General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access

146. 3GPP TS 44.018 - Mobile radio interface layer 3 specification; GSM/EDGE Radio Resource Control (RRC) protocol

147. 3GPP TS 43.064 - General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2

148. 3GPP TS 36.321 - Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification

149. 3GPP TS 22.011 - Service accessibility

150. 3GPP2 C.S0015-0 - Short Message Service

151. ETSI TS 102 223 - Smart cards; Card Application Toolkit (CAT)

152. ETSI TS 102 221 V8.2.0 (2009-06) Smart Cards; UICC-Terminal interface; Physical and logical characteristics (Release 8)

153. ETSI TS 127 007 V10.3.0 (2011-04) AT command set for User Equipment (UE) (3GPP TS 27.007 version 10.3.0 Release 10)

154. ETSI TS 122 101 V8.7.0 (2008-01) Service aspects; Service principles (3GPP TS 22.101 version 8.7.0 Release 8)

155. GSM 02.04 - Digital cellular telecommunications system (Phase 2+); Mobile Stations (MS) features

156. GSM 03.60 - Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS) Service description; Stage 2

157. GSM 04.12 - Digital cellular telecommunications system (Phase 2+); Short Message Service Cell Broadcast (SMSCB) Support on Mobile Radio Interface.

158. 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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162. RFC 3267 - Real-Time Transport Protocol (RTP) Payload Format and File Storage Format for the Adaptive Multi-Rate (AMR) and Adaptive Multi-Rate Wideband (AMR-WB) Audio Codecs

163. RFC 792 Internet Control Message Protocol (http://tools.ietf.org/html/rfc0792)

164. RFC 959 File Transfer Protocol (http://tools.ietf.org/html/rfc959)

165. RFC 2428 FTP Extensions for IPv6 and NATs (https://tools.ietf.org/html/rfc2428)

166. RFC 4291 - IP Version 6 Addressing Architecture (http://tools.ietf.org/html/rfc4291)

167. RFC 793 - Transmission Control Protocol (TCP) Protocol Specification (https://www.rfc-editor.org/rfc/rfc793.txt)

168. RFC 3969 - The Internet Assigned Number Authority (IANA) Uniform Resource Identifier (URI) Parameter Registry for the Session Initiation Protocol (SIP)

169. RFC 3261 - SIP: Session Initiation Protocol

170. RFC 5341 - The Internet Assigned Number Authority (IANA) tel Uniform Resource Identifier (URI) Parameter Registry
171. RFC 3966 - The tel URI for Telephone Numbers
172. RFC 2141 - URN Syntax
173. RFC 3406 - Uniform Resource Names (URN) Namespace Definition Mechanisms
174. RFC 5031 - A Uniform Resource Name (URN) for Emergency and Other Well-Known Services
175. RFC 4715 - The Integrated Services Digital Network (ISDN) Subaddress Encoding Type for tel URI
176. RFC 5626 - Managing Client-Initiated Connections in the Session Initiation Protocol (SIP)
177. RFC 4867 - RTP Payload Format and File Storage Format for the Adaptive Multi-Rate (AMR) and Adaptive Multi-Rate Wideband (AMR-WB) Audio Codecs
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180. RFC 1519 - Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy (https://tools.ietf.org/html/rfc1519)
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202. MQTT-SN Protocol Specification Version 1.2
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Revision history

Revision	Date	Name	Comments
R01	22-Aug-2016	sfal	Initial release
R02	23-Dec-2016	lpah	New commands: +NRB, +NCDP, +NUESTATS, +CSCON, +NBAND, +NEARFCN, +NMGR, +NMGS, +NQMGR, +NQMGS, +NNMI, +NSMI, +NLOGLEVEL, +NSOCR, +NSOCL, +NSOST, +NSONMI, +NSORF, +NPING, +NCONFIG Modified commands: +CGSN, +CIMI, +CMEE, +CFUN, +COPS, +CGDCONT, +CEREG, +CGATT Review the command applicability for these commands: +CGMM, +CGMR, +CGMI, +CGSN, +CIMI, +CLAC, +CFUN, +CMEE, +CSQ, +COPS, +CGDCONT, +CGPADDR, +CEREG, +CGATT
R03	30-Jan-2017	lpah	New commands: +NCONFIG Modified commands: +CIMI, +CSCON, +NCDP, +NUESTATS, +NBAND, +COPS, +CGPADDR, +CEREG, +NSOCR, +NSONMI, +NPING, +NMGR, +NMGS, +NQMGR, +NSMI, +NSORF, +NQMGS
R04	24-Mar-2017	lpah	Document aligned to FW V100R100C10B655SP2 Modified commands: +NUESTATS, +NSOCR, +NSOST, +NPING
R05	24-Apr-2017	lpah	Document aligned to FW V100R100C10B656 New commands: +NSOSTF Modified commands: AT command settings, +CGSN, +CCLK, +NRB, +CSQ, +NEARFCN, <PDP_addr>, +CGPADDR, +CEREG, +NSOCR, CME error result codes
R06	06-Jun-2017	lpah	Extended the document applicability to SARA-N200-02B, SARA-N201-02B, SARA-N210-02B, SARA-N211-02B, SARA-N280-02B. New commands: +CPSMS. Modified commands: AT command settings, General operation, I, +CCLK, +NUESTATS, +CGDCONT, +URING, +UTEST, Internet protocol transport layer, +NSOCR, +NPING. Review the command applicability for these commands: I, +CCID, +CTZU, +UFWUPD, +URING, +UTEST.
R07	27-Jul-2017	lpah	New commands: +CEDRXS, +CEDRXRDP, +CMGC, +CRTDCP, +CSODCP, +NATSPEED, +NMSTATUS. Modified commands: +CGMR, +CFUN, +CTZR, +NUESTATS, +NCONFIG, +COPS, +NEARFCN, +CSMS, +CNMA, +CMGS, +CGDCONT, +CGATT, +CGACT, +CEREG, +CPSMS, +NLOGLEVEL, GPIO introduction, +UGPIOC, +NSOCR, Datagram introduction, +NNMI, +NCDP, Mobile termination error result codes +CME ERROR. Review the command applicability for these commands: I, +CCID, +CTZU, +CTZR, +CNMA, +CSCA, +CMGS, +CSMS, +CGACT, +UFWUPD, +URING, +UTEST, +CPSMS, +UGPIOC.
R08	12-Sep-2017	lpah	New commands: +NPOWERCLASS, +NPTWEDRXS, +CIPCA, +CGAPNRC, +NPSMR. Modified commands: +CGSN, +CIMI, +NCONFIG, +NUESTATS, +COPS, +NEARFCN, +NATSPEED, <cid>, <PDP_Type>, +CGACT, GPIO introduction, +NSOCR, +NSOST, +NSOSTF, +NSORF, +NPING, +NMGR, +NMGS, +NSMI, +NCDP.
R09	03-Oct-2017	lpah	Modified commands: AT command settings, +CMGS, +CMGC, +CGACT, +NSOCR, +NCDP, +NMSTATUS.
R10	26-Jan-2018	lpah	Extended the document applicability to SARA-N211-02X. New commands: +CEER, +NCONFIG, +UMNOCONF, +NPIN, +NFWUPD, +UCOAPS, +UCOAPFWT, +UFOTAPT, +UFOTAS, +USELCP, +UCOAP, +UCOAPC. Modified commands: AT command settings, +CCLK, +CMEE, +CSQ, +NBAND, +NEARFCN, +CEDRXS, +NPOWERCLASS, +CSMS, +CNMA, +CMGS, +CSCA, +CMGC, V24 control and V25ter introduction, <APN>, <PDP_addr>, +CGDCONT, +CGACT, +CGPADDR, +CIPCA, +CGAPNRC,

Revision	Date	Name	Comments
			Multiple PDP contexts, +UTEST, GPIO introduction, +UGPIOC, +NSOST, +NSOSTF, Mobile termination error result codes +CME ERROR, Saving AT commands configuration. Review the command applicability for these commands: +UBANDSEL
R11	17-Apr-2018	Ipah	Modified commands: Information text responses and result codes, Start up and initialization, +CGSN, +CFUN, +NCONFIG, +COPS, +CSCON, +CEDRXS, +CEDRXRDP, +NPTWEDRXS, +CSODCP, PDP contexts and parameter definition, +UTEST, +NPING, +NSMI, +NMSTATUS, +UCOAPC, Parameters stored in profiles.
R12	12-Jul-2018	Ipah	Extended the document applicability to SARA-N201-02B-01. New commands: +NCSEARFCN, +CGAUTH. Modified commands: AT command settings, Reset reasons, +NUESTATS, +UMNOCONF, +UTEST, +URING, +NMGS, +NQMGS, +NCDP, +NMSTATUS, CoAP Introduction, +UCOAPC, +USELCP.
R13	24-Aug-2018	Ipah	Extended the document applicability to SARA-N200-02B-01, SARA-N210-02B-01, SARA-N211-02X-01, SARA-N280-02B-01. Modified commands: +UTEST, +NPSMR, +NSOCR, +UCOAP.
R14	08-Mar-2018	Ipah	Extended the document applicability to SARA-N3 series. Modified commands: +CFUN, +NUESTATS, +NCONFIG, SMS introduction, +CMGC, +CIPCA, +UTEST, +CPSMS, +UCOAPS, +UCOAPC.
R15	31-Jul-2019	Ipah	Extended the document applicability to SARA-N200-02B-02, SARA-N210-02B-02, SARA-N211-02X-02. Modified commands: Summary table, Information text responses and result codes, +CSCS, +CALA, +CSGT, +CTZU, +NUESTATS, +COPS, +CREG, +CPOL, +CEDRXS, +CMGD, +IPR, Z, &F, &V, <PDP_Type>, +CGDCONT, +UPSD, +CGACT, +CEREG, +UAUTHREQ, +CIPCA, +UADC, +UTEST, +UTEMP, +ULGASP, +NVSETPM, +CSCLK, File System Introduction, +UFTP, +UFTPC, +UHTTP, +UHTTPC, +UPING, +UCOAP, +UCOAPC, +UMQTTSNC, Saving AT commands configuration. Updated estimated response time information for these commands: +COPS.
R16	27-Nov-2019	Ipah	New commands: +UECLS, D*, +CFGDFTPDN, +NQSOS, LwM2M objects management, +ULWM2MCC, +ULWM2MOBJ, +ULWM2MSC, +ULWM2MUC, +ULWM2MDM, +ULWM2MIR, +ULWM2MER, +MIPLSETRAI, +MIPLNMI, +MIPLCLEARSTATE, +MIPLAUTHCODE, +FTPOPEN, +FTPCLOSE, +FTPSIZE, +FTPGET, +FTPPUT, +FTPSTAT, +FTPLST, +FTPURC. Modified commands: Information text responses and result codes, +CESQ, +CREG, +CPOL, +UJAD, +CSCON, +NCSEARFCN, +CEDRXS, +CEDRXRDP, +CFGCIOT, +CPIN, <cid>, +CGDATA, +UGCNTSET, +UTEMP, +UFOTACONF, +NVSETPM, GPIO Introduction, +UGPIOC, +USOCR, +USOSEC, +USOCO, +USOST, +USORD, +USOLI, +USODL, +UDCONF=2, +UDCONF=3, +UDCONF=5, +UDCONF=6, +UDCONF=7, +USOCTL, +USOAO, +USECMNG, +UCOAP, +UMQTTC, +ULWM2MSTAT. Review the command applicability for these commands: +CGATT.
R17	29-Jun-2020	Ipah	New commands: +NVSETRELEASEVERSION, +UDOPN, +USELFREGS, +UPINCNT, +CCHO, +CCHC, +CGLA, +CRSML, +UFOTA, +UFOTASTAT, +CMOLR, +CMTLR, +CMTLRA, +CMOLRE, +MIPLCREATE, +MIPLDELETE, +MIPLOPEN, +MIPLCLOSE, +MIPLADDOBJ, +MIPLDELOBJ, +MIPLNOTIFY, +MIPLREADRSP, +MIPLWRITERSP, +MIPLEXECUTERSP, +MIPLOBSERVERSP, +MIPLDISCOVERRSP, +MIPLPARAMETERRSP, +MIPLUPDATE, +MIPLVER, +MIPLEVENT, +MIPLSETRAI, +MIPLNMI, +MIPLCLEARSTATE, +MIPLAUTHCODE, +CMMUX, +IPSTART, +IPSEND, +IPCLOSE, +CMDNSGIP, +CMPROMPT, +CMMODE, +CMSACK, +CMNDI, +CMRD, +CMPING, +CMHEAD, +CMSHOWRA, +CMSHOWTP, +CMSHOWLA, +CMIPMODE, +CMSTATE, +CMLPORT, +CMLOCIP, +CMSTAT, +CIPSHUT, +CMHTTPINIT, +CIOTID, +CIOTIDC, +CIOTKEY, +CIOTKEYC, +CIOTAUTHINFO, +CIOTINIT, +CIOTLOC, +CIOTSTATUS, +CMHTTPSET, +CMHTTPGET, +CMHTTPPOST, +CMHTTPDL, +ONENETREGISTER, +ONENETPOST, +ONENETGET, +ONENETDELETE, +CMHTTPTERM, +CIOTIP,

Revision	Date	Name	Comments
			+CIOTPORT, +CIOTPROID, +CIOTMKEY, +CIOTCONNECTPARA, +CIOT, +CIOTSTART, +CIOTDAT, +CIOTQUIT, +CIOTPING, +CIOTSEND, +CIOTBINSET, +CIOTBINSEND, +CIOTBINEND, +CIOTSPLIT. Modified commands: Information text responses and result codes, +CGSN, +CSCS, +CFUN, +CIND, +CTZR, +CEER, +NUESTATS, +NCONFIG, <Requested_eDRX_cycle>, <Assigned_eDRX_cycle>, <Requested_paging_time_window>, <Assigned_paging_time_window>, +CSQ, +CESQ, +COPS, +CRCES, +CPOL, +UJAD, +UMNOCONF, +CSCON, +NEARFCN, +URPM, +URPMCONF, +CEDRXS, +CEDRXRDP, +NPTWEDRXS, +NPOWERCLASS, +CFGCIOT, +CCIOTOPT, +NVSETRSRPOFFSET, +UECLS, +CLCK, +CSMS, +CPMS, +CMGF, +CSDH, +CNMI, +CNMA, +CMGS, +CMSS, +CSMP, +CMGD, +CSCA, +CSCB, +CMMS, +CMGC, +CSODCP, +CRTDCP, +IPR, <cid>, PPP LCP handshake behavior, +CGDCONT, +UPSD, +CEREG, +UAUTHREQ, +CIPCA, +CFGDFTPDN, +UFWUPD, +UTEST, +UFACTORY, +ULGASP, +NVSETPM, GPIO Introduction, +NSOSTF, +USECMNG, +USECPRF, AT+USECMNG command example, +UCOAP, MQTT introduction, +UMQTT, +UMQTTC, MQTT-SN introduction, +UMQTTSN, +UMQTTSNC, +UMQTTSNER, +ULWM2MCC, +ULWM2MOBJ, +ULWM2MUC, +ULWM2MIR, CoAP error codes. Review the command applicability for these commands: +CEER, +NCONFIG, +UMNOCONF, +CNMA, +CSCB, +CMMS, +CMGC, +UBIP, +UBIPAPN, +CCED, +UDCONF=11, +USTS, +UTEMP, +UCTS, +NCDP, +NMGR, +NMGS, +NNMI, +UCOAPS, +ULWM2M, +ULWM2MSTAT.
R18	09-Oct-2020	Ipah	Modified commands: +CIND, <Requested_eDRX_cycle>, <Requested_paging_time_window>, +CREG, +CEDRXS, +CSMS, +CSMP, +CSCA, &K, +ICF, S3, S4, S5, +CGDCONT, +CIPCA, +CGAPNRC, +UDCONF=75, +CFGDFTPDN, +UFWINSTALL, +UFWUPD, +UTEST, +UFOTACONF, +ULGASP, +CPSMS, +NPSMR, GPIO introduction, +UGPIOC, +ULSTFILE, +USOCR, +USOSEC, +USOCL, +USOWR, +USOST, +USECPRF, Data security introduction, +UCOAPC, +UMQTT, +UMQTTC, Mobile termination error result codes +CME ERROR. Updated estimated response time information for these commands: +UFWUPD, +USOSEC, +USOCL, +USOWR, +USOST, +UDNSRN.
R19	21-May-2021	Ipah	Updated SARA-N310-00X application version. Modified commands: Auto-registration, +COPS, +CCIOTOPT, +UPSD, +UPSDA, +CGACT, +CEREG, +UGCNTRD, +UGCNTSET, +CIPCA, +UTEST, GPIO Introduction, +UGPIOC, +USORF, +USOST, +UDCONF=1, +UFTPC, +UHTTP, +UMQTT, +UMQTTC, +UMQTTSN, Internet suite error classes.
R20	28-Sep-2021	Ipah	Extended document applicability to SARA-N310-00X-01. Removed document applicability to SARA-N300. Modified commands: Unsolicited Result Code (URC), +CGMM, +GMM, I, +NVSETRELEASEVERSION, +CALA, +UMNOCONF, +CSODCP, +UFWINSTALL, +UFOTASTAT, +UGPIOC, +USOST, +USOCTL, MQTT introduction, +UMQTT, MQTT-SN introduction, +UMQTTSN.
R21	23-Nov-2021	Ipah	Modified commands: +NUESTATS, +UTEST, +CPSMS, +USOST, +UHTTPC, +UMQTTSNC.

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