LENA-R8

Multi-mode LTE Cat 1bis 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
LENA-R8001	LENA-R8001-00C-00	02.00	A01.40	UBXDOC-686885345-1771
LENA-R8001M10	LENA-R8001M10-00C-00	02.00	A01.40	UBXDOC-686885345-1771

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. It is the time needed to provide the response in the worst case, e.g. when all the steps that have to be run to carry out the operation take the longest time to be performed; it is based on a theoretical estimation, derived by the the 3GPP specifications in case of AT commands related to cellular modem features (e.g. registration, de-registration, PDP context activation). For additional details on the response time of cellular network related AT command, see Maximum vs typical response time of cellular network related AT commands.
  More precisely, the response time considers 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 baud rate, 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 re-transmissions.

  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 1 technologies, see the LARA-R6 series application development guide [8].

- For some guidelines when developing applications for LTE Cat M1 technologies, see the SARA-R41 application development guide [30] or the LEXI-R4 / SARA-R42 application development guide [31] or the SARA-R5 series application development guide [26].
- For some guidelines when developing applications for NB-IoT technologies, see the SARA-N3 series application development guide [46] or the NB-IoT application development guide [43].
- 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 [48].

See Related documentation 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 [211]. 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:
  - AT command port;
  - 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.

☞ LENA-R8
The 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).

☞ LENA-R8
The command line is not case sensitive.

☞ 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.

1.3.3 Notes

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- The maximum length of the command line is 3072 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

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).
DELAYED	9	Final	Delayed
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

Verbose	Numeric	Result code type	Description
ABORTED	18	Final	Aborted terminal

Table 1: Allowed result codes

The following result codes are not supported:

- LENA-R8 - `DISCONNECT`, `DELAYED`, `ABORTED`, `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.

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:

- LENA-R8 - Firmware update Over The Air: see the Appendix A.4
- LENA-R8 - Firmware update Over AT command: see the Appendix A.5
- LENA-R8 - DNS: see the Appendix A.6
- LENA-R8 - TCP and UDP connections: see the Appendix A.6, Appendix A.7
- LENA-R8 - FTP: see the Appendix A.7.1
- LENA-R8 - HTTP: see the Appendix A.7.2
- LENA-R8 - MQTT: see the Appendix A.7.4
- LENA-R8 - MQTT-SN: see the Appendix A.7.5
- LENA-R8 - CoAP: see the Appendix A.7.6
- LENA-R8 - 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 (where supported).

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

☞ LENA-R8
More details about loading, storing and updating profiles can be found in the command descriptions for: ATZ, AT&F, AT&W and AT&V.

1.5 S-parameters

The S-parameters, as specified in ITU-T recommendation V250 [207], constitute a group of commands that begin with the string "ATS". They are generally indicated as S registers and are used to configure the way the module operates. Their syntax is:

```
ATS<parameter_number>?
```

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

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

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

AT command	S Number	Description
S0	0	Automatic answer setting
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.

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

2.1.1 Auto-registration

If the +COPS <mode> parameter in the profiles or in NVM is left to its factory-programmed value 0 or 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.

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.

2.1.2 LENA-R8 Maximum vs typical response time of cellular network related AT commands

The AT command manual provides the response time as the maximum delay to get the final result code; the execution of an AT command which requires interaction with the network (e.g. PDP context activation) or with a remote server (e.g. connection of a TCP socket) is affected by several aspects, like the reliability of the radio link, which might introduce packet loss and imply re-transmissions, and the quality of the network coverage, which can force the module to look for a better serving cell or even for a different PLMN or Radio Access Technology. Provided that radio conditions are good (diagnostic commands like +CESQ, +CGED, +UCGED can report that) and the module is already registered, the typical response time is really low (e.g. a few seconds); and if the module is already in RRC connected state (so it does not need to establish the RRC connection) it is even lower. The response time will therefore range between the typical response time in good conditions and the documented maximum response time. The host application usually sets a timer for each AT command issued on the AT interface, at whose timeout it take countermeasures like:

- aborting the current command (if supported),
- triggering a registration cycle to restart the cellular protocol stack from a known state,
- triggering a SW reset.

Such host application timer can be configured as the documented maximum response time of the specific AT command issued, or to a shorter value provided that the module is in a known initial state (e.g. registered). In the latter case the timer duration can be theoretically derived from some frequent abnormal cases like the following:

- loss of one of the module's messages or network response,
- collision between the service request and some mobility procedure

and set to some tens of seconds. When there is no information on the module registration status, like at switch on, it is advisable to wait more, because the mobility procedure might last much longer due to e.g.:

- initial PLMN scan on all supported bands and RATs to find the highest priority PLMN in roaming condition; if NB-IoT is among the supported RATs, 2 minutes might be required to scan each NB-IoT band;
- registration attempts on several PLMNs rejecting the module due to subscription limitation; in legacy RATs (2G, 3G) this occurs within the steering of roaming (SoR) feature and can extend the registration response

time to more than the 3 minutes calculated as worst case in a single PLMN (at least 4 minutes are suggested in this case).

If the current command is aborted and re-issued, it might be that the module can never complete the required steps to find a suitable cell and PLMN and register on it. This holds in particular for the registration commands AT+COPS=0 issued in +COPS: 2. So it is suggested to use a larger timeout value at least once, before taking countermeasures like triggering a registration cycle or a SW reset.

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

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

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 [76]; 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.

3 IPC - Inter Processor Communication

3.1 Multiplexing mode +CMUX

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

3.1.1 Description

Enables the multiplexing protocol control channel as defined in 3GPP TS 27.010 [105]. The command sets the parameters for the control channel. The result code is returned using the old interface speed. The parameters become active only after sending the OK result code.

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

The multiplexer configuration is as follows:

Modules	Control channel	AT commands / data connection	GNSS tunneling	SAP (SIM Access Profile)
LENA-R8	Channel 0	Channel 1 - 3		

Table 2: Multiplexer configuration

3.1.2 Syntax

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

3.1.3 Defined values

Parameter	Type	Description
<mode>	Number	Multiplexer transparency mechanism: • 0: basic option
<subset>	Number	The way in which the multiplexer control channel is set up: • 0 (default value): UIH frames used only • 1: UI frames used only
<port_speed>	Number	Transmission rate. The allowed range is 1-6 and the default value is 5.
<N1>	Number	Maximum frame size. The range is 1-2048 and the default value is 31.
<T1>	Number	Acknowledgement timer in units of ten milliseconds. The allowed range is 1-255 and the default value is 10.
<N2>	Number	Maximum number of re-transmissions. The allowed range is 0-100 and the default value is 3.

Parameter	Type	Description
<T2>	Number	Response timer for the multiplexer control channel in units of ten milliseconds. The allowed range is 2-255 and the default value is 30.
<T3>	Number	Wake up response timer. The allowed range is 1-255 and the default value is 10.
<k>	Number	Window size, for advanced operation with Error Recovery options. The allowed range is 1-7 and the default value is 2.

3.1.4 Notes

- If the multiplexer protocol is not started (the +CMUX set command has not been issued or returned an error result code) and AT+CMEE is set to 2, the +CMUX read command returns the following error result code: +CME ERROR: operation not allowed.
- For complete compatibility between u-blox products, leave the unsupported/unused parameters blank (which are reported as blank by the +CMUX test command).
- <T1> must be lower than or equal to <T2>.
- To enable the GNSS tunneling on the dedicated MUX channel, configure properly the +UGPRF AT command, otherwise there will be no data flow on it.

4 General

4.1 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

4.1.1 Description

Text string identifying the manufacturer.

4.1.2 Syntax

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

4.1.3 Defined values

Parameter	Type	Description
<manufacturer>	String	Manufacturer name

4.2 Manufacturer identification +GMI

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

4.2.1 Description

Text string identifying the manufacturer.

4.2.2 Syntax

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

4.2.3 Defined values

Parameter	Type	Description
<manufacturer>	String	Manufacturer name

4.3 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

4.3.1 Description

Text string identifying the product name.

4.3.2 Syntax

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

4.3.3 Defined values

Parameter	Type	Description
<model>	String	Name of the product

4.4 Model identification +GMM

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

4.4.1 Description

Text string identifying the product name.

4.4.2 Syntax

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

4.4.3 Defined values

Parameter	Type	Description
<model>	String	Name of product

4.5 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

4.5.1 Description

Returns the firmware version of the module.

4.5.2 Syntax

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

4.5.3 Defined values

Parameter	Type	Description
<version>	String	Firmware version

4.6 Firmware version identification +GMR

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

4.6.1 Description

Returns the firmware version of the module.

4.6.2 Syntax

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

4.6.3 Defined values

Parameter	Type	Description
<version>	String	Firmware version

4.7 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

4.7.1 Description

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

4.7.2 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

4.7.3 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)

4.8 IMEI identification +GSN

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

4.8.1 Description

The commands handling is the same of +CGSN.

4.8.2 Syntax

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

4.8.3 Defined values

See +CGSN AT command.

4.8.4 Notes

LENA-R8

- The information text response to the test command is:

```
+GSN: (0-3,255)
OK
```

4.9 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

4.9.1 Description

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

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

4.9.2 Syntax

Type	Syntax	Response	Example
Action	**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

4.9.3 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"

4.10 TE character set configuration +CSCS

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

4.10.1 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.

4.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSCS=<chset>	OK	AT+CSCS="IRA" OK
Read	AT+CSCS?	+CSCS: <chset>	+CSCS: "IRA"

Type	Syntax	Response	Example
		OK	OK
Test	AT+CSCS=?	+CSCS: (list of supported <chset>'s) OK	+CSCS: ("IRA","GSM","PCCP437", "8859-1","UCS2","HEX", "PCCP936") OK

4.10.3 Defined values

Parameter	Type	Description
<chset>	String	Allowed characters set: • "IRA": 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 • "UTF-8": octet (8-bit) lossless encoding of UCS characters (see RFC 3629 [206]); UTF-8 encodes each UCS character as a variable number of octets, where the number of octets depends on the integer value assigned to the UCS character. The input format shall be a stream of octets. It shall not be converted to hexadecimal numbers as in "HEX" or "UCS2". This character set requires an 8-bit TA - TE interface. Allowed values: • LENA-R8 - "IRA" (factory-programmed value), "GSM", "UCS2", "HEX", "PCCP936", "UTF-8"

4.11 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

4.11.1 Description

Request the IMSI (International Mobile Subscriber Identity).

4.11.2 Syntax

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

4.11.3 Defined values

Parameter	Type	Description
<IMSI>	Number	International Mobile Subscriber Identity

4.12 Card identification +CCID

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

4.12.1 Description

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

4.12.2 Syntax

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

4.12.3 Defined values

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

4.12.4 Notes

- The command needs of the SIM to correctly work.

5 Mobile equipment control and status

5.1 Module switch off +CPWROFF

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

5.1.1 Description

Switches off the MT. During 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 AT+CPWROFF command.

5.1.2 Syntax

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

5.1.3 Notes

LENA-R8

- The +UCPWROFF URC is not supported.
- The information text response to the action command is:

```
+CPOF: MS OFF
OK
```

5.2 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	Appendix B.4	+CME Error

5.2.1 Description

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

☞ LENA-R8
If the AT+CFUN=16 (reset) command is issued, the rest of the command line, placed after that will be ignored.

5.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+CFUN=<fun>[,<rst>]	OK	AT+CFUN=1 OK
Read	AT+CFUN?	+CFUN: <power_mode>,<STK_mode> OK	+CFUN: 1,0 OK
Test	AT+CFUN=?	+CFUN: (list of supported <fun>'s),(list of supported <rst>'s) OK	+CFUN: (0,1,4,6,7,8,9,16),(0-1) OK

Type	Syntax	Response	Example
URC		+UUFASTSHUTDOWN: <value>	+UUFASTSHUTDOWN: 0

5.2.3 Defined values

Parameter	Type	Description
<fun>	Number	Selected functionality: • 0: sets the MT to minimum functionality (disable both transmit and receive RF circuits by deactivating both CS and PS services) • 1 (factory-programmed value): sets the MT to full functionality, e.g. from airplane mode or minimum functionality • 4: disables both transmit and receive RF circuits by deactivating both CS and PS services and sets the MT into airplane mode. Airplane mode is persistent between power cycles triggered by AT+CFUN=15, AT+CFUN=16 or AT+CPWROFF (where supported). • 6: enables the SIM toolkit interface in dedicated mode and fetching of proactive commands by SIM Application Toolkit from the SIM card • 7 or 8: disables the SIM toolkit interface and fetching of proactive commands by SIM Application Toolkit from the SIM card • 9: enables the SIM toolkit interface in raw mode and fetching of proactive commands by SIM Application Toolkit from the SIM card • 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 • 126: at the exit from deep-sleep mode (PSM or eDRX) by means of PWR_ON input pin, it triggers the protocol stack activation, if the bit 4 of <psm_ver> parameter in the +UPSMVER AT command has been set to 1. The module returns the "OK" final result code even if not used at exit from deep-sleep mode by means of PWR_ON input pin. • 127: sets the MT in a deep low power state "HALT" (with detach from the network and saving of the NVM parameters); the only way to wake up the module is a power cycle or a module reset Allowed values: • LENA-R8 - 0, 1, 4, 16
<rst>	Number	Reset mode. This parameter can be used only when <fun> is 1, 4 or 19. • 0 (default value): do not reset the MT before setting it to the selected <fun> • 1: performs a MT silent reset (with detach from network and saving of NVM parameters) with reset of the SIM card before setting it to the selected <fun>
<power_mode>	Number	• 0: MT is switched on with minimum functionality • 1: MT is switched on • 4: MT is in "airplane mode" • 19: MT is in minimum functionality with SIM deactivated
<STK_mode>	Number	• 6: the SIM-toolkit interface in dedicated mode and fetching of proactive commands by SIM-APPL from the SIM-card are enabled • 0, 7 or 8: the SIM-toolkit interface is disabled; fetching of proactive commands by SIM-APPL from the SIM-card is enabled • 9: the SIM-toolkit interface in raw mode and fetching of proactive commands by SIM-APPL from the SIM-card are enabled
<value>	Number	Allowed values: • 0: fast power-off ongoing • 1: fast power-off completed • 2: fast power-off error

5.2.4 Notes

LENA-R8

- When the module is set to +CFUN: 0, and the AT+COPS=0 AT command is issued, then the module is automatically set to +CFUN: 1.

5.3 Indicator control +CIND

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

5.3.1 Description

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

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

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

For more details, see the 3GPP TS 27.007 [76].

5.3.2 Syntax

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

5.3.3 Defined values

Parameter	Type	Description
<ind>	Number	Range of corresponding <descr> used to identify the service when an unsolicited indication is provided
<descr>	String	Reserved by the norm and their <ind> ranges; it may have the values: • "battchg": battery charge level (0-5) • "signal": signal 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

Parameter	Type	Description
		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 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 Allowed <descr> values: • LENA-R8 - "battchg", "signal", "service", "sounder", "message", "call", "roam", "smsfull"

5.3.4 Notes

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

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

5.4 Mobile termination event reporting +CMER

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

5.4.1 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.

5.4.2 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>	

5.4.3 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

Parameter	Type	Description
		o 1: unread message available • 6 ("call"): <value> provides the call in progress: o 0: no call in progress o 1: call in progress • 7 ("roam"): <value> provides the registration on a roaming network: o 0: not in roaming o 1: roaming • 8 ("smsfull"): <value> provides the SMS storage status: o 0: SMS storage not full o 1: SMS Storage full (an SMS has been rejected with the cause of SMS storage full) • 9 ("gprs"): <value> provides the GPRS indication status: o 0: no GPRS available in the network o 1: GPRS available in the network but not registered o 2: registered to GPRS o 65535: PS service indication is not available • 10 ("callsetup"): <value> provides the call set-up: o 0: no call set-up o 1: incoming call not accepted or rejected o 2: outgoing call in dialing state o 3: outgoing call in remote party alerting state • 11 ("callheld"): <value> provides the call on hold: o 0: no calls on hold o 1: at least one call on hold • 12 ("simind"): <value> provides the SIM detection: o 0: no SIM detected o 1: SIM detected o 2: not available

5.4.4 Notes

LENA-R8

- <mode>=0, 1, 2 are not supported.
- <ind>=1 is not supported.
- The <bfr> parameter is not supported.

5.5 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

5.5.1 Description

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

5.5.2 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	

5.5.3 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. • LENA-R8 - The factory-programmed value is "00/01/01,00:00:11+00". Values prior to the factory-programmed value are not allowed.

5.5.4 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.

5.6 Set greeting text +CSGT

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

5.6.1 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.

5.6.2 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

5.6.3 Defined values

Parameter	Type	Description
<text>	String	Greeting text. The factory-programmed value is: • LENA-R8 - "+UUSTATUS: READY"
<mode>	Number	Allowed values: • 0: turn off the greeting text • 1: turn on the greeting text Factory-programmed value: • LENA-R8 - 1
<ltext>	Number	Maximum length of the <text> parameter.

5.6.4 Notes

LENA-R8

- The read command returns an error result code if the greeting text has not been configured.

5.7 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

5.7.1 Description

Configures the automatic time zone update via NITZ.

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

5.7.2 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

5.7.3 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: • LENA-R8 - 0, 1 (factory-programmed value), 2

5.8 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

5.8.1 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

5.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+CTZR=<mode>	OK	AT+CTZR=1 OK
Read	AT+CTZR?	+CTZR: <mode>	+CTZR: 0

Type	Syntax	Response	Example
		OK	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

5.8.3 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: • LENA-R8 - 0 (default value), 1, 2, 3
<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.
<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.

5.8.4 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.

LENA-R8

- The command setting is stored in the personal profile.

5.9 List current calls +CLCC

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

5.9.1 Description

Returns the list of current calls of MT. If no calls are available, no information text response is sent.

5.9.2 Syntax

Type	Syntax	Response	Example
Action	AT+CLCC	[+CLCC: <id1>,<dir>,<stat>,<mode>,<mpty>[,<number>,<type>[,alpha>[,<priority>[,<CLI_validity>]]]] [+CLCC: <id2>,<dir>,<stat>,<mode>,<mpty>[,<number>,	+CLCC: 1,0,0,0,0,"0913137880",129 OK

Type	Syntax	Response	Example
		<type>[,<alpha>[,<priority>[,<CLI_validity>]]]] [...]]] OK or OK (if no calls)	
Test	AT+CLCC=?	OK	

5.9.3 Defined values

Parameter	Type	Description
<idx>	Number	Indicates the call identification (see +CHLD x)
<dir>	Number	Direction: • 0: mobile originated (MO) call • 1: mobile terminated (MT) call
<stat>	Number	State of the call: • 0: active • 1: held • 2: dialling (Mobile Originated call) • 3: alerting (Mobile Originated cal) • 4: incoming (Mobile Terminated call) • 5: waiting (Mobile Terminated call) • 7: release (network release this call) • 8: handshake Allowed values: • LENA-R8 - 0, 1, 2, 3, 4, 5, 7, 8
<mode>	Number	Teleservice: • 0: voice • 1: data • 2: FAX • 3: voice followed by data, voice mode • 4: alternating voice/data, voice mode • 5: alternating voice/fax, voice mode • 6: voice followed by data, data mode • 7: alternating voice/data, data mode • 8: alternating voice/fax, fax mode • 9: unknown Allowed values: • LENA-R8 - 0, 1, 2, 3, 4 ,5, 6, 7, 8, 9
<mpty>	Number	• 0: call is not one of multiparty (conference) call parties • 1: call is one of multiparty call parties
<number>	String	Indicates the phone number in format specified by <type>
<type>	Number	Type of address octet (phone number)
<alpha>	String	Optional string alphanumeric representation of <number> corresponding to the entry found in phonebook; this parameter is not managed
<priority>	Number	Indicates the eMLPP priority level of the call, values specified in 3GPP TS 22.067 [109].
<CLI_validity>	Number	Provide details why <number> does not contain a calling party BCD number (see the 3GPP TS 24.008 [85] subclause 10.5.4.30). The parameter is not present for MO call types: • 0: CLI valid • 1: CLI has been withheld by the originator (see the 3GPP TS 24.008 [85] table 10 .5.135a/3GPP TS 24.008 code "Reject by user") • 2: CLI is not available due to interworking problems or limitations of originating network (see the 3GPP TS 24.008 [85] table 10.5.135a/3GPP TS 24.008 code "Interaction with other service") • 3: CLI is not available due to calling party being of type payphone (see the 3GPP TS 24.008 [85] table 10.5.135a/3GPP TS 24.008 code "Coin line/payphone")

Parameter	Type	Description
		• 4: CLI is not available due to other reasons (see the 3GPP TS 24.008 [85] table 10 .5.135a/3GPP TS 24.008 code "Unavailable") When the CLI is not available (<CLI_validity>=2, <CLI_validity>=3 or <CLI_validity>= 4), the <number> parameter shall be an empty string ("") and <type> value will not be significant. Nevertheless, the MT may return the recommended value 128 for <type> (TON/NPI unknown in accordance with 3GPP TS 24.008 [85] subclause 10 .5.4.7). When the CLI has been withheld by the originator, (<CLI_validity>=1) and the CLIP is provisioned with the "override category" option (see the 3GPP TS 22.081 [96] and 3GPP TS 23.081 [97]), <number> and <type> is provided. Otherwise, the MT shall return the same setting for <number> and <type> as if the CLI was not available

5.9.4 Notes

LENA-R8

- The <alpha>, <priority> and <CLI_validity> parameters are not supported.

5.10 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

5.10.1 Description

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

5.10.2 Syntax

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

5.10.3 Defined values

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

5.10.4 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

5.11 Extended error report +CEER

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

5.11.1 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.

5.11.2 Syntax

Type	Syntax	Response	Example
Action	AT+CEER	+CEER: <type>[,<cause>,<error_description>] OK	+CEER: "CC setup error",277,"SIM status failure" OK
Test	AT+CEER=?	OK	

5.11.3 Defined values

Parameter	Type	Description
<type>	String	• "CC setup error": <cause> and <error_description> parameters are provided • "CC modification error": <cause> and <error_description> parameters are provided • "CC release": <cause> and <error_description> parameters are provided • "SM attach error": <cause> and <error_description> parameters are provided • "SM detach": <cause> and <error_description> parameters are provided • "SM activation error": <cause> and <error_description> parameters are provided • "SM deactivation": <cause> and <error_description> parameters are provided • "SS network GSM cause": <SS_cause_errors> parameters are provided • "SS network reject cause": <tag> and <SS_cause> parameters are provided • "EMM cause": <cause> and <error_description> parameters are provided • "ESM attach error": <cause> and <error_description> parameters are provided • "ESM detach": <cause> and <error_description> parameters are provided • "IMS USSD Network cause": <cause> parameter is provided • "No report available": no more parameters are provided
<cause>	Number	Code number of the received error (internal or network originated); more details in Appendix A.3
<error_description>	String	Code description of the received error; more details in Appendix A.3

6 Call control

6.1 Dial command D

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

6.1.1 Description

Lists characters that may be used in a dialling string for making a call (voice, data or fax call) or controlling supplementary services in accordance with 3GPP TS 22.030 [78] and initiates the indicated kind of call. No further commands may follow in the command line in case of data or fax calls.

6.1.2 Syntax

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

6.1.3 Defined values

Parameter	Type	Description
<number>	Number	Dial string; the allowed characters are: 1 2 3 4 5 6 7 8 9 0 * # + A B C D , T P ! W @ (see the 3GPP TS 27.007 [76]). The following characters are ignored: , T ! W @. ☞ The first occurrence of P is interpreted as pause and separator between the dialling number and the DTMF string. The following occurrences are interpreted only as pause. The use of P as pause has been introduced for AT&T certification.
<I>	String	Set the CLI status; the allowed values are: • I (ASCII code 49 Hex): CLI presentation restricted • i: CLI presentation allowed ☞ The CLIR supplementary service subscription is overridden for this call.
<G>	String	Configures the CUG supplementary service for the specific call: • G: CUG activated • g: CUG deactivated

6.2 Call answer A

A						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 20 s	+CME Error

6.2.1 Description

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

6.2.2 Syntax

Type	Syntax	Response	Example
Action	ATA	RING OK	

6.3 Hook control H

H						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 20 s	+CME Error

6.3.1 Description

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

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

6.3.2 Syntax

Type	Syntax	Response	Example
Action	ATH	OK	

6.4 Hang up call +CHUP

+CHUP						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 20 s	+CME Error

6.4.1 Description

Causes the MT to hang up the current GSM or UMTS call.

☞ LENA-R8
In case of multiple calls, all calls (active and on hold) will be released.

☞ The command does not replace the ITU-T V.250 [207] command H, but gives an assured procedure to terminate an alternating mode call. For further information see the 3GPP TS 27.007 [76].

6.4.2 Syntax

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

Type	Syntax	Response	Example
			OK

6.5 Automatic answer S0

S0						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

6.5.1 Description

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

☞ For an incoming CSD call, if the autoanswering is enabled and the <value> parameter of &D command is set to 2, the autoanswering only works if the DTR line of the AT interface with activated autoanswering is set to ON. Otherwise, if DTR is OFF, then the call is rejected. If the <value> parameter of &D command is not set to 2, the DTR state has no impact on autoanswering.

6.5.2 Syntax

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

6.5.3 Defined values

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

7 Network service

7.1 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.	+COPS
<RxLev>	Number	Received Signal Strength Indicator (RSSI) index as defined in 3GPP TS 45.008 [91]: • 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 [162]	+COPS
<scrambling_code>	Number	Primary scrambling code (PSC).	+COPS
<dl_frequency>	Number	Downlink frequency. The range is 0-16383.	+COPS, +UJAD
<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
<EARFCN>	Number	E-UTRAN Absolute radio frequency channel number as defined in the 3GPP TS 36.101 [128]. As per 3GPP TS 36.101 [128] the allowed values depend on the module supported bands. See the corresponding module data sheet for the complete list of the bands supported by each module.	+UJAD
<PhysCellID>	Number	Physical cell ID. The range is 0-503.	+COPS, +UJAD
<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 [133]: • 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	• LENA-R8 - The parameter is not supported	+COPS
<BSIC>	Number	Base Station Identify Code (BSIC) in hexadecimal format, the range is 0x0-0x3F (6 bits).	+COPS
<Lband>	Number	E-UTRAN band (see 3GPP TS 36.101 Table 5.5-1 [128]). Allowed values:	+UJAD

Parameter	Type	Description	Commands
		• LENA-R8 - The parameter is not supported	

7.2 Subscriber number +CNUM

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

7.2.1 Description

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

☞ MSISDN is read from the SIM.

7.2.2 Syntax

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

7.2.3 Defined values

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

7.3 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

7.3.1 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.

7.3.2 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)	+CSQ: (0-31,99),(0-7,99) OK

Type	Syntax	Response	Example
		OK	

7.3.3 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. 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 [156] • In 2G RAT EGPRS packet transfer mode indicates the Mean Bit Error Probability (BEP) of a radio block. 3GPP TS 45.008 [156] 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 [134] 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 [133] specifies the range 0-34 for RSRQ which is mapped to the range 0-7 of <qual> See Table 3 for the complete parameter mapping.

7.3.4 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

LENA-R8

- 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

7.4 Operator selection +COPS

+COPS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	Yes	Appendix B.4	+CME Error

7.4.1 Description

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

By default, u-blox cellular modules support auto-registration, therefore AT+COPS=0 or AT+COPS=1 command are not required at switch on: for more details, see Auto-registration.

The response time refers to the worst case for AT+COPS=0 and AT+COPS=1 command on a specific PLMN, where the AT command can last up to several minutes due to abnormal cases in radio resource and mobility management procedures. In case NB-IoT bands must be scanned to find a suitable cell, or when the module is in roaming and attempts registration on several PLMN before getting access to the cellular services, the response time can dramatically increase: for more details, see Maximum vs typical response time of cellular network related AT commands.

☞ 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 [118], 3GPP TS 34.121-2 [119], 3GPP TS 36.521-2 [140] and 3GPP TS 36.523-2 [141], 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 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 (for more details on the <mode> parameter allowed values, see Defined values):

- **<mode>=0 and <mode>=1**: the AT command setting is immediately stored in the current activated profile or in the NVM if the personal profile are not supported. 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.
- **<mode>=5 and <mode>=6**: an extended network search, also called deep scan, is triggered; all cells detected during the PLMN scan are reported at the AT interface, more precisely:
  - **for GSM networks**: all cells found of any visible PLMNs will be reported, including those belonging to the neighbor list of the serving cell. The command response includes the following data (if supported): AcT, MCC, MNC, LAC, CI, BSIC, Arfcn, RxLev (see the Network parameters definition section for the parameter description)
  - **for UMTS networks**: all cells found on any visible PLMNs will be reported, including those belonging to the neighbor list of the serving cell. For each cell, the scan will trigger the additional reception of the SIB type 1 and type 3, to properly report the LAC, RAC, and CI of the cell. The command response includes the following data: MCC, MNC, LAC, RAC, CI, DLF, ULF, SC, RSCP LEV, ECN0 LEV (see the Network parameters definition section for the parameter description)
  - **for LTE networks**: all cells found will be reported, including those belonging to the neighbor list of the serving cell. For each cell, the command response includes the following data: MCC, MNC, TAC, CI, DLF, ULF, PCI, RSRP and RSRQ (see the Network parameters definition section for the parameter description).
- **<mode>=8**: when a module is registered on the GSM network, a network timing advance search is performed

- The network timing advance search is performed only on the serving cell and the 6 neighbor cells of BA list with the higher power levels.
- The information text response always includes the following data for the serving cell and for the other 6 neighbor cells: MCC, MNC, LAC, CI, BSIC, Arfcn, RxLev (see the Network parameters definition section for the parameter description) and TA. When the <CI> value is not valid, no data of the correspondent neighbor cell is inside the information text response.
- It can be started only when the module is in idle mode and no cell reselection is ongoing. The network condition could sometimes increase the estimated response time.
- No mobile terminated/originated SMS, PS or CS call are handled when the network timing advance search is running. Furthermore mobility management procedures (for example: routing area update procedure or location update procedure) are delayed after the end of timing advance search.

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 [113]), i.e. the module triggers a search for the HPLMN or a higher order PLMN excluding the previously selected PLMN/access technology combination. 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 either selects another PLMN that has the best signal quality or remains in the state it was in prior to the search (e.g. camped and/or registered on the PLMN before the search). Both behaviors are accepted by 3GPP TS 23.122 [113]

The AT+COPS=1,<format>,<oper> command forces the MT to select and register with the network even if the operator currently belongs to the list of the Forbidden Public Land Mobile Networks (FPLMNs).

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

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 check the current network registration status:

- LENA-R8 - GPRS network registration status +CGREG

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 test command returns long and short <oper> strings from the module's ROM PLMN name list (see +COPN). To handle possible mismatches between the PLMN names returned by the test command and the read command, the numeric format should be preferred.

☞ LENA-R8
When the module is deregistered from the network (+COPS: 2), no emergency call can be established and an error result code is returned.

7.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+COPS=[<mode>[,<format>[,<oper>[,<AcT>]]]]	**If <mode>=0, 1, 2, 3, 4:** OK	AT+COPS=0,0 OK
		If <mode>=5 and on GSM networks: [MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<arfcn>, RxLev:<RxLev> [MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<arfcn>, RxLev:<RxLev> [...]]] OK	AT+COPS=5 MCC:222, MNC: 88, LAC:55fa, CI:ffff, BSIC:3f, Arfcn:00104, RxLev:037 MCC:222, MNC: 10, LAC:4e54, CI:ffff, BSIC:32, Arfcn:00080, RxLev:032 ... ... MCC:222, MNC: 88, LAC:55fa, CI:1d39, BSIC:3d, Arfcn:00756, RxLev:005 OK
		If <mode>=5 and on UMTS networks:	AT+COPS=5

Type	Syntax	Response	Example
		[MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, RAC:<RAC>, CI:<CI>, DLF:<dl_frequency>, ULF:<ul_frequency>, SC:<scrambling_code>, RSCP LEV:<rscp_lev>, ECN0 LEV:<ecn0_lev> [MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, RAC:<RAC>, CI:<CI>, DLF:<dl_frequency>, ULF:<ul_frequency>, SC:<scrambling_code>, RSCP LEV:<rscp_lev>, ECN0 LEV:<ecn0_lev> [...]]] OK	MCC:222, MNC:10, LAC:61ef, RAC:14, CI:07d2088, DLF:10788, ULF: 9838, SC:81, RSCP LEV:23, ECN0 LEV:41 MCC:222, MNC:10, LAC:61ef, RAC:14, CI:07d2085, DLF:10813, ULF: 9863, SC:81, RSCP LEV:26, ECN0 LEV:41 ... ... MCC:222, MNC:01, LAC:ef8d, RAC:0, CI:52d36fb, DLF:10688, ULF: 9738, SC:285, RSCP LEV:16, ECN0 LEV:32 OK
		If <mode>=5 and on LTE networks: [MCC:<MCC>, MNC:<MNC>, TAC:<TAC>, CI:<CI>, DLF:<dl_EARFCN>, ULF:<ul_EARFCN>, PCI:<PhysCellID>, RSRP LEV:<RSRP>, RSRQ LEV:<RSRQ> [MCC:<MCC>, MNC:<MNC>, TAC:<TAC>, CI:<CI>, DLF:<dl_EARFCN>, ULF:<ul_EARFCN>, PCI:<PhysCellID>, RSRP LEV:<RSRP>, RSRQ LEV:<RSRQ> [...]]] OK	AT+COPS=5 MCC:222, MNC:88, TAC:562c, CI:57367043, DLF: 1325, ULF:19325, PCI:163, RSRP LEV:25, RSRQ LEV:1 MCC:222, MNC:10, TAC:5a25, CI:10086944, DLF: 1850, ULF:19850, PCI:287, RSRP LEV:25, RSRQ LEV:6 ... ... MCC:293, MNC:40, TAC:27ec, CI:519425, DLF: 6400, ULF:24400, PCI:393, RSRP LEV:27, RSRQ LEV:9 OK
		If <mode>=6 and on GSM networks: [<AcT>,<MCC>,<MNC>,<LAC>,<CI>,<BSIC>,<arfcn>,<RxLev> [<AcT>,<MCC>,<MNC>,<LAC>,<CI>,<BSIC>,<arfcn>,<RxLev> [...]]] OK	AT+COPS=6 0,222,88,55fa,ffff,3f,00104,037 ... 0,222,10,4e54,ffff,32,00080,032 ... OK
		If <mode>=6 and on UMTS networks: [<MCC>,<MNC>,<LAC>,<RAC>,<CI>,<dl_frequency>,<ul_frequency>,<scrambling_code>,<RSCP LEV>,<ecn0_lev> [<MCC>,<MNC>,<LAC>,<RAC>,<CI>,<dl_frequency>,<ul_frequency>,<scrambling_code>,<RSCP LEV>,<ecn0_lev> [...]]] OK	AT+COPS=6 222,99,754f,2,03554d7,10713,9763,341,255,14 ... 222,01,ef8d,0,52d2647,10663,9713,453,4,23 ... OK
		If <mode>=6 and on LTE networks: [<AcT>,<MCC>,<MNC>,<TAC>,<CI>,<dl_EARFCN>,<ul_EARFCN>,<PhysCellID>,<RSRP>,<RSRQ> [<AcT>,<MCC>,<MNC>,<TAC>,<CI>,<dl_EARFCN>,<ul_EARFCN>,<PhysCellID>,<RSRP>,<RSRQ> [...]]] OK	AT+COPS=6 7,222,88,562c,57367043,1325,19325,163,35,10 7,222,01,3aa3,179291197,6300,24300,271,48,14 7,222,01,3aa3,179290685,6300,24300,402,27,11 7,293,40,27ec,519425,6400,24400,393,24,1 OK
		If <mode>=8 and on GSM networks:	AT+COPS=8 MCC:222, MNC: 10, LAC:4e54, CI:12f1, BSIC:3f, Arfcn:00104, RxLev:037, TA:3

Type	Syntax	Response	Example
		[MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<arfcn>, RxLev:<RxLev>, TA:<TA> [MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<arfcn>, RxLev:<RxLev>, TA:<TA> [...]]] OK	MCC:222, MNC: 10, LAC:4e54, CI:8841, BSIC:32, Arfcn:00080, RxLev:032, TA:5 MCC:222, MNC: 10, LAC:4e54, CI:1ef4, BSIC:31, Arfcn:00082, RxLev:022, TA:255 ... MCC:222, MNC: 10, LAC:55fa, CI:1d39, BSIC:3d, Arfcn:00756, RxLev:005, TA:7 OK
Read	AT+COPS?	+COPS: <mode>[,<format>,<oper>[,<AcT>]] OK	+COPS: 0,0,"vodafone IT" OK
Test	AT+COPS=?	+COPS: [(<stat>, long <oper>, short <oper>, numeric <oper>[,<AcT>])[,(<stat>, long <oper>, short <oper>, numeric <oper>[,<AcT>]),[...]]],(list of supported <mode>s),(list of supported <format>s) OK	+COPS: (2,"vodafone IT","voda IT","22210 "),(1,"SI vodafone","vodafone SI","29340 "),(1,"I WIND","I WIND","22288"),(1,"I TIM", "TIM","22201"),(1,"MOBITEL","MOBITEL", "29341"),,(0-4),(0-2) OK

7.4.3 Defined values

Parameter	Type	Description
<mode>	Number	Is used to chose whether the network selection is automatically done by the MT or is forced by this command to the operator <oper> given in the format <format>: • 0 (default value and factory-programmed value): automatic (<oper> field is ignored) • 1: manual • 2: deregister from network • 3: set only <format> • 4: manual/automatic • 5: extended network search • 6: extended network search without the tags (e.g. MCC, RxLev will not be printed, see the syntax and the command example) • 8: network timing advance search Allowed values: • LENA-R8 - 0, 1, 2, 3, 4
<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 FFFFF (undefined).
<stat>	Number	• 0: unknown • 1: available • 2: current • 3: forbidden
<AcT>	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: LTE • 8: EC-GSM-IoT (A/Gb mode) • 9: E-UTRAN (NB-S1 mode) Allowed values:

Parameter	Type	Description
		• LENA-R8 - 0, 7
<TA>	Number	Timing Advance; the range is 0-63. If the information is not known or not detectable or currently not available, the value is 255.
<MCC>	Number	See <MCC>.
<MNC>	Number	See <MNC>.
<LAC>	Number	See <LAC>.
<CI>	Number	See <CI>.
<BSIC>	Number	See <BSIC>.
<arfcn>	Number	See <arfcn>.
<RxLev>	Number	See <RxLev>.
<RAC>	Number	See <RAC>.
<dl_frequency>	Number	See <dl_frequency>.
<ul_frequency>	Number	See <ul_frequency>.
<scrambling_code>	Number	See <scrambling_code>.
<rscp_lev>	Number	See <rscp_lev>.
<ecn0_lev>	Number	See <ecn0_lev>.
<TAC>	Number	See <TAC>.
<dl_EARFCN>	Number	See <dl_EARFCN>.
<ul_EARFCN>	Number	See <ul_EARFCN>.
<PhysCellID>	Number	See <PhysCellID>.
<RSRP>	Number	See <RSRP>.
<RSRQ>	Number	See <RSRQ>.

7.4.4 Notes

LENA-R8

- In the information text response to the test command, the set of parameters referring to each network (i.e. <stat>, long <oper>, short <oper>, numeric <oper>[,<AcT>]) is delimited by <LF><CR> (i.e. 0x0A 0x0D).
- When the module is set to +CFUN: 0, and the AT+COPS=0 AT command is issued, then the module is automatically set to +CFUN: 1.

7.5 Radio Access Technology (RAT) selection +URAT

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

7.5.1 Description

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

By means of <PreferredAct> and <2ndPreferredAct> parameters it is possible to define the order of RAT selection at boot or when entering full functionality from deregistered state. If <SelectedAcT> is set to dual or tri mode, it is possible to specify the preferred RAT parameter <PreferredAct>, which determines which RAT is selected first. If the preferred RAT parameter is omitted, it will be set by default to the highest RAT in the current multi-mode range. If tri mode is selected, it is also possible to specify a second preferred RAT <2ndPreferredAct> in addition to the preferred RAT. This parameter determines which RAT is selected if no cellular service can be obtained by the module on the preferred RAT. The remaining RAT will be selected when no service can be obtained in the preferred one(s).

☞ Any change in the RAT selection must be done deregistered state, entered by issuing the AT+CFUN=0 or AT+CFUN=4 AT command. Use AT+CFUN=1 to return to the module full functionality.

☞ 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 [118], 3GPP TS 34.121-2 [119], 3GPP TS 36.521-2 [140] and 3GPP TS 36.523-2 [141], is a

statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

7.5.2 Syntax

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

7.5.3 Defined values

Parameter	Type	Description
<SelectedAcT>	Number	Indicates the radio access technology and may be: • 0: GSM / GPRS / eGPRS (single mode) • 1: GSM / UMTS (dual mode) • 2: UMTS (single mode) • 3: LTE (single mode) • 4: GSM / UMTS / LTE (tri mode) • 5: GSM / LTE (dual mode) • 6: UMTS / LTE (dual mode) Allowed values depend on the module series: • LENA-R8 - 0, 3, 5 (factory-programmed value)
<PreferredAct>	Number	Indicates the preferred access technology; it is ignored if dual mode or tri mode are not selected. • 0: GSM / GPRS / eGPRS • 2: UTRAN • 3: LTE Allowed values depend on the module series: • LENA-R8 - 0, 3 (default and factory-programmed value)
<2ndPreferredAct>	Number	Indicates the second preferred access technology; it is ignored if tri mode is not selected. • 0: GSM / GPRS / eGPRS • 2: UTRAN • 3: LTE Allowed values depend on the module series: • LENA-R8 - The parameter is not supported

7.5.4 Notes

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

7.6 Network registration status +CREG

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

7.6.1 Description

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

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

☞ LENA-R8
When the module is deregisterd from the network, no emergency call can be established and the module returns an error result code.

7.6.2 Syntax

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

7.6.3 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) • 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 [85] and 3GPP TS 24.301 [120] 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: • LENA-R8 - 0, 7
<cause_type>	Number	<reject_cause> type. Allowed values: • 0: indicates that <reject_cause> contains an EMM cause value, see 3GPP TS 24.30 1 [120] Annex A
<reject_cause>	Number	Cause of the failed registration. The value is of type as defined by <cause_type>

7.6.4 Notes

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

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

  The registration is not started

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

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

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

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

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

LENA-R8

- <n> parameter is not returned in the information text response to the read command.

7.7 Preferred operator list +CPOL

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

7.7.1 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.

The set command can write an entry in the selected list or can delete it if the operator parameter is not provided.

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.

7.7.2 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

7.7.3 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	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

Parameter	Type	Description
		• 1: access technology selected

7.8 Read operator names +COPN

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

7.8.1 Description

Returns the list of operator names from the MT. Each operator code <numeric n> that has an alphanumeric equivalent <alpha n> in the MT memory shall be returned.

7.8.2 Syntax

Type	Syntax	Response	Example
Action	AT+COPN	+COPN: <numeric 1>,<alpha1> [+COPN: <numeric2>,<alpha2> [...]] OK	+COPN: "21901","T-Mobile HR" +COPN: "21910","HR VIP" +COPN: "22201","I TIM" +COPN: "22210","vodafone IT" OK
Test	AT+COPN=?	OK	OK

7.8.3 Defined values

Parameter	Type	Description
<numeric n>	String	Operator in numeric format (see +COPS AT command)
<alpha n>	String	Operator in long alphanumeric format (see +COPS AT command)

7.9 Configure supported LTE bands +SETLOCK

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

7.9.1 Description

Sets the supported LTE bands; the MT can operate only using the configured bands. By factory-programmed configuration all the bands supported by the modules are enabled.

☞ Reboot the module to make the change effective.

7.9.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+SETLOCK=<op_code>,0[,<band1>[,<band2>[,<band3>[,<band4>]]]]	OK	AT+SETLOCK=0,0 OK
Enable all the supported LTE bands			
Set	AT+SETLOCK=0,0	OK	AT+SETLOCK=0,0 OK
Configure allowed LTE band(s)			
Set	AT+SETLOCK=1,0,<band1>[,<band2>[,<band3>[,<band4>]]	OK	AT+SETLOCK=1,0,2,5,8 OK
Read LTE bands configuration			

Type	Syntax	Response	Example
Set	AT+SETLOCK=2,0	**If all the bands are enabled** +SETLOCK: 0 OK	AT+SETLOCK=2,0 +SETLOCK: 0 OK
		If only some bands are enabled +SETLOCK: <nr_of_bands>,<band1>[,<band2>[,<band3>[,<band4>]] OK	AT+SETLOCK=2,0 +SETLOCK: 2,5,8 OK

7.9.3 Defined values

Parameter	Type	Description
<op_code>	Number	Allowed values: • 0: enables all the bands • 1: configure allowed LTE band(s) • 2: read the allowed band configuration
<band1>,...,<band4>	Number	Specifies the LTE band to enable. Allowed values: • 1: LTE band 1 • 2: LTE band 2 • 3: LTE band 3 • 4: LTE band 4 • 5: LTE band 5 • 7: LTE band 7 • 8: LTE band 8 • 12: LTE band 12 • 20: LTE band 20 • 28:LTE band 28 • 66: LTE band 66
<nr_of_bands>	Number	Number of enabled bands.

7.10 Select GSM bands +SETBAND

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

7.10.1 Description

Sets the supported GSM bands; the MT can operate only using the configured bands.

☞ Reboot the module to make the change effective.

7.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+SETBAND=<band>	OK	AT+SETBAND=0 OK
Read	AT+SETBAND?	+SETBAND: <band> OK	+SETBAND: 0 OK

7.10.3 Defined values

Parameter	Type	Description
<band>	Number	Sets the supported GSM bands. Allowed values: • 0 (factory-programmed value): 900P, 900E, 850, 1800, 1900 • 1: 900E

Parameter	Type	Description
		• 2: 1800

7.11 Smart jamming detection +UJAD

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

7.11.1 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 condition occurs when simultaneously:

- The synchronization is lost (i.e. the MT is no longer camped on the serving cell and cannot select any other suitable cell)
- An interference is detected (i.e. the band scan reveals radio channels with power levels equal to or higher than a specified threshold)
- On all such carriers, no synchronization is possible

The jamming condition is cleared when any of the above mentioned statements does not hold.

The feature works independently on the RAT. 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. If the smart jamming detection per carrier is enabled (<op_code>=2, where supported) the +UJAD URC may be generated for each jammed cell detected by the module.

☞ The read command returns the <active> value, if and only if jamming detection has been previously enabled (<op_code>=1 or <op_code>=2).

7.11.2 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 **Or:** +UJAD: 2,0 OK
Test	AT+UJAD=?	+UJAD: (list of supported <op_code>s) OK	+UJAD: (0-1) OK
Smart jamming detection status (<op_code>=1)			
URC		+UJAD: <active>	+UJAD: 1
Smart jamming detection per carrier status (<op_code>=2)			
URC		+UJAD: <op_code>,<active>,<Lband>,<PhysCellID>,<EARFCN>,<dl_frequency>	+UJAD: 2,"DETECTED",1,1,300,2140

7.11.3 Defined values

Parameter	Type	Description
<op_code>	Number	Jamming detection operation mode: • 0: smart jamming detection disabled • 1: smart jamming detection enabled; the +UJAD URC may be generated • 2: smart jamming detection per carrier enabled; the +UJAD URC may be generated for each jammed cell detected by the module Allowed values: • LENA-R8 - 0 (factory-programmed value), 1
<active>	Number / String	Jamming detection status. Allowed values: • LENA-R8 o 0: jamming not detected o 1: jamming detected o 2: jamming unknown
<Lband>	Number	See <Lband>.
<PhysCellID>	Number	See <PhysCellID>.
<EARFCN>	Number	See <EARFCN>.
<dl_frequency>	Number	See <dl_frequency>.

7.11.4 Notes

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

LENA-R8

- The command setting is not stored in the NVM.

7.12 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

7.12.1 Description

Returns details of the current terminal's 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.

7.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSCON=<n>	OK	AT+CSCON=1 OK
Read	AT+CSCON?	+CSCON: <n>[,<mode>[,<state>[,<access>[,<coreNetwork>]]]] 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

7.12.3 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: • LENA-R8 - 0 (factory-programmed value), 1, 2, 3
<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 • 7: E-UTRAN connected • 8: NG-RAN connected state • 9: NG-RAN inactive state Allowed values: • LENA-R8 - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
<access>	Number	Indicates the radio access technology: • 0: GERAN • 1: UTRAN TDD • 2: UTRAN FDD • 3: E-UTRAN TTD • 4: E-UTRAN FDD • 5: NR Allowed values: • LENA-R8 - 0, 1, 2, 3, 4, 5
<coreNetwork>	Number	Indicates the core network type the UE is connected to: • 0: EPC • 1: 5GCND Allowed values: • LENA-R8 - 0, 1

7.13 Cell environment description +CCED

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

7.13.1 Description

Retrieves the cell parameters of the main and of up to ten GSM neighbor cells or nine LTE neighbor cells. It is possible to trigger the network scan periodically (by URC every 5 or 10 s) or on demand. The cell environment scan can be customized by means of the <requested_dump> parameter. The URC reporting is not supported during communication or registration.

7.13.2 Syntax

Type	Syntax	Response	Example
Generic syntax			

Type	Syntax	Response	Example
Set	AT+CCED=<mode>,<requested_dump>	+CCED:[<net_mode_display>:]... OK	AT+CCED=1,1 OK
One shot reporting of serving cell information			
Set	AT+CCED=0,1	**LTE RAT:** +CCED:LTE current cell:<MCC>,<MNC>,<imsi>,<roamingFlag>,<bandInfo>,<bandwidth>,<dlEarfcn>,<cellid>,<rsrp>,<rsrq>,<tac>,<SrxLev>,<pcid> OK	AT+CCED=0,1 +CCED:LTE current cell:222,88,222885850018995,0,1,n75,125,36b5a15,37,26,22060,16,163 OK
		GSM RAT: +CCED:GSM current cell info:<MCC>,<MNC>,<lac>,<cellid>,<bsic>,<rxlev>,<RxLevSub>,<Arfcn> OK	AT+CCED=0,1 +CCED:GSM current cell info:222,88,5fb7,1281,56,30,30,66 OK
Automatic reporting of serving cell information			
Set	AT+CCED=1,1	**LTE RAT:** +CCED:LTE current cell:<MCC>,<MNC>,<imsi>,<roamingFlag>,<bandInfo>,<bandwidth>,<dlEarfcn>,<cellid>,<rsrp>,<rsrq>,<tac>,<SrxLev>,<pcid> OK	AT+CCED=1,1 +CCED:LTE current cell:222,88,222885850018995,0,1,n75,125,36b5a15,37,26,22060,16,163 OK
		GSM RAT: +CCED:GSM current cell info:<MCC>,<MNC>,<lac>,<cellid>,<bsic>,<rxlev>,<RxLevSub>,<Arfcn> OK	AT+CCED=1,1 +CCED:GSM current cell info:222,88,5fb7,1281,56,30,30,66 OK
URC		**LTE RAT:** +CCED:LTE current cell:<MCC>,<MNC>,<imsi>,<roamingFlag>,<bandInfo>,<bandwidth>,<dlEarfcn>,<cellid>,<rsrp>,<rsrq>,<tac>,<SrxLev>,<pcid> ...	+CCED:LTE current cell:222,10,222105401145841,0,20,n50,6400,93a60c,36,10,23076,23,483 +CCED:LTE current cell:222,10,222105401145841,0,20,n50,6400,93a60c,36,10,23076,23,483 ....
		GSM RAT: +CCED:GSM current cell info:<MCC>,<MNC>,<lac>,<cellid>,<bsic>,<rxlev>,<RxLevSub>,<Arfcn> ...	+CCED:GSM current cell info:222,88,5fb7,1281,56,30,30,66 +CCED:GSM current cell info:222,88,5fb7,1281,56,30,30,66 ...
One shot reporting of neighbor cell information			
Set	AT+CCED=0,2	**LTE RAT:** +CCED:LTE neighbor cell:<MCC>,<MNC>,<frequency>,<cellid>,<rsrp>,<rsrq>,<tac>,<SrxLev>,<pcid> ... OK	AT+CCED=0,2 +CCED:LTE neighbor cell:222,50,9260,f533649,53,23,56396,34,150 +CCED:LTE neighbor cell:222,50,400,f533617,52,26,56396,37,150 +CCED:LTE neighbor cell:222,50,1500,f533653,51,25,56396,36,150 +CCED:LTE neighbor cell:222,88,6200,36b1306,45,22,22060,24,91 +CCED:LTE neighbor cell:222,50,2900,f53363f,42,25,56396,27,150 OK
		GSM RAT:	AT+CCED=0,2

Type	Syntax	Response	Example
		+CCED:GSM neighbor cell info:<MCC>,<MNC>,<lac>,<cellid>,<bsic>,<rxlev> OK	+CCED:GSM neighbor cell info:222,88,5fb7,1281,56,80 OK
Automatic reporting of neighbor cell information			
Set	AT+CCED=1,2	**LTE RAT:** +CCED:LTE neighbor cell:<MCC>,<MNC>,<frequency>,<cellid>,<rsrp>,<rsrq>,<tac>,<SrxLev>,<pcid> ... OK	AT+CCED=1,2 +CCED:LTE neighbor cell:222,50,9260,f533649,53,23,56396,34,150 +CCED:LTE neighbor cell:222,50,400,f533617,52,26,56396,37,150 +CCED:LTE neighbor cell:222,50,1500,f533653,51,25,56396,36,150 +CCED:LTE neighbor cell:222,88,6200,36b1306,45,22,22060,24,91 +CCED:LTE neighbor cell:222,50,2900,f53363f,42,25,56396,27,150 OK
		GSM RAT: +CCED:GSM neighbor cell info:<MCC>,<MNC>,<lac>,<cellid>,<bsic>,<rxlev> OK	AT+CCED=1,2 +CCED:GSM neighbor cell info:222,10,4e54,6a1a,51,91 +CCED:GSM neighbor cell info:222,10,4e54,98be,49,89 OK
URC		**LTE RAT:** +CCED:LTE neighbor cell:<MCC>,<MNC>,<frequency>,<cellid>,<rsrp>,<rsrq>,<tac>,<SrxLev>,<pcid> ...	+CCED:LTE neighbor cell:222,10,9460,93a63e,37,15,23076,24,315 +CCED:LTE neighbor cell:222,10,9460,93a63d,34,9,23076,21,135 ....
		GSM RAT: +CCED:GSM neighbor cell info:<MCC>,<MNC>,<lac>,<cellid>,<bsic>,<rxlev> ...	+CCED:GSM neighbor cell info:222,10,4e54,6a1a,51,91 +CCED:GSM neighbor cell info:222,10,4e54,98be,49,89 ...
One shot reporting of serving cell received signal strength			
Set	AT+CCED=0,8	+CCED: <RSSI>,<ber> OK	AT+CCED=0,8 +CCED: 17,99 OK
Automatic reporting of serving cell received signal strength			
Set	AT+CCED=1,8	+CCED: <RSSI>,<ber> OK	AT+CCED=1,8 +CCED: 17,99 OK
URC		+CCED: <RSSI>,<ber> +CCED: <RSSI>,<ber> ...	+CCED: 19,99 +CCED: 18,99 ...
Stop URC reporting			
Set	AT+CCED=2,<requested_dump>	OK	AT+CCED=2,0 OK
Test	AT+CCED=?	+CCED: (list of supported <mode>s),(list of supported <requested_dump>s) OK	+CCED: (0,1,2),(1,2,8) OK

7.13.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 0: single shot requested • 1: enable URC reporting • 2: stop URC reporting
<requested_dump>	Number	Allowed values: • 1: serving cell information is provided. When URC reporting is enabled an URC is issued every 5 s. • 2: neighbor cell information is provided. The information up to 10 GSM neighbor cells or 9 LTE neighbor cells is available. When URC reporting is enabled an URC is issued every 5 s. • 8: serving cell received signal strength. When URC reporting is enabled an URC is issued every 10 s.
<net_mode_display>	String	Allowed values: • GSM current cell info • GSM neighbor cell info • LTE current cell • LTE neighbor cell
<MCC>	Number	Mobile country code
<MNC>	Number	Mobile network code
<lac>	Number	Location area code. The parameter determines the two-byte location area code in hexadecimal format (e.g. 00C1 equals 193 in decimal) of the cell that was scanned. The range is 0-65535.
<cellid>	Number	Cell ID. The upper 24 bits for eNodeB-ID and the lower 8 bits for Cell-ID in LTE mode.
<bsic>	Number	Base station identification code. The range is 0-63.
<RxLev>	Number	Received signal level
<RxLevSub>	Number	Rxlev value calculated by Sub mode
<Arfcn>	Number	The absolute radio frequency channel number
<imsi>	Number	International mobile subscriber identity
<roamingFlag>	Number	Roaming Flag
<bandInfo>	Number	Band information
<bandwidth>	String	Allowed values: • n6 • n15 • n25 • n50 • n75 • n100 String is not enclosed in "".
<dlEarfcn>	Number	DL E-UTRA Absolute Radio Frequency Channel Number
<rsrp>	Number	Reference signal received power
<rsrq>	Number	Reference signal received quality
<tac>	Number	Tracking Area Code
<SrxLev>	Number	Cell selection RX level value
<pcid>	Number	Physical cell id
<frequency>	Number	Frequency
<RSSI>	Number	Received signal strength indication: • 0: -113 dBm or less • 1: -111 dBm • 2...30: -109. . . -53 dBm • 31: -51 dBm or greater • 99: not known or not detectable
<ber>	Number	Allowed values: • 0...7: RX quality • 99: not known or not detectable

7.14 Read GSM/LTE cells +GTCCINFO

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

7.14.1 Description

Retrieves the cell parameters of the serving cell and neighbor cells.

7.14.2 Syntax

Type	Syntax	Response	Example
Read	AT+GTCCINFO?	**LTE network:** +GTCCINFO: LTE service cell:1,4,<mcc>,<mnc>,<tac>,<cellid>,<earfcn>,<physicalcellId>,<band>,<bandwidth>,<rssnr_value>,<rxlev>,<rsrp>,<rsrq> +GTCCINFO: LTE neighbor cell:2,4,<mcc>,<mnc>,<tac>,<cellid>,<earfcn>,<physicalcellId>,<bandwidth>,<rxlev>,<rsrp>,<rsrq> [+GTCCINFO: LTE neighbor cell:2,4,<mcc>,<mnc>,<tac>,<cellid>,<earfcn>,<physicalcellId>,<bandwidth>,<rxlev>,<rsrp>,<rsrq>] [...] OK **GSM network:** +GTCCINFO:GSM service cell:1,4,<mcc>,<mnc>,<lac>,<cellid>,<arfcn>,<basic>,<band>,<txpwr>,<dtx_used>,<c1>,<c2>,<access_tech>,<rsvd>,<maio>,<hsn>,<rxlevsub>,<rxlevfull>,<rxqualsub>,<rxqualfull>,<rxlev>,<rssi>,<ber_lev> +GTCCINFO:GSM neighbor cell:2,4,<mcc>,<mnc>,<lac>,<cellid>,<arfcn>,<basic>,<c1>,<c2>,<c31>,<c32>,<rxlev>,<rssi> [+GTCCINFO:GSM neighbor cell:2,4,<mcc>,<mnc>,<lac>,<cellid>,<arfcn>,<basic>,<c1>,<c2>,<c31>,<c32>,<rxlev>,<rssi>] [...] OK	AT+GTCCINFO? +GTCCINFO:LTE service cell:1,4,460,00,4318,16886789,38950,312,40,n100,67,40,57,21 +GTCCINFO:LTE neighbor cell:2,4,460,00,4318,16888080,38950,131,n100,37,54,16 ... OK

7.14.3 Defined values

Parameter	Type	Description
<mcc>	Number	Mobile country code (first part of the PLMN code)
<mnc>	Number	Mobile network code (second part of the PLMN code)
<lac>	Number	Location area code. The parameter determines the two-byte location area code in hexadecimal format (e.g. 00C1 equals 193 in decimal) of the cell that was scanned. The range is 0-65535.
<tac>	Number	Tracking Area Code
<cellid>	Number	Cell ID. The parameter determines the 16-bit (GSM) cell ID. The range is 0-0xFFFFFFF.
<earfcn>	Number	E-arfcn

Parameter	Type	Description
<physicalcellId>	Number	Physical cell id
<basic>	Number	Base station identification code. The range is 0-63.
<band>	Number	Frequency value
<bandwidth>	String	Allowed values: • n6 • n15 • n25 • n50 • n75 • n100 String is not enclosed in "".
<rssnr_value>	Number	Signal to interference plus noise ratio
<rxlev>	Number	Cell selection RX level value
<txpwr>	Number	TX power level for the UE
<c1>	Number	Cell selection criterion
<c2>	Number	Cell reselection criterion
<rssi>	Number	Received signal strength indication: • 0: -113 dBm or less • 1: -111 dBm • 2...30: -109. . . -53 dBm • 31: -51 dBm or greater • 99: not known or not detectable
<arfcn>	Number	The parameter determines the ARFCN of the cell that was scanned. The range is 0-10 23.
<c31>	Number	GPRS cell selection criterion
<c32>	Number	GPRS cell reselection criterion
<rsrp>	Number	Reference signal received power
<rsrq>	Number	Reference signal received quality
<dtx_used>	Number	Used dtx
<access_tech>	Number	Access technology
<rsvd>	Number	Reserved
<maio>	Number	Mobile allocation index offset
<hsn>	Number	Hopping sequence number
<rxlevsub>	Number	RX level (sub). The range is 0-63.
<rxlevfull>	Number	RX level (full). The range is 0-63.
<rxqualsub>	Number	RX quality (sub). The range is 0-7.
<xqualfull>	Number	RX quality (full). The range is 0-7.

8 IP Multimedia Subsystem (IMS)

8.1 Configure VoLTE support +SETVOLTE

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

8.1.1 Description

Configures the VoLTE support.

8.1.2 Syntax

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

8.1.3 Defined values

Parameter	Type	Description
<enable>	Number	Allowed values: • 0: VoLTE disabled • 1 (factory-programmed value): VoLTE enabled

9 Device lock

9.1 Enter PIN +CPIN

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

9.1.1 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.

9.1.2 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	

9.1.3 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

9.1.4 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"
```

9.2 Read remaining SIM PIN attempts +UPINCNT

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

9.2.1 Description

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

9.2.2 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

9.2.3 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
<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

9.2.4 Notes

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

9.3 Facility lock +CLCK

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

9.3.1 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.

9.3.2 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

9.3.3 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 [93]) • "PU": network sUbset Personalisation (see the 3GPP TS 22.022 [93]) • "PP": service Provider Personalisation (see the 3GPP TS 22.022 [93]) • "PC": Corporate Personalisation (see the 3GPP TS 22.022 [93]) • "PS": SIM/USIM Personalisation (see the 3GPP TS 22.022 [93]) • "FD": SIM fixed dialling phonebook feature • "AO": BAR (Bar All Outgoing Calls) • "OI": BOIC (Bar Outgoing International Calls) • "OX": BOIC-exHC(Bar Outgoing International Calls except to Home Country) • "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 [76]) • "PF": Lock Phone to the very First inserted SIM/UICC card (see the 3GPP TS 27.007 [76]) • "NT": Barr incoming calls from numbers Not stored to TA memory (see the 3GPP TS 27.007 [76])

Parameter	Type	Description
		• "NM": Barr incoming calls from numbers Not stored to MT memory (see 3GPP TS 27.007 [76]) • "NS": Barr incoming calls from numbers Not stored to SIM/UICC memory (see the 3GPP TS 27.007 [76]) • "NA": Barr incoming calls from numbers Not stored in any memory (see the 3GPP TS 27.007 [76])
<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

9.3.4 Notes

Module series	SC	PN	PU	PP	PC	PS	FD	AO	OI	OX	AI	IR	AB	AG	AC	CS	PF	NT	NM	NS	NA
LENA-R8	x						x	x	x	x											

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

9.4 Change password +CPWD

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

9.4.1 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.

9.4.2 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

9.4.3 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

Parameter	Type	Description
<pwdlength>	Number	Length of password (digits)

9.4.4 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.

LENA-R8

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

9.5 Custom SIM lock +USIMLCK

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

9.5.1 Description

Allows locking the module to work only with user-defined sets of SIM cards (e.g. a subset of networks, with a specified SIM card). According to the 3GPP TS 22.022 [93] there are different kinds of lock as follows:

- Network
- Network Subset
- SIM
- Service Provider (not supported)
- Corporate (not supported)

The module is locked according to user needs even if the SIM card is not inserted or the PIN code is not provided.

9.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+USIMLCK=<facility>,<pers_data>,<pwd>,<status>	OK	AT+USIMLCK="PN","222.01", "12345678",1 OK
Test	AT+USIMLCK=?	+USIMLCK: (list of supported <facility>s),,,(list of supported <status>) OK	+USIMLCK: ("PN","PU","PS"),,,(0-1) OK

9.5.3 Defined values

Parameter	Type	Description
<facility>	String	Personalization type, which can be: • "PN" Network personalization • "PU" Networks subset personalization • "PS" SIM/USIM personalization
<pers_data>	String	Data for device personalization. The contents depend on the selected <facility>. • If <facility> is "PN": <pers_data> is in the format: "MCC1.MNC1min[-MNC2max][,MCC2.MNC2min[-MNC2max]... [, MCCn.MNCnmin[-MNCnmax]]" It contains a list of comma-separated pairs of MCCs and MNC ranges. • If <facility> is "PU": <pers_data> is in the format: "MCC1.MNC1min[-MNC2max][,MCC2.MNC2min[-MNC2max]... [,MCC10.MNC10min[-MNC10max]]:MSIN1[,MSIN2...[,MSIN10]]"

Parameter	Type	Description
		It contains a list of comma-separated pairs of MCCs+MNC ranges as above; a list of comma-separated MSIN(s) or ranges of MSINs is appended after the MCC/MNC range using a ':' as separator. At most 10 personalizations can be simultaneously configured. MSINs can be written with wildcards ('*') with the syntax: [*[*]]D1[D2[...]] (one wildcard for each MSIN digit to skip) followed by one or more digits. It is possible to use ranges of MSIN digits; in this case the minimum and maximum values should have the same number of wildcard and the same number of digits. In addition it is possible to concatenate more MSIN ranges with the comma separator (example: "123.456:56,**70-**72"). In this case all ranges must create a non empty set since MSIN comma separator behavior is an AND operator: an empty set means that any SIM is accepted • If <facility> is "PS": <pers_data> contains a list of at most 10 IMSIs; the format of the string is: "IMSI1, IMSI2,...,IMSIn"
<pwd>	String	Password to enable/disable the personalization. The password length goes from 6 to 16 digits.
<status>	Number	• 0: feature set but disabled • 1: feature set and enabled

9.5.4 Notes

- The current personalization status can be queried using the AT+CLCK command with the proper facilities <fac> and the query status mode <mode>=2.
- At the end of command execution, the module is deregistered from network, reset and rebooted.
- A maximum of 5 attempts are allowed if a wrong password is inserted during an unlock operation with +CLCK command; after that, further unlock operations are blocked. The ME can still be used with the right SIM.
- The following error result codes could be provided:

Verbose string	Numeric code	Meaning
+CME ERROR: invalid characters in text string	25	An error is present in the <pers_data> format
+CME ERROR: operation not allowed	3	The user attempted the module personalization with an already active facility. An unlock operation must be performed before. Alternatively, an internal driver error occurred
+CME ERROR: incorrect password	16	The password format or length is wrong

- If the SIM lock is disabled it is possible to enable the lock with AT+CLCK command providing needed parameters (<fac>, <mode>=1 and the password); otherwise the same personalization type can be modified at any time by means of AT+USIMLCK command.
- If the SIM lock is enabled the same personalization can be modified only if before it has been disabled through AT+CLCK command.

10 Short Messages Service

10.1 Introduction

For a complete overview of SMS, see 3GPP TS 23.040 [81] and 3GPP TS 27.005 [87].

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

10.1.1 Class 0 SMS

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

- LENA-R8 - by default class 0 SMSes are only displayed by the +CLASS0 URC. The storing of a class 0 SMS can be enabled by the +MTSMSCLASS0 AT command.

10.1.2 <index> parameter range

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

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

- LENA-R8
  - Values between 1 and 100: SMS stored in ME.
  - Values between 1 and n: SMS stored in SIM (n depends on SIM card used).

BM (Broadcast Message):

- LENA-R8 - Broadcast Message storage is not supported.

SR (Status Report):

- LENA-R8 - Status Report storage is not supported.

10.1.3 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.

10.2 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

10.2.1 Description

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

10.2.2 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

10.2.3 Defined values

Parameter	Type	Description
<service>	Number	Allowed values: • 0: see 3GPP TS 23.040 [81] and 3GPP TS 23.041 [82]; syntax of AT commands is compatible with 3GPP TS 27.005 [87] phase 2; phase 2+ features may be supported if no new command syntax is required • 1: see 3GPP TS 23.040 [81] and 3GPP TS 23.041 [82]; syntax of AT commands is compatible with 3GPP TS 27.005 [87] phase 2+
<mt>	Number	Mobile terminated messages: • 0: not supported • 1: supported
<mo>	Number	Mobile originated messages: • 0: not supported • 1: supported
<bm>	Number	Broadcast messages: • 0: not supported • 1: supported

10.3 Preferred message storage +CPMS

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

10.3.1 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.

10.3.2 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	+CPMS: ("MT","ME","SM","BM","SR"),("MT","ME","SM"),("MT","ME","SM")

Type	Syntax	Response	Example
		<mem2>s),(list of supported <mem3>s) OK	OK

10.3.3 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>

10.3.4 Notes

- LENA-R8 - the factory-programmed value is "SM", "SM" and "SM".

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- "BM" and "SR" message storages are not supported.

10.4 Configure storing of class 0 SMS +MTSMSCLASS0

+MTSMSCLASS0						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

10.4.1 Description

Configures the storing of class 0 SMSes:

- When **<storing>=0**, the class 0 SMSes are not stored, but simply displayed by the +CLASS0 URC.
- When **<storing>=1**, the class 0 SMSes are stored according to the +CPMS AT command setting, and the SMS are handled like all the SMSes. No +CLASS0 URC is issued.

The +CLASS0 URC reporting format is configured according to the +CMGF AT command.

10.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+MTSMSCLASS0=<storing>	OK	AT+MTSMSCLASS0=1 OK
Read	AT+MTSMSCLASS0?	+MTSMSCLASS0: <storing>	+MTSMSCLASS0: 0 OK
URC		**If +CMGF: 0 (PDU mode)** +CLASS0: , <length><CR><LF><CR><LF> <PDU>	+CLASS0: ,23 0791932350591711040 C91938359542419001032 30 611132254004F4F29C0E
		If +CMGF: 1 (text mode) +CLASS0: <oa>,, <scts><CR><LF><CR><LF> <text>	+CLASS0: "+393890054999",,"20 23/03/16,11:26:16+04" test

10.4.3 Defined values

Parameter	Type	Description
<storing>	Number	Enable / disable the storing of class 0 SMSes. Allowed values: • 0 (default value): the class 0 SMSes are not stored, but simply displayed by the +CLASS0 URC. • 1: the class 0 SMSes are stored according to the +CPMS AT command setting. The +CLASS0 URC is disabled.
<length>	Number	PDU's length in octets without the service center's address. In example: 03912143010 0038166F6000004E374F80D: 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). The parameter is not enclosed in "".
<oa>	String	Originator address.
<scts>	String	Service center time stamp in time-string format.
<text>	String	SMS text. The parameter is not enclosed in "".

10.5 Preferred message format +CMGF

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

10.5.1 Description

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

10.5.2 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

10.5.3 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

10.6 Show text mode parameters +CSDH

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

10.6.1 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.

10.6.2 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

10.6.3 Defined values

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

10.7 New message indication +CNMI

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

10.7.1 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 [80].

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).

10.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+CNMI=[<mode>[,<mt>[,<bm>[,<ds>[,<bfr>]]]]]	OK	AT+CNMI=1,1 OK
Read	AT+CNMI?	+CNMI: <mode>,<mt>,<bm>,<ds>,<bfr>	+CNMI: 0,0,0,0,0

Type	Syntax	Response	Example
		OK	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>	

10.7.3 Defined values

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

Parameter	Type	Description
		(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 [81] TP-User-Data in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [80] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS command in 3GPP TS 27.0 07 [76]): 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 [82] CBM Content of Message in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [80] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS in 3GPP TS 27.007 [76]): 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

Parameter	Type	Description
<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 [82]
<pages>	Number	CBM Page Parameter bits 0-3 in integer format as described in 3GPP TS 23.041 [82]
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [81])
<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

10.8 Select service for MO SMS messages +CGSMS

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

10.8.1 Description

Specifies the service (PS or CS) or service preference that the MT will use to send MO SMS messages.

In particular:

- in 2G RAT, PS service means GPRS and CS service means transmission on GSM dedicated channels;
- in 3G RAT, PS service means transmission on PS domain SRB (Signalling Radio Bearer) and CS service means transmission on CS domain SRB; SRB can be mapped to several UMTS transport channels, e.g. RACH/FACH or DCH;
- in 4G RAT, PS service means IMS messaging on EPS bearers and CS service means transmission on SGs (Signalling Gateways).

10.8.2 Syntax

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

10.8.3 Defined values

Parameter	Type	Description
<service>	Number	Service or service preference to be used: • 0 (default value): PS • 1 (factory-programmed value): CS • 2: PS preferred (use CS if PS is not available) • 3: CS preferred (use PS if CS is not available)

10.9 Read message +CMGR

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

10.9.1 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.

10.9.2 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 **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**	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

Type	Syntax	Response	Example
		+CMGR: <stat>,<fo>,<ct>[,<pid>,[<mn>],[<da>],[<toda>],<length> [<cdata>]] OK	
		CBM storage +CMGR: <stat>,<sn>,<mid>,<dcs>,<page>,<pages> <data> OK	
	PDU mode (+CMGF=0): AT+CMGR=<index>	+CMGR: <stat>,[<alpha>],<length> <pdu> OK	AT+CMGR=1 +CMGR: 1,,40 0791934329002000040C91932309826614000080703280452180 18D4F29CFE06B5CBF379F87C4EBF41E434082E7FDBC3 OK
Test	AT+CMGR=?	OK	

10.9.3 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 [85]. 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 [81])
<pid>	Number	TP-Protocol-Identifier (default 0); see the 3GPP TS 23.040 [81]
<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 [85]); 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 [81] TP-User-Data in text mode responses; format:
		• if <dcs> indicates that 3GPP TS 23.038 [80] 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 [82] CBM Content of Message in text mode responses; format:

Parameter	Type	Description
		• if <dcs> indicates that 3GPP TS 23.038 [80] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see +CSCS command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<vp>	Number	Format depending of the <fo> setting: • Relative format: validity period starting from when the SMS is received by the SMSC, in range 0-255 (default value 167); for more details see the 3GPP TS 23.040 [81] • 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 [81]); 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 [81] 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 [82] CBM Page Parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [82] 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

10.10 New message acknowledgement to MT +CNMA

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

10.10.1 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 [86] 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.

10.10.2 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

10.10.3 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 [81] TP-FCS value set to 'FF' (unspecified error cause))
<length>	Number	PDU's length in octets without the Service Center's address

10.11 List message +CMGL

+CMGL						
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

10.11.1 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".

10.11.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGL[=<stat>]	**Command successful and SMS-DELIVERs:** +CMGL: <index>,<stat>,<oa>,[<alpha>],[<scts>][,<tooa>,<length>] <data> [+CMGL: <index>,<stat>,<oa>,[<alpha>],[<scts>][,<tooa>,<length>]<data>[...]] OK	AT+CMGL +CMGL: 303,"REC READ","+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:	

Type	Syntax	Response	Example
		+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

10.11.3 Defined values

Parameter	Type	Description
<stat>	Number or String	Number type in PDU mode (default value: 4), or string type in text mode (default value: "ALL"); indicates the status of message in memory: • 0: in PDU mode or "REC UNREAD" in text mode: received unread SMS messages • 1: in PDU mode or "REC READ" in text mode: received read SMS messages • 2: in PDU mode or "STO UNSENT" in text mode: stored unsent SMS messages • 3: in PDU mode or "STO SENT" in text mode: stored sent SMS messages • 4: in PDU mode or "ALL" in text mode: all SMS messages
<index>	Number	Storage position
<oa>	String	Originator address
<alpha>	String	Alphanumeric representation of <da> or <oa> corresponding to the entry found in the phonebook 3GPP TS 24.008 [85]. 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

Parameter	Type	Description
<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 [81]; format: • if DCS indicates that 3GPP TS 23.038 [80] 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 [82] CBM Content of Message in text mode responses; format: • if DCS indicates that 3GPP TS 23.038 [80] 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 [81])
<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 [82] CBM Page Parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [82] 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

10.12 Send message +CMGS

+CMGS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	Appendix B.4	+CMS Error

10.12.1 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.

10.12.2 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> > 039121430100038166F600000 4E374F80D<Ctrl-Z> +CMGS: 2 OK
Test	AT+CMGS=?	OK	

10.12.3 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 [81] RP-User-Data element of RP-ACK PDU; the format is same as for <PDU> in case of SMS

10.13 Write message to memory +CMGW

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

10.13.1 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.

10.13.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):**	+CMGW: <index> OK	AT+CMGW="091137880"<CR> > This is the text<Ctrl-Z>

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

10.13.3 Defined values

Parameter	Type	Description
<da>	String	TP-Destination-Address Address-Value field (see the 3GPP TS 23.040 [81]); 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 [81]); 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 [86]); see the <toda> parameter for the default value
<toda>	Number	TP-Destination-Address Type-of-Address octet (see the 3GPP TS 24.011 [86]); when the first character of <da> is + (IRA 43) the default value is 145, otherwise it is 129)
<stat>	Number or String	Number type in PDU mode (default value: 2), or string type in text mode (default value: "STO UNSENT"); it indicates the message status in memory: • 0: in PDU mode or "REC UNREAD" in text mode: received unread SMS messages • 1: in PDU mode or "REC READ" in text mode: received read SMS messages • 2: in PDU mode or "STO UNSENT" in text mode: stored unsent SMS messages • 3: in PDU mode or "STO SENT" in text mode: stored sent SMS messages
<text>	String	SMS string
<index>	Number	Storage position
<length>	Number	The parameter meaning depends on the message format: • In text mode: number of characters • In PDU mode: PDU's length in octets without the Service Center's address. In example: 039121430100038166F6000004E374F80D is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length>=13.
<PDU>	String	Protocol Data Unit: each 8-bit octet of the PDU must be written as two IRA character long hexadecimal numbers, e.g. an octet with integer value 42 must be written as two characters 2A (IRA 50 and 65)

10.14 Send message from storage +CMSS

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

10.14.1 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.

10.14.2 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	

10.14.3 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

10.15 Set text mode parameters +CSMP

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

10.15.1 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 [80] and the 3GPP TS 23.040 [81].

☞ LENA-R8
The command setting is stored in the NVM following the procedure described in the Saving AT commands configuration section.

10.15.2 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	

10.15.3 Defined values

Parameter	Type	Description
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [81]). The factory-programmed value is 17.
<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

Parameter	Type	Description
		• Relative format: validity period, counted from when the SMS-SUBMIT is received by the SMSC, in range 0-255 (the factory-programmed value is 167); for more details see the 3GPP TS 23.040 [81] <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 [81]); the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<pid>	Number	TP-Protocol-Identifier (factory-programmed value: 0); see the 3GPP TS 23.040 [81]
<dcs>	Number	Data Coding Scheme. The factory-programmed value is 0.

10.16 Delete message +CMGD

+CMGD						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	Appendix B.4	+CMS Error

10.16.1 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.

10.16.2 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

10.16.3 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

10.17 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

10.17.1 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.

☞ LENA-R8
The command stores the SMS Service Center Address in the SIM card.

10.17.2 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	

10.17.3 Defined values

Parameter	Type	Description
<sca>	String	Service center address.
<tosca>	String	Type of address of <sca> (for more details refer to 3GPP TS 24.008 [85]); the default value is 145 when string includes '+', otherwise the default is 129.

11 Supplementary services

11.1 Introduction

Supplementary services (SS) allow to configure how the incoming or mobile originated voice calls are handled. Cellular standards provide call related supplementary services (CRSS), that operate on calls while they are active (e.g. performing call hold or merge of calls in a multi-party conversation), and others that imply a signalling session with the mobile network to perform query and set of the specific supplementary service (e.g. call barring or call forwarding). Unstructured Supplementary Services Data (USSD) are mobile terminated or originated signalling transactions, where a binary string is transmitted to the network to retrieve information on the subscription (e.g. residual credit) or sent from the NW to notify the subscriber of specific events.

On VoLTE capable modules, supplementary services operate on VoLTE calls in the same way they work on legacy speech calls. Query and set of supplementary services are performed via XCAP (XML Configuration Access Protocol), that is an HTTP-based service that uses a specific default EPS bearer on a specific XCAP APN (see +UIMSCFG, XCAP_APN value of <ImsConfig> parameter) to accomplish the query or the update of the SS. Usually supplementary services via XCAP require IMS registration to be performed; if the device has not yet successfully completed IMS registration, the SS is carried out via CSFB if 2G or 3G RAT is supported.

11.2 Calling line identification presentation +CLIP

+CLIP						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 3 min (<1 s for prompt ">" when present)	+CME Error

11.2.1 Description

Controls the Calling Line Identification Presentation (CLIP) supplementary service, but it has no effect on the execution of CLIP service in the network. When the CLI (Calling Line Identification) is enabled, the command response is returned after every RING unsolicited result code. The URC is displayed after RING if the CLI presentation at the TE is enabled.

☞ LENA-R8
The +CLIP URC is displayed only after the first RING unsolicited result code.

11.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+CLIP=[<n>]	OK	AT+CLIP=1 OK
Read	AT+CLIP?	+CLIP: <n>,<m> OK	+CLIP: 0,2 OK
Test	AT+CLIP=?	+CLIP: (list of supported <n>s) OK	+CLIP: (0-1) OK
URC		+CLIP: <number>,<type>[,<subaddr>,<satype>[,<alpha>[,<CLI validity>]]]	

11.2.3 Defined values

Parameter	Type	Description
<n>	Number	Optional parameter sets/shows the result code presentation in the TA: • 0 (default value): disable • 1: enable
<m>	Number	Shows the subscriber CLIP service status in the network • 0: CLIP not provisioned

Parameter	Type	Description
		• 1: CLIP provisioned • 2: unknown
<number>	String	Phone number of calling address in format specified by <type>.
<type>	Number	Type of address octet.
<subaddr>	String	Subaddress of format specified by <satype>.
<satype>	Number	Type of subaddress octet.
<alpha>	String	Optional string type alphanumeric representation of <number> corresponding to the entry found in phonebook; the parameter is not managed.
<CLI validity>	Number	• 0: CLI valid • 1: CLI has been withheld by the originator • 2: CLI is not available

11.2.4 Notes

- When CLI is not available (<CLI validity>=2), the <number> parameter shall be an empty string ("") and <type> value will not be significant. Nevertheless, the TA may return the recommended value 128 for <type> (TON/NPI unknown). When CLI has been withheld by the originator, (<CLI validity>=1) and the CLIP is provisioned with the "override category" option (see the 3GPP TS 22.081 [96] and 3GPP TS 23.081 [97]), <number> and <type> is provided. Otherwise, TA shall return the same setting for <number> and <type> as if the CLI was not available.

12 V24 control and V25ter

12.1 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).

12.2 Circuit 109 behavior &C

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

12.2.1 Description

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

12.2.2 Syntax

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

12.2.3 Defined values

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

12.2.4 Notes

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

12.3 Circuit 108/2 and escape sequence behavior &D

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

12.3.1 Description

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

It also controls how the escape sequence may change the on-line data state.

12.3.2 Syntax

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

12.3.3 Defined values

Parameter	Type	Description
<value>	Number	Allowed values: • 0: the DCE ignores circuit 108/2 • 1: upon an ON-to-OFF transition of circuit 108/2, the DCE enters online command state and issues the final result code • 2: upon an ON-to-OFF transition of circuit 108/2, the DCE performs an orderly cleardown of the call. The automatic answer is disabled while circuit 108/2 remains OFF The default and factory-programmed value is: • LENA-R8 - 1

12.3.4 ~+++ behavior

- A special meaning of the &D value is provided for the ~+++ sequence during a PS data transfer with PPP L2 protocol (this is outside the ITU-T V.25ter recommendation [208] scope). The ~+++ causes context deactivation during a PS data transfer session for the AT&D0 and AT&D2 value (the +++ return to on-line command mode is provided for each &D value during a CS data call)
- A different implementation for the ~+++ is done with the &D1 value: the PS data transfer is escaped and the system returns in the on-line command state. The ATO command is used to resume the PS data transfer session

☞ For more details, see the ITU-T recommendation V250 [207], ITU-T V.25ter recommendation [208] and ITU-T V.32 recommendation [209].

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

12.3.5 DTR, +++ behavior

PS data mode (PPP L2 protocol case)		
Event	**DTE sends ~+++**	**DTR ON-to-OFF transition**
&D0	DCE enters online command mode	No action
&D1	DCE enters online command mode	DCE enters online command mode
&D2	DCE enters online command mode	Context deactivation

Table 6: PS data mode

12.3.6 Notes

- The escape sequence for the PS data mode with a L2 protocol different from the PPP is not ~+++, and it could be not supported. For more information, see the S2 notes.

12.4 DSR override &S

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

12.4.1 Description

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

12.4.2 Syntax

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

12.4.3 Defined values

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

12.4.4 Notes

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

12.5 Flow control &K

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

12.5.1 Description

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

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

12.5.2 Syntax

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

12.5.3 Defined values

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

12.5.4 Notes

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

12.6 DTE-DCE character framing +ICF

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

12.6.1 Description

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

☞ The following restrictions must be reminded:

- If a data frame format refers to a frame without parity (ex. <format>=3), the command is accepted, but the parity value is ignored; it is returned by the +ICF read command (and displayed in the current personal profile configuration where supported) but it has no meaning

- The command setting is ignored when the AT command interface runs on the USB or on the SPI interface

12.6.2 Syntax

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

12.6.3 Defined values

Parameter	Type	Description
<format>	Number	• 0: auto detect • 1: 8 data 2 stop • 2: 8 data 1 parity 1 stop • 3: 8 data 1 stop • 4: 7 data 2 stops • 5: 7 bit, 1 parity, 1 stop • 6: 7 bit, 1 stop Allowed values: • LENA-R8 - 1, 2, 3 (default and factory-programmed value)
<parity>	Number	• 0: odd • 1: even Allowed values: • LENA-R8 - 0, 1 (default and factory-programmed value)

12.7 DTE-DCE local flow control +IFC

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

12.7.1 Description

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

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

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

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

12.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+IFC=[<DCE_by_DTE>[,<DTE_by_DCE>]]	OK	AT+IFC=2,2 OK

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

12.7.3 Defined values

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

12.7.4 Notes

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

12.8 UART data rate configuration +IPR

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

12.8.1 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.

12.8.2 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

12.8.3 Defined values

Parameter	Type	Description
<rate>	Number	Allowed baud rates expressed in b/s (0, if present, means autobauding): • LENA-R8 - 0 (factory-programmed value), 115200 (default value), 230400, 460800 , 921600

12.8.4 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.

12.8.5 Autobauding description

LENA-R8

One shot autobauding is supported: automatic baud rate detection is performed only once, at module start-up. After the detection, the module works at the fixed baud rate (the detected one).

12.9 Return to on-line data state O

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

12.9.1 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.

12.9.2 Syntax

Type	Syntax	Response	Example
Action	ATO	<response>	ATO CONNECT

12.9.3 Defined values

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

12.9.4 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).

12.10 Command line termination character S3

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

12.10.1 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.

12.10.2 Syntax

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

12.10.3 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)).

12.11 Response formatting character S4

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

12.11.1 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.

12.11.2 Syntax

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

12.11.3 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)).

12.12 Command line editing character S5

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

12.12.1 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.

12.12.2 Syntax

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

12.12.3 Defined values

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

12.13 Command echo E

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

12.13.1 Description

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

12.13.2 Syntax

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

12.13.3 Defined values

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

12.14 Result code suppression Q

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

12.14.1 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.

12.14.2 Syntax

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

12.14.3 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

12.15 DCE response format V

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

12.15.1 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.

12.15.2 Syntax

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

12.15.3 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

12.16 Reset to default configuration Z

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

12.16.1 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.

12.16.2 Syntax

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

12.16.3 Defined values

Parameter	Type	Description
<value>	Number	Profile index, optional parameter. Allowed values: • LENA-R8 - 0 (default value), 1

12.17 Set to factory defined configuration &F

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

12.17.1 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.

12.17.2 Syntax

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

12.17.3 Defined values

Parameter	Type	Description
<value>	Number	Only 0 allowed

12.18 Store current configuration &W

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

12.18.1 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.

12.18.2 Syntax

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

12.18.3 Defined values

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

12.19 Display current configuration &V

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

12.19.1 Description

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

12.19.2 Syntax

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

13 SIM management

13.1 Generic SIM access +CSIM

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

13.1.1 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.

13.1.2 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

13.1.3 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 [89] and ETSI TS 102 221 [168]
<response>	String	Response to the command passed on by the SIM to the MT (3GPP TS 51.011 [89] and ETSI TS 102 221 [168])

13.2 Restricted SIM access +CRSM

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

13.2.1 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.

13.2.2 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

13.2.3 Defined values

Parameter	Type	Description
<command>	Number	Allowed commands: • 176: read binary • 178: read record • 192: get response • 203: retrieve data • 214: update binary • 219: set data • 220: update record • 242: status Allowed values: • LENA-R8 - 176, 178, 192, 214, 220, 242, 203, 219
<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 [90].
<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 [89] and ETSI TS 102 221 [168].
<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 [168] (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 [168].
<sw1>, <sw2>	Number	Contains SIM information about the execution of the actual command and can be (more details in 3GPP TS 51.011 [89] and ETSI TS 102 221 [168]). 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

Parameter	Type	Description
		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 [89] and the ETSI TS 102 221 [168]). 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.

14 Packet switched data services

14.1 PDP contexts and parameter definition

14.1.1 Primary and secondary PDP contexts

A PDP context can be either **primary** or **secondary**. In LTE, PS data connections are referred to as EPS bearers: EPS bearers are conceptually equivalent to the legacy PDP contexts, which are often referred to for sake of simplicity. Similarly to a PDP context, the EPS bearer can be a default (primary) or dedicated (secondary) one. The initial EPS bearer established during LTE attach procedure is actually a default EPS bearer. A secondary PDP context uses the same IP address of a primary PDP context (the usual PDP context activated e.g. via dial-up). The Traffic Flow Filters for such secondary contexts shall be specified according to 3GPP TS 23.060 [83].

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.

14.1.2 Multiple PDP contexts

Two PDP context types are defined:

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

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

- Using the MT's embedded TCP/IP stack, only 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.

14.1.3 Parameter definition

14.1.3.1 <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:

- LENA-R8 - 99 characters (the maximum length of coded APN is 100 octets, see 3GPP TS 23.003 [142], subclause 9.1)

14.1.3.2 <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
LENA-R8	5 (see notes)	5

LENA-R8
The <cid> range goes from 1 to 7.
<cid>=0 is mapped to the initial default EPS bearer (see Primary and secondary PDP contexts) with default parameters.
Its configuration can be done only with +CFGDFTPDN AT command.

14.1.3.3 <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"

14.1.3.4 <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 [120])
- "IPV6": Internet Protocol, version 6 (see RFC 2460 [177])

14.2 PPP LCP handshake behavior

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.

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.

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

14.3 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

14.3.1 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 [83] 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.

14.3.2 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** 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	+CGDCONT: (1-3),"IP",,,(0-2),(0-4) +CGDCONT: (1-3),"IPV6",,,(0-2),(0-4) OK

Type	Syntax	Response	Example
		<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	

14.3.3 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) • 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 [131] 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

Parameter	Type	Description
<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 [120] and 3GPP TS 24.008 [85].
<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 [85]): • 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.

14.3.4 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) OK	Test command
AT+CGDCONT=4,"IP","internet"	+CME ERROR: operation not allowed	Define out of range PDP contexts
AT+CGDCONT=2,"IP","internet"	OK	Define allowed PDP contexts
AT+CGDCONT=1,"IP","STATREAL"	OK	Define allowed PDP contexts
AT+CGDCONT=3,"IP","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

LENA-R8

- By factory-programmed configuration all the contexts are undefined.
- The <IPv4AddrAlloc>, <emergency_indication>, <P-CSCF_discovery>, <IM_CN_Signalling_Flag_Ind>, <NSLPI> parameters are not supported.
- <cid>=0 is mapped to the initial default EPS bearer. Although the read command displays the default EPS bearer setting, its configuration can be done only with +CFGDFTPDN AT command.

14.4 Default PDP context configuration +CFGDFTPDN

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

14.4.1 Description

Configures and queries the default PDP context configuration and APN.

☞ LENA-R8
The command AT+CFGDFTPDN=0 deletes all the parameters settings.

14.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+CFGDFTPDN=<default_PDP_type>[,<auth_type>[,<APN>[,<username>[,<password>]]]]	OK	AT+CFGDFTPDN=3,0,"CMNET" OK
Read	AT+CFGDFTPDN?	+CFGDFTPDN: <default_PDP_type>,<auth_type>,<APN>,<username>,<password> OK	+CFGDFTPDN: 3,0,"CMNET","","" OK
Test	AT+CFGDFTPDN=?	+CFGDFTPDN: pdptype=[list of supported <default_PDP_type>s], nAuthProt=[list of supported <auth_type>s],"apn","Username", "Password" OK	+CFGDFTPDN: pdptype=[1,2,3], nAuthProt=[0,1,2],"apn","Username", "Password" OK

14.4.3 Defined values

Parameter	Type	Description
<default_PDP_type>	Number	Indicates the default PDP type: • 0: delete all the parameters settings • 1: IP • 2: IPv6 • 3: IPv4v6 • 5: NON-IP For more details, see <PDP_type>. Allowed values: • LENA-R8 - 0, 1 (factory-programmed value), 2, 3
<auth_type>	Number	Configure the authentication: • 0 (factory-programmed value): none • 1: PAP • 2: CHAP
<APN>	String	See <APN>. The factory-programmed configuration is an empty string.
<username>	String	Username. The factory-programmed value is an empty string.
<password>	String	Password. The factory-programmed value is an empty string.

14.5 Domain name server configuration +CDNSCFG

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

14.5.1 Description

Sets the system domain name server.

Issue the AT command after every change in the PDP context activation to make the setting effective.

14.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+CDNSCFG=<primary_dns>[,<secondary_dns>]	OK	AT+CDNSCFG="168.48.6.0","8.8.8.8" OK
Read	AT+CDNSCFG?	**If no PDP context is active** +CDNSCFG: DNS1:0.0.0.0 DNS2:0.0.0.0 OK	+CDNSCFG: DNS1:0.0.0.0 DNS2:0.0.0.0 OK
		If at least one PDP context is active +CDNSCFG: DNS1:<primary_dns>, DNS2:<secondary_dns> OK	+CDNSCFG: DNS1:<217.200.201.67>, DNS2:<217.200.201.66> OK
Test	AT+CDNSCFG=?	+CDNSCFG: ("Primary DNS"), ("Secondary DNS") OK	+CDNSCFG: ("Primary DNS"), ("Secondary DNS") OK

14.5.3 Defined values

Parameter	Type	Description
<primary_dns>	String	IP address of the primary domain name server, the default value is "0.0.0.0". The parameter cannot be set to "255.255.255.255".
<secondary_dns>	String	IP address of the secondary domain name server, the default value is "0.0.0.0". The parameter cannot be set to "255.255.255.255".

14.6 Quality of service profile (requested) +CGQREQ

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

14.6.1 Description

Allows the DTE to specify the QoS (Quality of Service) profile requested from the Network during the PDP context activation procedure. The set command specifies the QoS profile for the context identified by the <cid> parameter. When set command is used with only <cid> parameter, it sets all requested QoS parameters for the given profile to their default value 0 (subscribed QoS).

The command defines a PDP context having <PDP_type> set to "IP", <apn> set to "" and with the specified <cid>, if a PDP context with the specified <cid> was not already defined by +CGDCONT AT command.

LENA-R8
The command setting is not stored in the NVM.

If not specified the following values are assumed:

- <cid>:1
- <precedence>: 0
- <delay>: 0
- <reliability>: 0
- <peak>: 0
- <mean>: 0

14.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGQREQ=[<cid>[,<precedence>[,<delay>[,reliability>[,<peak>[,<mean>]]]]]]	OK	AT+CGQREQ=1,1,1,1,1,1 OK

Type	Syntax	Response	Example
Read	AT+CGQREQ?	+CGQREQ: <cid>,<precedence>,<delay>,<reliability>,<peak>,<mean> OK	+CGQREQ: 1,1,1,1,1,1 OK
Test	AT+CGQREQ=?	+CGQREQ: <PDP_type>,(list of supported <precedence>s),(list of supported <delay>s),(list of supported <reliability>s), (list of supported <peak>s),(list of supported <mean>s) [+CGQREQ: <PDP_type>,(list of supported <precedence>s),(list of supported <delay>s),(list of supported <reliability>s), (list of supported <peak>s),(list of supported <mean>s)] [...]] OK	+CGQREQ: "IP",(0-3),(0-4),(0-5),(0-9),(0-18,31) OK

14.6.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<PDP_type>	String	See <PDP_type>
<precedence>	Number	Precedence class, it can assume the values: • 0 (default value): network subscribed • 1: high priority • 2: normal priority • 3: low priority
<delay>	Number	QoS delay class according to 3GPP TS 24.008 [85]: • 0 (default value): subscribed • 1: class 1 • 2: class 2 • 3: class 3 • 4: best effort
<reliability>	Number	QoS reliability class: • 0 (default value): subscribed • 1: class 1 (interpreted as class 2) • 2: class 2 (GTP Unack, LLC Ack and Protected, RLC Ack) • 3: class 3 (GTP Unack, LLC Unack and Protected, RLC Ack) • 4: class 4 (GTP Unack, LLC Unack and Protected, RLC Unack) • 5: class 5 (GTP Unack, LLC Unack and Unprotected, RLC Unack) • 6: class 6 (interpreted as class 3)
<peak>	Number	QoS peak throughput class in range 0-9 according to 3GPP TS 24.008 [85]. The default value is 0.
<mean>	Number	QoS mean throughput class in range 0-18, 31 according to 3GPP TS 24.008 [85]. The default value is 0.

14.7 Quality of service profile (minimum acceptable) +CGQMIN

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

14.7.1 Description

DTE specifies a minimum acceptable QoS (Quality of Service) profile which is checked by the MT against the negotiated QoS profile returned by the network during the PDP context activation procedure.

The set command specifies a QoS profile for the context identified by the <cid> parameter. The QoS profile consists in a set of parameters, each one is configurable. When the set command is used with only <cid> parameter, the minimum acceptable QoS profile for the given context is undefined. In this case no check is made against the negotiated QoS profile during PDP context activation.

☞ The command defines a PDP context having <PDP_type> set to "IP", <apn> set to "" and with the specified <cid>, if a PDP context with the specified <cid> was not already defined by +CGDCONT AT command.

☞ LENA-R8
The command setting is not stored in the NVM.

☞ If not specified the following values are assumed:
- <cid>: 1
- <precedence>: 3
- <delay>: 4
- <reliability>: 5
- <peak>: 1
- <mean>: 1

14.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGQMIN=[<cid>[,<precedence>[,<delay>[,reliability>[,<peak>[,<mean>]]]]]]	OK	AT+CGQMIN=1,1,1,1,1,1 OK
Read	AT+CGQMIN?	+CGQMIN: <cid>,<precedence>,<delay>,<reliability>,<peak>,<mean> OK	+CGQMIN: 1,1,1,1,1,1 OK
Test	AT+CGQMIN=?	+CGQMIN: <PDP_type>,(list of supported <precedence>s),(list of supported <delay>s),(list of supported <reliability>s), (list of supported <peak>s),(list of supported <mean>s) [+CGQMIN: <PDP_type>,(list of supported <precedence>s),(list of supported <delay>s),(list of supported <reliability>s), (list of supported <peak>s),(list of supported <mean>s) [...]] OK	+CGQMIN: "IP",(0-3),(0-4),(0-5),(0-9),(0-18,31) OK

14.7.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>. The default value is 1.
<PDP_type>	String	See <PDP_type>
<precedence>	Number	Precedence class, it can assume the values: • 0: network subscribed • 1: high priority • 2: normal priority • 3 (default value): low priority
<delay>	Number	Minimum acceptable QoS delay class according to 3GPP TS 24.008 [85]: • 0: subscribed • 1: class 1 • 2: class 2 • 3: class 3 • 4 (default value): best effort
<reliability>	Number	Minimum acceptable QoS reliability class:

Parameter	Type	Description
		• 0: subscribed • 1: class 1 (interpreted as class 2) • 2: class 2 (GTP Unack, LLC Ack and Protected, RLC Ack) • 3: class 3 (GTP Unack, LLC Unack and Protected, RLC Ack) • 4: class 4 (GTP Unack, LLC Unack and Protected, RLC Unack) • 5 (default value): class 5 (GTP Unack, LLC Unack and Unprotected, RLC Unack) • 6: class 6 (interpreted as class 3)
<peak>	Number	Minimum acceptable QoS peak throughput class in range 0-9 according to 3GPP TS 24.008 [85]. The default value is 1.
<mean>	Number	Minimum acceptable QoS mean throughput class in range 0-18, 31 according to 3GPP TS 24.008 [85]. The default value is 1.

14.7.4 Notes

LENA-R8

- <reliability>=6 (class 6) is not supported.

14.8 PS attach or detach +CGATT

+CGATT						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Appendix B.4	+CME Error

14.8.1 Description

Register (attach) the MT to, or deregister (detach) the MT from the packet switched (PS) services. 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 PS 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 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.

14.8.2 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

14.8.3 Defined values

Parameter	Type	Description
<state>	Number	Indicates the state of GPRS attachment: • 0: detached • 1 (default value): attached

14.9 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	Appendix B.4	+CME Error

14.9.1 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.

14.9.2 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

14.9.3 Defined values

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

14.10 Enter data state +CGDATA

+CGDATA						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	See Appendix (<1 s for prompt ">" when present)	+CME Error

14.10.1 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>.

☞ 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.

14.10.2 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

14.10.3 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>.

14.10.4 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.

LENA-R8

- Only <L2P>= "PPP" value is supported.
- To exit from data mode and enter online command mode, wait for 1 s after the last data is sent before issuing the +++ sequence.

14.11 Enter PPP state/GPRS dial-up D*

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

14.11.1 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 the escape sequence "+++" or "~+++" (see &D where supported).
- via a DTR transition from ON to OFF (see &D where supported).
- sending an LCP Terminate Request.

14.11.2 Syntax

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

14.11.3 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>

14.11.4 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***#.

LENA-R8

- Only <L2P>= "PPP" is supported.
- To exit from data mode and enter online command mode, wait for 1 s after the last data is sent before issuing the +++ sequence.

14.12 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

14.12.1 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.

14.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGPADDR=[<cid>[,<cid> [,...]]]	+CGPADDR: <cid>,<PDP_addr> [+CGPADDR: <cid>,<PDP_addr> [...]] OK	AT+CGPADDR=1 +CGPADDR: 1,"1.2.3.4" OK
Test	AT+CGPADDR=?	+CGPADDR: [(list of defined <cid>s)] OK	+CGPADDR: 1,3 OK

14.12.3 Defined values

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

14.13 GPRS MS class configuration +CGCLASS

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

14.13.1 Description

Forces the detach/attach to the disabled/enabled service.

The read command gives the current class which does not depend on user settings but on the current registration state (e.g. on a CS cell only, class CC is returned).

The dial-up connection is not allowed if the module class was set to CC by means of this command.

If the module class was not forced to CC by the user, the dial-up connection is allowed even if the module is not registered for PS services (e.g. AT+CGATT=0 was entered), as it will trigger a PS registration beforehand.

14.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGCLASS=[<class>]	OK	AT+CGCLASS="B" OK
Read	AT+CGCLASS?	+CGCLASS: <class> OK	+CGCLASS: "B" OK

Type	Syntax	Response	Example
Test	AT+CGCLASS=?	+CGCLASS: (list of supported <class>s) OK	+CGCLASS: ("A","B","CC","CG") OK

14.13.3 Defined values

Parameter	Type	Description
<class>	String	GPRS mobile class • "A" (default value in Iu mode): class-A mode of operation (A/Gb mode), or CS/PS mode of operation (Iu mode) (highest mode of operation) • "B" (default value in A/Gb mode): class B mode of operation (the MT can operate in both circuit-switched and packet-switched services but not simultaneously) • "CC": class CC mode of operation (the MT can operate only in circuit-switched service) • "CG": class CG mode of operation (the MT can operate only in packet-switched service)

14.13.4 Notes

- <class>="A" is only supported when in Iu mode.
- When in Iu mode (i.e. UMTS RAT), class A and class B have equivalent meanings (both CS and PS services supported). When in A/Gb mode (i.e. GSM RAT), class-A mode operation is not supported.

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- <class>="A" and "CC" are not supported.

14.14 Packet switched event reporting +CGEREP

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

14.14.1 Description

Configures sending of URCs from MT to the DTE, if certain events occur in the packet switched MT or the network. By 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).

14.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGEREP=[<mode>[,<bfr>]]	OK	AT+CGEREP=1,1 OK
Read	AT+CGEREP?	+CGEREP: <mode>,<bfr> OK	+CGEREP: 0,0 OK
Test	AT+CGEREP=?	+CGEREP: (list of supported <mode>s),(list of supported <bfr>s) OK	+CGEREP: (0-2),(0-1) OK
URC		+CGEV: ME PDN ACT <cid>[,<reason>[,<cid_other>]]	+CGEV: NW CLASS "CC"
		+CGEV: ME ACT <p_cid>,<cid>,<event_type>	
		+CGEV: ME PDN DEACT <cid>	
		+CGEV: PDN DEACT <cid>	
		+CGEV: ME DEACT <PDP_type>,<PDP_addr>,[<cid>]	

Type	Syntax	Response	Example
		+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>	

14.14.3 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>
<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.

Parameter	Type	Description
<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

14.14.4 Explanation of URCs

URC	Remarks
+CGEV: ME PDN ACT <cid>[,<reason>[,<cid_other>]]	The MT has activated a primary context.
+CGEV: ME ACT <p_cid>,<cid>,<event_type>	The network has responded to a MT initiated secondary context activation.
+CGEV: ME PDN DEACT <cid>	The MT has forced a primary context deactivation.
+CGEV: PDN DEACT <cid>	A primary context deactivation has been forced either by the MT or by the network.
+CGEV: ME DEACT <PDP_type>,<PDP_addr>,[<cid>]	The MT has forced a context deactivation.
+CGEV: ME DEACT,<p_cid>,<cid>,0	The UE has forced a secondary context deactivation.
+CGEV: ME DEACT <p_cid>,<cid>,<event_type>	The MT has forced a secondary context deactivation.
+CGEV: ME MODIFY <cid>,<change_reason>,<event_type>	The MT has forced a context modification.
+CGEV: ME DETACH	The mobile station has forced a GPRS detach
+CGEV: ME CLASS <class>	The mobile station has forced a change of MT class; the highest available class is reported.
+CGEV: NW PDN ACT <cid>[,<reason>]	The network has activated a primary context.
+CGEV: NW ACT <p_cid>,<cid>,<event_type>	The network has forced a secondary context activation.
+CGEV: NW PDN DEACT <cid>	The network has forced a primary context deactivation.
+CGEV: NW DEACT <p_cid>,<cid>,0	The network has forced a secondary context deactivation.
+CGEV: NW DEACT <p_cid>,<cid>,<event_type>	The network has forced a secondary context deactivation.
+CGEV: NW DEACT <PDP_type>,<PDP_addr>,[<cid>]	The network has forced a context deactivation.
+CGEV: NW MODIFY <cid>,<change_reason>,<event_type>	The network has forced a context modification.
+CGEV: NW DETACH	The network has forced a GPRS detach.
+CGEV: NW CLASS <class>	The network has forced a change of MT class (e.g. due to service detach); the highest available class is reported.
+CGEV: VZW_SUBS_ACTION_NORMAL (0) - No restriction to data traffic	No restriction to data traffic. The URC is provided only on Verizon network.
+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.

14.15 GPRS network registration status +CGREG

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

14.15.1 Description

Configures the GPRS network registration information. Depending on the <n> parameter value, a URC can be issued:

- +CGREG: <stat> if <n>=1 and there is a change in the GPRS network registration status in GERAN/UTRAN
- +CGREG: <stat>[,<lac>,<ci>[,<AcT>,<rac>]] if <n>=2 and there is a change of the network cell in GERAN/UTRAN
- +CGREG: <stat>[,<lac>,<ci>[,<AcT>,<rac>,,,<Active-Time>,[<Periodic-RAU>,[<GPRS-READY-timer>]]]] if <n>=4 and there is a change of the network cell in GERAN/UTRAN, or in PSM configuration

The parameters <lac>, <ci>, <AcT>, <rac>, <Active-Time>, <Periodic-RAU>, <GPRS-READY-timer>, are provided only if available.

The read command provides the same information issued by the URC together with the current value of the <n> parameter. The location information elements <lac>, <ci> and <AcT>, if available, are returned only when <n>=2 or 4 and the MT is registered with the network.

☞ When <n>=2 or 4, in UMTS RAT, unsolicited location information can be received if the network sends the UTRAN INFORMATION MOBILITY message during dedicated connections; in the latter cases the reported <ci> might be not correct because the UE in DCH state cannot read broadcast system information before the change of serving cell. In contrast, in GSM RAT no unsolicited location information is received during a CS connection.

☞ If the GPRS MT also supports circuit mode services in GERAN/UTRAN and/or EPS services in E-UTRAN, the +CREG / +CEREG commands return the registration status and location information for those services.

14.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGREG=[<n>]	OK	AT+CGREG=1 OK
Read	AT+CGREG?	**If <n>=0 or 1:** +CGREG: <n>,<stat> OK	+CGREG: 0,4 OK
		If <n>=2: +CGREG: <n>,<stat>[,<lac>,<ci>[,<AcT>,<rac>]] OK	+CGREG: 2,1,"61EF","7D58A3",2,"14" OK
		If <n>=4: +CGREG: <n>,<stat>[,<lac>,<ci>[,<AcT>,<rac>],,,[<Active-Time>,[<Periodic-RAU>,[<GPRS-READY-timer>]]]] OK	+CGREG: 4,1,"5FB7","1298",3,"0",,,"00000000","01100000","00000000" OK
Test	AT+CGREG=?	+CGREG: (list of supported <n>s) OK	+CGREG: (0-2) OK
URC		**If <n>=1:** +CGREG: <stat>	+CGREG: 1
		If <n>=2: +CGREG: <stat>[,<lac>,<ci>[,<AcT>,<rac>]]	+CGREG: 1,"4E54","44A5"
		If <n>=4:	+CGREG: 1,"5FB7","1298",3,"0",,,"00000000","01100000","00000000"

Type	Syntax	Response	Example
		+CGREG: <stat>[,<lac>,<ci>[,<AcT>,<rac>,,,[<Active-Time>,[<Periodic-RAU>,[<GPRS-READY-timer>]]]]]	

14.15.3 Defined values

Parameter	Type	Description
<n>	Number	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 • 4: network registration, location information and PSM URC enabled Allowed values: • LENA-R8 - 0, 1, 2
<stat>	Number	Allowed values: • 0: not registered, the MT is not currently searching an operator to register to • 1: registered, home network • 2: not registered, but MT is currently searching a new operator to register to • 3: registration denied • 4: unknown (e.g. out of GERAN/UTRAN coverage) • 5: registered, roaming • 8: attached for emergency bearer services only (see 3GPP TS 24.008 [85] and 3GPP TS 24.301 [120] that specify the condition when the MS is considered as attached for emergency bearer services) (applicable only when <AcT> indicates 2,4,5,6) Allowed values: • LENA-R8 - 0, 1, 2, 3, 4, 5, 8
<lac>	String	Two bytes location area in hexadecimal format; it is optionally provided in the URC and in the response to the read command if <n>=2. The value FFFF means that the current <lac> value is invalid.
<ci>	String	From 2 to 4 bytes cell ID in hexadecimal format; it is optionally provided in the URC and in the response to the read command if <n>=2. The value FFFFFFFF means that the current <ci> value is invalid.
<AcT>	Number	Indicates the radio access technology: • 0: GSM • 1: GSM COMPACT • 2: UTRAN • 3: GSM/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 <AcT> value is invalid Allowed values: • LENA-R8 - 0, 7
<rac>	String	One byte routing area in hexadecimal format
<Active-Time>	String	One byte in 8 bit format. Indicates the Active Time value (T3324) allocated to the UE in GERAN/UTRAN. The 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 [85] Table 10.5.163.
<Periodic-RAU>	String	One byte in 8 bit format. Indicates the extended periodic RAU value (T3312) allocated to the UE in GERAN/UTRAN. The extended periodic RAU value s 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 3 IE in 3GPP TS 24.008 [85] Table 10.5.163a.
<GPRS-READY-timer>	String	One byte in 8 bit format. Indicates the GPRS READY timer value (T3314) allocated to the UE in GERAN/UTRAN. The 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

Parameter	Type	Description
		decihours or 18 minutes). For the coding and the value range, see the GPRS Timer IE in 3GPP TS 24.008 [85] Table 10.5.172.

14.15.4 Notes

- The DTE application should set a reasonable timer (10 s) when receiving the +CGREG: 3 URC, since this might be due to the fact that the LTE registration was rejected (SIM not enabled for LTE RAT, wrong APN during the initial default bearer set-up in the EPS attach procedure and other temporary reject causes).
- If the device does not support 2G or 3G RAT, the command will report only <stat>=0, 2 and 4.

14.16 Manual deactivation of a PDP context H

H						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 20 s	+CME Error

14.16.1 Description

Deactivates an active PDP context with PPP L2 protocol in online command mode. The MT responds with a final result code. For a detailed description, see the H command description. For additional information about OLCM, see the AT command settings .

☞ In GPRS online command mode, entered by typing the escape sequence "+++" or "~+++" (see &D), the ATH command is needed to terminate the connection. Alternatively, in data transfer mode, DTE originated DTR toggling or PPP disconnection may be used.

14.16.2 Syntax

Type	Syntax	Response	Example
Action	ATH	OK	

14.17 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

14.17.1 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 and an extended periodic TAU value (T3412_ext) is assigned.

☞ LENA-R8
If the EPS MT in GERAN/UTRAN/E-UTRAN also supports circuit mode services and/or GPRS services, the +CREG / +CGREG set and read command result codes apply to the registration status and location information for those services.

14.17.2 Syntax

Type	Syntax	Response	Example
Set	AT+CEREG=[<n>]	OK	AT+CEREG=1 OK
Read	AT+CEREG?	**If <n>=0, 1, 2, 3 and <stat>=0, 2, 3 or 4** +CEREG: <n>,<stat>[,[<tac>],[<ci>],[<AcT>[,<cause_type>,<reject_cause>]]] OK **If <n>=0, 1, 2, 3 and <stat>=1, 5 or 8** +CEREG: <n>,<stat>[,[<tac>],[<ci>],[<AcT>]] **If <n>=4, 5** +CEREG: <n>,<stat>[,[<tac>],[<ci>],[<AcT>][,[<cause_type>],[<reject_cause>][,[<Assigned_Active_Time>],[<Assigned_Periodic_TAU>]]]]	+CEREG: 2,1,"3a9b","0000c33d",7 OK
Test	AT+CEREG=?	+CEREG: (list of supported <n>s) OK	+CEREG: (0-5) OK
URC		**<n>=1** +CEREG: <stat> **<n>=2** +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>]] **<n>=3** +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,<cause_type>,<reject_cause>]] **<n>=4** +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>]["[,[<Assigned_Active_Time>],[<Assigned_Periodic_TAU>]]]] **<n>=5** +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,[<cause type>],[<reject cause>][,[<Assigned_Active_Time>],[<Assigned_Periodic_TAU>]]]]	+CEREG: 1,"3a9b","0000c33d",7

14.17.3 Defined values

Parameter	Type	Description
<n>	Number	Mode configuration: • 0: network registration URC disabled • 1: network registration URC +CEREG: <stat> enabled • 2: network registration and location information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>]] enabled

Parameter	Type	Description
		• 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: • LENA-R8 - 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 [85] and 3GPP TS 24.301 [120] that specify the condition when the MS is considered as attached for emergency bearer services) Allowed values: • LENA-R8 - 0, 1, 2, 3, 4, 5, 8
<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 [121] 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: • LENA-R8 - 7
<cause_type>	Number	<reject_cause> type: • 0: indicates that <reject_cause> contains an EMM cause value, see 3GPP TS 24.30 1 [120] Annex A • 1: indicates that <reject_cause> contains a manufacture-specific cause Allowed values: • LENA-R8 - 0, 1
<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 [85]. See also 3GPP TS 23.682 [160], 3GPP TS 23.060 [83]) and 3GPP TS 23.401 [161].
<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 3 IE in 3GPP TS 24.008 table 10.5.163a/3GPP TS 24.008 [85]. See also 3GPP TS 23.682 [160] and 3GPP TS 23.401 [161].
<rac_or_mme>	String	RAC (Routing Area Code) or MME Code (Mobile Management Entity) in hexadecimal format

14.17.4 Notes

LENA-R8

- The <reject_cause> parameter should be ignored since it is not supported.
- While the network does not assign values of <Assigned_Active_Time> and <Assigned_Periodic_TAU>, when <n>=4 or 5 and command successful, the information text response to the read command is the same as <n>=1, 2 or 3.

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

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

14.18.1 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.

☞ LENA-R8
To update the authentication parameters of a PDP/EPS bearer, redefine the PDP/EPS bearer by the +CGDCONT AT command before issuing the +UAUTHREQ set command.

14.18.2 Syntax

Type	Syntax	Response	Example
Set	AT+UAUTHREQ=<cid>,<auth_type>,<username>,<password>	OK	AT+UAUTHREQ=1,1,"user","pass" OK
Test	AT+UAUTHREQ=?	+UAUTHREQ: (list of supported <cid>s),(list of supported <auth_type>s)[,,] OK	+UAUTHREQ: (1-8),(0-2),, OK

14.18.3 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: • LENA-R8 - 0, 1, 2
<username>	String	Username. The factory-programmed value is an empty string: • LENA-R8 - The maximum length is 64.
<password>	String	Password. The default value is an empty string: • LENA-R8 - The maximum length is 64.

14.18.4 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).

14.19 PDP context read dynamic parameters +CGCONTRDP

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

14.19.1 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.

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

14.19.2 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

14.19.3 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

Parameter	Type	Description
		• "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.
<WLAN_offload>	Number	Indicates whether the traffic can be offloaded using the specified PDN connection via a WLAN. This refers to bits 1 and 2 of the WLAN offload acceptability IE as specified in 3GPP TS 24.008 [85] 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 the MS and the network support local IP address in TFTs (see 3GPP TS 24.301 [120] and 3GPP TS 24.008 [85] 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 [120].

14.19.4 Notes

LENA-R8

- The <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> parameters are not supported.

14.20 Configure auto PDP activation +VERCTRL

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

14.20.1 Description

Configures and queries the auto activation of a PDP context for specific operation.

14.20.2 Syntax

Type	Syntax	Response	Example
Set	AT+VERCTRL=<op_code>[,<state>]	OK	AT+VERCTRL=0,1 OK
Read	AT+VERCTRL?	+VERCTRL: <op_code>,<state> OK	+VERCTRL: 0,0 OK

14.20.3 Defined values

Parameter	Type	Description
<op_code>	Number	Operation code: • 0: storeroom Allowed values: • LENA-R8 - 0 (factory-programmed value)
<state>	Number	Controls the PDP activation: • 0 (default and factory-programmed value): auto PDP activation disabled • 1: auto PDP activation enabled

14.20.4 Notes

LENA-R8

- To test IPv6 with a test SIM card issue AT+VERCTRL=0,1. In the real network scenario, the +VERCTRL: 0,0 configuration must be applied.

15 System features

15.1 Firmware installation +UFWINSTALL

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

15.1.1 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).

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

After having issued the command, the +UFWPREVAL URC displays the progress indication for the validation package. In case of a successful validation the FW installation procedure will continue with the +UUFWINSTALL URC. Otherwise the FW installation procedure will be suspended and the module exits from firmware update mode and returns to normal mode since the FW is still unchanged and usable. A +UUFWINSTALL URC will be issued stating the unsuccessful FW update. During the update operations, the +UUFWINSTALL URC displays the progress indication and the result operation on the interface chosen via the +UFWINSTALL command. When the FW update is completed, a 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).

☞ When the <uFOTA_URC> parameter is issued, the AT command does not trigger the FW installation procedure, but it allows the uFOTA URCs configuration. By factory-programmed configuration the uFOTA URCs are disabled: if the <uFOTA_URC> parameter is set to 1, the +UUFWINSTALL and the +UFWPREVAL URCs will be issued, on the specified <Serial_Port_Number> using the selected <BaudRate>, during the next FW upgrade by means of uFOTA. The +UUFWINSTALL and the +UFWPREVAL uFOTA URCs configuration (including serial port and baud rate) is stored in the file system and it is persistent across power-cycles; to disable the +UUFWINSTALL and the +UFWPREVAL URCs during the FW upgrade by means of uFOTA, issue the AT+UFWINSTALL=0,,,1 command. Triggering a FW update by means of the AT+UFWINSTALL[=<Serial_Port_Number>[,<BaudRate>]] command, update also the +UUFWINSTALL and +UFWPREVAL uFOTA URCs serial port and baud rate settings. The +UUFWINSTALL and the +UFWPREVAL uFOTA URCs configuration (the <uFOTA_URC> parameter, the serial port and baud rate values) is not persistent to FW upgrade by means of EasyFlash.

15.1.2 Syntax

Type	Syntax	Response	Example
Firmware upgrade			
Set	AT+UFWINSTALL[=<Serial_Port_Number>[,<BaudRate>]]	OK	AT+UFWINSTALL=1,115200 OK
Configure uFOTA FW update URCs			
Set	AT+UFWINSTALL=[<Serial_Port_Number>],[<BaudRate>],[<Reserved>],<uFOTA_URC>	OK	AT+UFWINSTALL=1,115200,,1 OK
Test	AT+UFWINSTALL=?	+UFWINSTALL: (list of supported <Serial_Port_Number>s),(list of supported <BaudRate>s),,(list of supported <uFOTA_URC>s)	+UFWINSTALL: (0,2),(115200,230400,460800,921600),,(1) OK

Type	Syntax	Response	Example
		OK	
URC		+UFWPREVAL: <progress_validation>	
URC		+UUFWINSTALL: <progress_install>	

15.1.3 Defined values

Parameter	Type	Description
<Serial_Port_Number>	Number	Serial interface where the progress percentage and the information text responses will be sent: • 0: no info will be shown. In this case the <BaudRate> parameter is ignored • 1: UART interface If omitted, the command will take as default value for <Serial_Port_Number> the port where the command is issued.
<BaudRate>	Number	Available baud rates expressed in b/s: • 115'200 • 230'400 • 460'800 • 921'600 If omitted, the command will take the current value set for the <BaudRate> parameter as the baud rate to be used during the FW installation.
<Reserved>	String	Reserved for future usage
<uFOTA_URC>	String	Allowed value: • 1: enables the +UUFWINSTALL and the +UFWPREVAL URCs during the next FW upgrade by means of uFOTA; the URCs will be issued on the specified <Serial_Port_Number> using the specified <BaudRate>. If the <Serial_Port_Number> parameter is omitted, the URCs will be issued on the port where the command has been issued. If the <BaudRate> parameter is omitted, the current value set for the <BaudRate> parameter will be used. The parameter setting is stored in the file system and is persistent across power cycles.
<progress_validation>	Number	Provide the validation progress from 1 to 100.
<progress_install>	Number	Provide the installation progress from 1 to 100 and the update result (see FWINSTALL error result codes).

15.2 Firmware update Over AT (FOAT) +UFWUPD

+UFWUPD						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	Appendix B.4	FOAT Error

15.2.1 Description

Triggers the firmware update using the Xmodem or Xmodem-1k protocol.

The update will affect:

- Module firmware
- NVM and profile data: they are reset to the factory-programmed values

Issue the command and wait the device for switching in Xmodem protocol. Send the FOAT package which will be downloaded into the module file system. After the download ends, the +UFWPREVAL URCs displays the progress indication for the validation package. In case of a successful validation, the FW installation procedure will start with the +UFWUPD URCs. Otherwise the procedure will be suspended, a proper +UFWUPD URC error result code will be issued. The module exits from the update procedure mode and returns to the normal mode since the firmware is unchanged and usable. During the update operations, the +UFWUPD URCs display the progress indication and the result operation on the interface set via the +UFWUPD command. When the firmware update is completed, a URC will notify the final result of the operation.

☞ The errors (data corruption, data loss, etc.) during the Update phase are internally handled by the Xmodem protocol itself; for more details about the error result codes, see FOAT error result codes.

☞ If no data comes to the module after having issued the AT+UFWUPD command, up to ten NACK are sent and then Firmware Update Mode is dropped out coming back to normal mode; the FW is unchanged and still useable (ERROR1).

☞ In case of power loss during the update, at the next module wake-up a fault is detected and the module remains in Firmware Update Mode expecting that the upgrade restarts from the Xmodem handshake; the FW is corrupted and useless.

☞ If the FW upgrade ends with an ERROR condition, the module remains in Firmware Update Mode expecting that the upgrade restarts from the Xmodem handshake; the FW is corrupted and useless.

15.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UFWUPD[=<Serial_Port_Number>[,<BaudRate>]]	+UFWUPD: ONGOING (Sent at new baud rate, if specified) CCC<NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK> OK	AT+UFWUPD=1,115200 +UFWUPD: ONGOING CCC<NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK> OK
Test	AT+UFWUPD=?	+UFWUPD: (list of supported <Serial_Port_Number>s),(list of supported <BaudRate>s) OK	+UFWUPD: (0,1),(115200,230400,460800,921600) OK
URC		+UFWPREVAL: <progress_validation>	
URC		+UFWUPD: <progress_install>	

15.2.3 Defined values

Parameter	Type	Description
<Serial_Port_Number>	Number	Serial interface where the progress percentage and the information text responses will be sent: • 0: no update info will be shown. The current interface and baud rate will be used for the xmodem fw download. In this case the <BaudRate> parameter is ignored. • 1: UART interface
<BaudRate>	Number	Available baud rates expressed in b/s: • 115'200 • 230'400 • 460'800 • 921'600 When a USB interface is selected, the parameter has no effect in the FW install configuration. If omitted, the command will take the current value set for the <BaudRate> parameter as the baud rate to be used during the FW installation.
<progress_install>	Number	Provide the installation progress from 1 to 100 and the update result (see FWINSTALL error result codes).
<progress_validation>	Number	Provide the validation progress from 1 to 100.

15.3 Antenna detection +UANTR

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

15.3.1 Description

Measures the DC component of load of the cellular antenna. The antenna load is expressed in kOhm.

15.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UANTR=[<antenna_id>]	+UANTR: <antenna_id>,<antenna_load> OK	AT+UANTR=0 +UANTR: 0,10 OK
Test	AT+UANTR=?	+UANTR: (list of supported <antenna_id>s) OK	+UANTR: (0) OK

15.3.3 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)

15.3.4 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.

15.4 Smart temperature supervisor +USTS

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

15.4.1 Description

Enables/disables the Smart Temperature Supervisor feature.

When the feature is enabled the internal temperature is measured via the internal temperature sensor:

- If the measured value goes over the t_{+1} threshold or below the t_{-1} threshold a URC will be issued to notify a warning: the module is still in a valid and good working condition.
- If the measured value goes over the t_{+2} threshold or below the t_{-2} threshold a URC will be issued to notify the dangerous working condition. After the notification the device will start the shutting down procedure to avoid damaging itself.

The +UUSTS URC will be also issued after having enabled the feature indication (by means of <mode>= 1 or <mode>= 2) and at the module power-on (if the feature indication is enabled).

☞ The shutdown procedure is performed only if <mode>=1 (notified by a URC) or <mode>=3 (without notification).

☞ For security reasons the shutdown is suspended in case of emergency call in progress. In this case the device will switch off at the call termination: a URC will be sent to notify this.

☞ If the feature is disabled (<mode>= 0 and <mode>= 2) there is no embedded protection against not allowed temperature working conditions.

☞ For more details on Smart Temperature Supervisor feature and the thresholds definition, see the corresponding module system integration manual.

15.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+USTS=<mode>	OK	AT+USTS=0 OK
Read	AT+USTS?	+USTS: <mode> OK	+USTS: 0 OK
Test	AT+USTS=?	+USTS: (list of supported <mode>s) OK	+USTS: (0-2) OK
URC		+UUSTS: <mode>,<event>	+UUSTS: 1,1

15.4.3 Defined values

Parameter	Type	Description
<mode>	Number	Enables / disables the smart temperature mode: • 0 (default value and factory-programmed value): smart temperature feature disabled • 1: smart temperature feature enabled; the indication by means of the +UUSTS URC and shutting down (if needed) are performed • 2: smart temperature indication enabled; the +UUSTS URC will be issued to notify the Smart Temperature Supervisor status • 3: smart temperature feature enabled with no indication; the shutdown (if needed) is performed, but without a URC notification Allowed values: • LENA-R8 - 0 (default value and factory-programmed value), 1, 2
<event>	Number	Provides the event status: • -2: temperature below t_{-2} threshold • -1: temperature below t_{-1} threshold • 0: temperature inside the allowed range - not close to the limits • 1: temperature above t_{+1} threshold • 2: temperature above the t_{+2} threshold • 10: timer expired and no emergency call is in progress, shutdown phase started • 20: emergency call ended, shutdown phase started • 100: error during measurement

15.5 CTS line state in case of disabled HW flow control +UCTS

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

15.5.1 Description

Configures the CTS line's state (module's output) of the UART interface in case the HW flow control is not enabled. Instead, if the HW flow control is enabled, the CTS line's state is the result of power saving and flow control conditions.

15.5.2 Syntax

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

15.5.3 Defined values

Parameter	Type	Description
<mode>	Number	Configures the CTS line state of the UART interface: • 0 (factory-programmed value): set the CTS line to the ON state (output low) in case of SW or no flow control. • 1: set the CTS line to the OFF state (output high) in case of SW or no flow control.

15.5.4 Notes

- Regardless the AT interface where the command is issued (UART, SPI, USB), it always has effect on the UART CTS line behavior.

15.6 PPP/LCP silent mode configuration +UDCONF=0

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

15.6.1 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.

15.6.2 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

15.6.3 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

15.7 System configuration +SYSNV

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

15.7.1 Description

Allows configuring:

- USB network function
- Network address translation (NAT)

15.7.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+SYSNV=1,<op_code>,<param_val>	OK	AT+SYSNV=1,"usbmode",3 OK
Read	AT+SYSNV=0,<op_code>	+SYSNV: <op_code>,<param_val> OK	AT+SYSNV=0,"usbmode" +SYSNV: 0,"usbmode",2 OK
USB network function configuration			
Set	AT+SYSNV=1,"usbmode",<USB_function>	OK	AT+SYSNV=1,"usbmode",3 OK
Read	AT+SYSNV=0,"usbmode"	+SYSNV: "usbmode",<USB_function> OK	AT+SYSNV=0,"usbmode" +SYSNV: 0,"usbmode",2 OK
NAT configuration			
Set	AT+SYSNV=1,"nat_cfg",<enable>	OK	AT+SYSNV=1,"nat_cfg",3 OK
Read	AT+SYSNV=0,"nat_cfg"	+SYSNV: "nat_cfg",<enable> OK	AT+SYSNV=0,"nat_cfg" +SYSNV: 0,"nat_cfg",0 OK

15.7.3 Defined values

Parameter	Type	Description
<op_code>	String	Allowed values: • "usbmode": configures USB network function • "nat_cfg": enables / disables NAT
<USB_function>	Number	USB network functionalities. Allowed values: • 2 (factory-programmed value): 8 serials logical interfaces (3 AT and data interfaces) on USB • 3: RNDIS interface + 8 serials logical interfaces (3 AT and data interfaces) on USB • 5: CDC-ECM interface + 8 serials logical interfaces (3 AT and data interfaces) on USB
<enable>	Number	Enables / disables NAT: • 0 (factory-programmed value): NAT disabled • 255: NAT enabled
<param_val>	Number	Supported content depends on related <op_code> (details are given above).

15.8 Restore factory configuration +UFACTORY

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

15.8.1 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.

15.8.2 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

15.8.3 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

15.8.4 Notes

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- <fs_op>=1 erases the FS flash sectors.
- <nvm_op>=2 is reserved for internal use.

16 Power management

16.1 Power saving control (Power SaVing) +UPSV

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

16.1.1 Description

Sets the UART low power idle mode, but it has a global effect on the module low power idle mode:

- If the low power idle mode is disabled (+UPSV: 0), the UART interface is always enabled and the module does not enter low power idle mode
- If the low power idle mode is controlled by the UART **RTS** line (+UPSV: 2), the UART interface is enabled and the module does not enter low power idle mode as long as the UART **RTS** line state is ON
- If the low power idle mode is controlled by the UART **DTR** line (+UPSV: 3), the UART interface is enabled and the module does not enter low power idle mode as long as the UART **DTR** line state is ON
- If the low power idle mode is controlled by data received over the UART interface (+UPSV: 4), the module enters low power idle mode whenever possible, and it wakes up upon data received over the UART interface

16.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UPSV=<mode>[,<Timeout>]	OK	AT+UPSV=4,3000 OK
Read	AT+UPSV?	+UPSV: <mode>[,<Timeout>] OK	+UPSV: 4,3000 OK
Test	AT+UPSV=?	+UPSV: (list of supported <mode>s), (list of supported <Timeout>s) OK	+UPSV: (0,2-4),(40-65000) OK

16.1.3 Defined values

Parameter	Type	Description
<mode>	Number	Low power idle mode configuration. Allowed values: • 0 (default and factory-programmed value): disabled • 2: low power idle mode is controlled by UART **RTS** line: o If the **RTS** line state is set to OFF, the low power idle mode is allowed o If the **RTS** line state is set to ON, the module shall exit from low power idle mode ☞ <mode>=2 is allowed only if the HW flow control has been previously disabled on the UART interface (e.g. with AT&K0), otherwise the command returns an error result code (+CME ERROR: operation not allowed if +CMEE is set to 2). ☞ With <mode>=2 the DTE can start sending data to the module without risk of data loss after having asserted the UART **RTS** line (**RTS** line set to ON state). • 3: low power idle mode is controlled by UART **DTR** line: o If the **DTR** line state is set to OFF, the low power idle mode is allowed o If the **DTR** line state is set to ON, the module shall exit from low power idle mode ☞ <mode>=3 is allowed regardless the flow control setting on the UART interface. In particular, the HW flow control can be set on UART during this mode. ☞ With <mode>=3 the DTE can start sending data to the module without risk of data loss after having asserted the UART **DTR** line (**DTR** line set to ON state). • 4: low power idle mode is controlled by data received over the UART interface: o The module enters low power idle mode whenever possible, and it wakes up upon data received over the UART interface, then the module remains in active mode until the expiration of the defined <Timeout>, and then the module enters

Parameter	Type	Description
		back the low power idle mode until a subsequent reception of data over UART interface.
<Timeout>	Number	If <mode>=4 and active mode entered, it provides the guard period of no reception of characters on the UART interface before entering low power idle mode again. It is expressed in GSM frames (4.615 ms) • The range goes from 40 to 65000 (approximately from 184 ms to 300 s); the default value is 2000 GSM frames (ca 9.2 s) • This parameter is accepted only if <mode>=4

16.1.4 Notes

LENA-R8

- The low power idle mode controlled by the UART **RTS** line (+UPSV: 2) cannot be supported at the same time of the "General Purpose I/O" function and/or the "GNSS data ready" function over the GPIO3 line.

17 GPIO

17.1 Introduction

The section describes the AT commands used to configure the GPIO pins provided by u-blox cellular modules.

17.1.1 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 7 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	Safe memory and power-off	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	33	255
LENA-R8	*	*	*	*	*																												*

Table 7: 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.

17.1.2 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.

17.1.2.1 LENA-R8 GPIO mapping

<gpio_id>	Pin name	Pin number	Factory-programmed function	Remarks
16	GPIO1	16	Pin disabled	-
23	GPIO2	23	Pin disabled	-
24	GPIO3	24	Pin disabled	Only pin 24 can be configured for "External GNSS data ready" functionality
25	GPIO4	25	Pin disabled	-
42	GPIO5	42	Pin disabled	

Table 8: LENA-R8 series GPIO mapping

17.1.2.2 Additional notes

☞ LENA-R8
The low power idle mode controlled by the UART **RTS** line (+UPSV: 2) cannot be supported at the same time of the "General Purpose I/O" function and/or the "GNSS data ready" function over the GPIO3 line.

☞ <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.

☞ See the corresponding module system integration manual for the complete overview of all allowed configurations.

17.1.3 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

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.

17.1.3.1 No service (no network coverage or not registered)

- Continuous Output / Low

Figure 1: GPIO pin progress for no service

17.1.3.2 Registered home network 2G

- Cyclic Output / High for 100 ms, Output / Low for 2 s

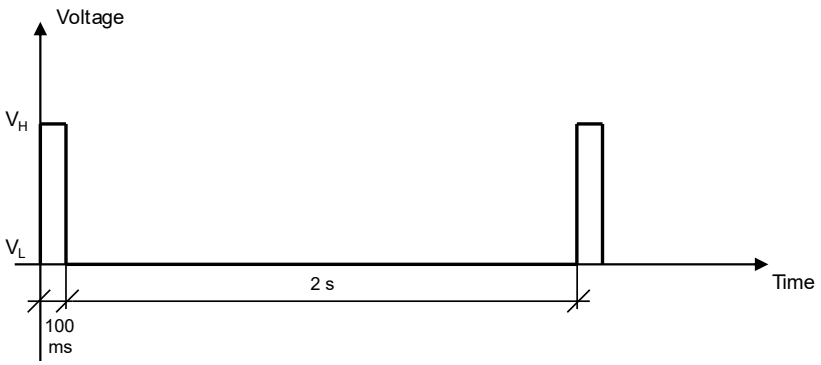

Figure 2: GPIO pin progress for registered home network 2G

17.1.3.3 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

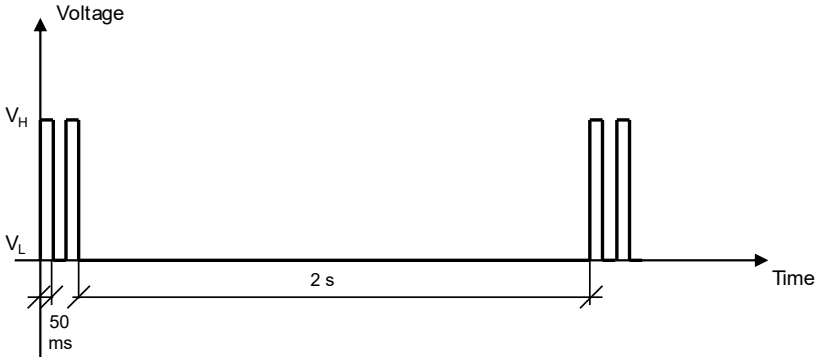

Figure 3: GPIO pin progress for registered home network 3G

17.1.3.4 Registered home network NB-IoT

- Cyclic Output / High for 100 ms, Output / Low for 30 s

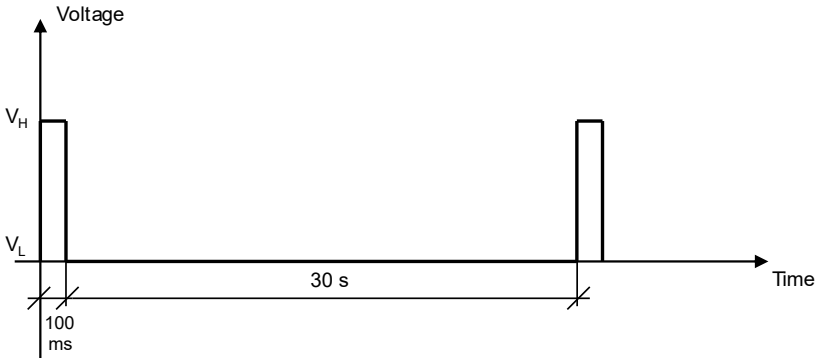

Figure 4: GPIO pin progress for registered home network NB-IoT

17.1.3.5 Registered roaming 2G

- Cyclic Output / High for 100 ms, Output / Low for 100 ms, Output / High for 100 ms, Output / Low for 2 s

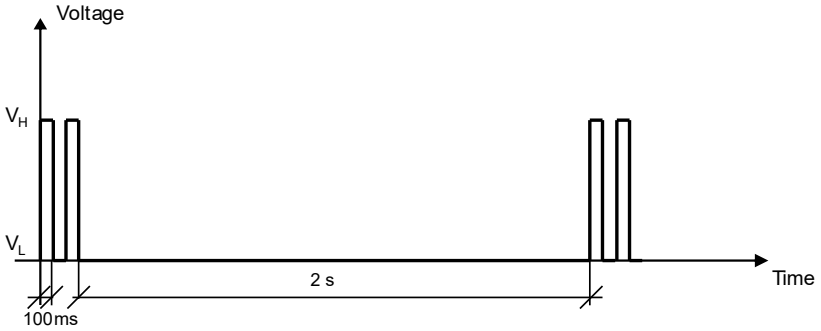

Figure 5: GPIO pin progress for registered roaming 2G

17.1.3.6 Registered roaming 3G

- Cyclic Output / High for 50 ms, Output / Low for 50 ms, Output / High for 50 ms, Output / Low for 100 ms

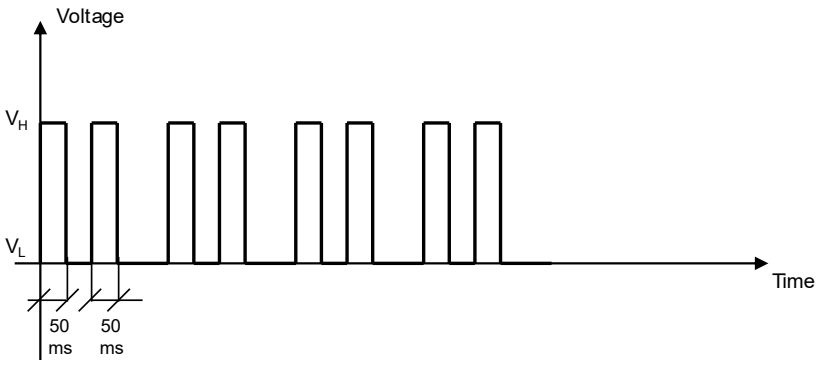

Figure 6: GPIO pin progress for registered roaming 3G

17.1.3.7 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

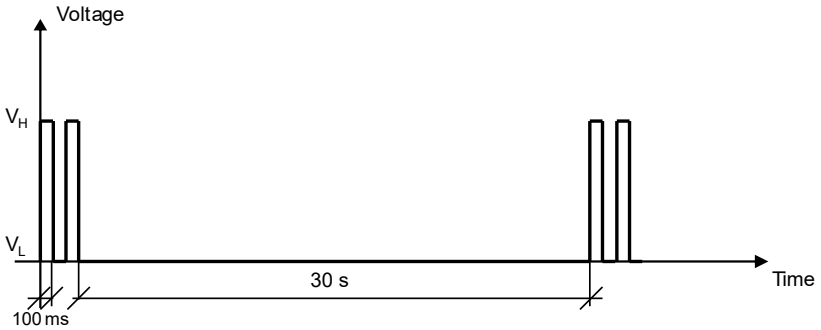

Figure 7: GPIO pin progress for registered roaming NB-IoT

17.1.3.8 Data transmission

- Continuous Output / High

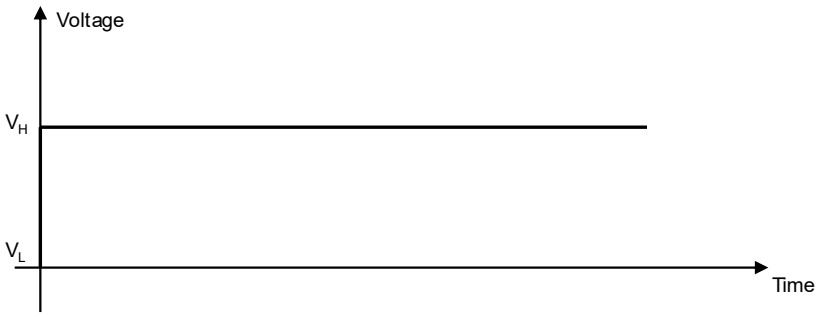

Figure 8: GPIO pin progress for data transmission

17.1.3.9 Data transmission roaming

- Cyclic Output / High for 800 ms, Output / Low for 200 ms

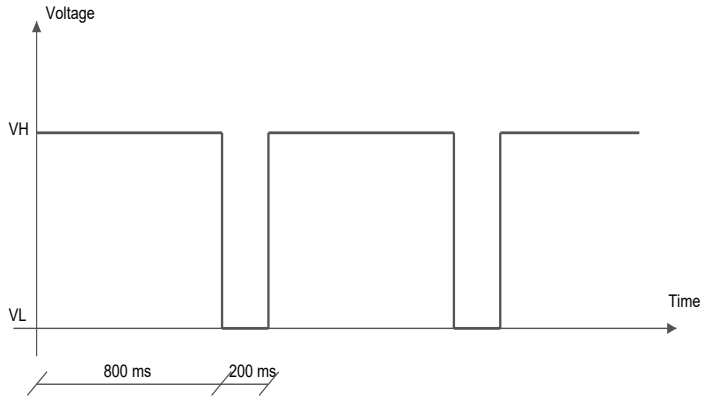

Figure 9: GPIO pin progress for data transmission roaming

17.1.4 UART (DSR, DTR, DCD e RI) interface

The UART interface lines (DSR, DTR, DCD and RI) can be set on GPIO pins. For more details, see the corresponding module system integration manual.

17.1.5 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, or deep-sleep mode 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)

17.1.6 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)

17.2 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

17.2.1 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").
Where supported, 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
- Safe memory and power-off
- Primary UART DTR line on GPIO pin

☞ 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.

17.2.2 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

17.2.3 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:

Parameter	Type	Description
		• 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 • 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 • 33: safe memory and power-off • 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

17.3 GPIO read command +UGPIOR

+UGPIOR						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

17.3.1 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.

17.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPIOR=<gpio_id>	+UGPIOR: <gpio_id>,<gpio_val>	AT+UGPIOR=20

Type	Syntax	Response	Example
		OK	+UGPIOR: 20,0 OK
Test	AT+UGPIOR=?	+UGPIOR: (list of supported <gpio_id>s) OK	+UGPIOR: (20, 21) OK

17.3.3 Defined values

Parameter	Type	Description
<gpio_id>	Number	GPIO pin identifier: pin number See the GPIO mapping for the available GPIO pins, their mapping and factory-programmed values on different u-blox cellular modules series and version.
<gpio_val>	Number	GPIO value. Allowed values are 0 and 1.

17.3.4 Notes

- The set command works only if the <gpio_mode> parameter of the +UGPIOC AT command is set to 0 or 1.

17.4 GPIO set command +UGPIOW

+UGPIOW						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

17.4.1 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).

17.4.2 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

17.4.3 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.

17.4.4 Notes

- The set command works only if the <gpio_mode> parameter of the +UGPIOC AT command is set to 0.

18 File System

18.1 File tags

18.1.1 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 9 for the allowed tags supported by the interested product. An overview about each file tag is provided in Table 10.

Module	"USER"	"FOAT"	"AUDIO"	"ECALL_EXT"	"FOTA_EXT"	"AUDIO_EXT"	"PROFILE"	"GNSS"	"CALLSRV_EXT"	"XLWM2M"	"MNO"	"UNVM"
LENA-R8	*	*										

Table 9: 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 [58]) 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).
"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.

Tag	Name	Specification

"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 [85] 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%number of MNO1's iccid%iccid1%iccid2%MNO2%number of MNO2's iccid%iccid3%iccid4...%MNOn%number of MNOn's iccid%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%number of MNO1's mccmnc%mcc1mnc1%mcc2mnc2%MNO2%number of MNO2's mccmnc%mcc3mnc3...%MNOn%number of MNOn's mccmnc%mcckmnck`. By factory-programmed configuration the following mno_list file is stored in the module file system: `2%9%310150%310170%310410%310560%311180%310030%310280%310950%313790%3%41%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%311482%311483%311484%311485%311486%311487%311488%311489%4%5%50501%50511%50539%50571%50572%206%6%313100%312670%313130%313140%313110%313120%5%16%310160%310200%310210%310220%310230%310240%310250%310260%310270%310310%310490%310660%310800%311660%311882%312250%28%4%44000%44020%44021%44101%20%1%44010%41%12%44050%44051%44052%44053%44054%44070%44071%44072%44073%44074%44075%44076%39%3%45005%45011%45012%43%1%302720%21%2%302220%302760%32%3%310730%311220%311580%47%3%302610%302640%302690%38%1%45006`

Tag	Name	Specification
		Allowed MNO1,..., MNOn values for both iccid_list and mno_list files are the same of <MNO> in +UMNOPROF command. In the previous list `2%9%310150%310170%310410%310560%311180%310030%310280%310950%313790` 2 means AT&T, 9 is the number of the next MCC and MNC. The maximum entries number in the MCC/MNC list and ICCID list is 256 and the file overall maximum size is 2048 bytes.
"UNVM"	Saving in NVM	This tag is used to list or delete the NVM items related to AT commands with parameter configuration saved in the UNVM section. The AT commands with parameters in this section can be listed with the +UNVMCFG test command. Deletion of a UNVM item restores the factory-programmed configuration at next boot. To delete a UNVM item use the +UDELFILE AT command. To list all the UNVM items, use the +ULSTFILE AT command. ☞ If the UNVM item of an AT command is not listed by +ULSTFILE AT command, the factory-programmed settings are in use.

Table 10: Tag meanings

18.2 Download file +UDWNFILE

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

18.2.1 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.

☞ LENA-R8
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 an error occurs during the file writing, the file will not be deleted but it will have 0 bytes size.

18.2.2 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			
Set	AT+UDWNFILE=<filename>,<size>,"AUDIO_EXT"	OK	AT+UDWNFILE="audioconfig",4873,"AUDIO_EXT" OK

18.2.3 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.

18.2.4 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".

18.3 List files information +ULSTFILE

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

18.3.1 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.

18.3.2 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			
Set	AT+ULSTFILE=2,<filename>[,<tag>]	+ULSTFILE: <file_size> OK	AT+ULSTFILE=2,"filename" +ULSTFILE: 784 OK

18.3.3 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).

18.4 Read file +URDFILE

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

18.4.1 Description

Retrieves a file from the file system.

18.4.2 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

18.4.3 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.

18.4.4 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.

18.5 Partial read file +URDBLOCK

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

18.5.1 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.

18.5.2 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

18.5.3 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.

18.5.4 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.

18.6 Delete file +UDELFILE

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

18.6.1 Description

Deletes a stored file from the file system.

LENA-R8
If <filename> file is not stored in the file system the following error result code will be provided: "+CME ERROR: FILE NOT FOUND".

18.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDELFILE=<filename>[,<tag>]	OK	AT+UDELFILE="filename","USER" OK

18.6.3 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.

18.7 File system limits

18.7.1 Allowed characters in filenames

A filename cannot contain the following characters: / * : % | " < > ?

18.7.2 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:

- LENA-R8 - 63 characters

Maximum file size:

- LENA-R8 - File size limited by the available file system space retrieved by AT+ULSTFILE=1 command

Maximum number of files:

- LENA-R8 - The maximum number of root directory is 31. The maximum number of child nodes can be created in the root directory is 234. The maximum number of child nodes can be created in the lowest level directory is 202.

☞ 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.

19 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.

19.1 Resolve name / IP number through DNS +UDNSRN

+UDNSRN						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	Appendix B.4	TCP/UDP/IP Error

19.1.1 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.

19.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDNSRN=<resolution_type>,<domain_ip_string>[,<async>[,<cid>[,<preferred_protocol_type>]]]	+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.dau.dau",1,1,0 OK +UUDNSRN: 0,"172.22.1.201"
			AT+UDNSRN=0,"www.rs-ipv6-test.com",1,1,1 OK +UUDNSRN: 0,"FC01:CAFE::1"
			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

19.1.3 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)

Parameter	Type	Description
<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 • 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
<cid>	Number	See <cid>. For more details on the default value of the parameter (where supported), see DNS.
<preferred_protocol_type>	Number	Select the specific IP type between IPv4 and IPv6. Allowed values: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see DNS.
<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

19.1.4 Notes

LENA-R8

- The <cid> and <preferred_protocol_type> parameters are not available.
- <resolution_type>=1 is not supported.

20 Internet protocol transport layer

20.1 Introduction

LENA-R8
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.

LENA-R8
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 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

LENA-R8
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

20.1.1 <socket>

The <socket> parameter sets the socket identifier to be used for any future operation on that socket. <socket> range lists the allowed range:

Product	Maximum number of sockets	Allowed range
LENA-R8	7	0-6

Table 11: <socket> range

20.2 IPv4/IPv6 addressing

20.2.1 Introduction

The section describes the IP addressing formats and IP address rules used by TCP/IP UDP/IP enabled applications.

20.2.2 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

IPv4 address	Remarks
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
0x10.0xE4.0x4C.0x22	Invalid address; dot-hexadecimal notation; decimals given as hexadecimal numbers

Table 12: IPv4 address format examples

20.2.3 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 13: 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.

20.3 Create Socket +USOCR

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

20.3.1 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; for the maximum number of sockets that can be created, see the <socket> parameter description. 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. When context is IPV4V6, it is possible to set preferred type (IPV4 or IPV6) using <preferred_protocol_type> parameter. Any socket can select context that can be used via <cid> parameter otherwise sockets are created using default CID value.

The socket creation operation can be performed only after the PDP context activation on one of the defined profiles.

20.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCR=<protocol>[,<local_port>[,<preferred_protocol_type>[,<cid>]]]	+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 <preferred_protocol_type>s),(list of supported <cid>s) OK	+USOCR: (6,17),(1-65535),(0,1),(1-24) OK

20.3.3 Defined values

Parameter	Type	Description
<protocol>	Number	Allowed values: • 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	See <socket>.
<preferred_protocol_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: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see Internet protocol transport layer.
<cid>	Number	Specifies the PDP context that will be used for the socket operations. For the parameter range, see <cid>. For more details on the default value of the parameter (where supported), see Internet protocol transport layer.

20.3.4 Notes

LENA-R8

- To create a socket using the IPv6 protocol, the <preferred_protocol_type> must be set to 1 (IPv6).
- The <cid> parameter is not supported.

20.4 SSL/TLS/DTLS mode configuration on TCP/UDP socket +USOSEC

+USOSEC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	Appendix B.4	+CME Error

20.4.1 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.

☞ 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.

20.4.2 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

20.4.3 Defined values

Parameter	Type	Description
<socket>	Number	See <socket>.
<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).

20.5 Set socket option +USOSO

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

20.5.1 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.

20.5.2 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

20.5.3 Defined values

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

Parameter	Type	Description
<level>	Number	Allowed values: • 0: IP protocol <opt_name> for IP protocol level may be: o 1: type of service (TOS) <opt_val>: 8 bitmask that represents the flags of IP TOS. The range is 0-255 (the default value is 0). For more information, see the RFC 791 [176] 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 seconds. 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).

20.5.4 Notes

LENA-R8

- If <level>=128 (linger on close if data present), the range of <opt_val2> parameter goes from 0 to 65535 s.

20.6 Get Socket Option +USOGO

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

20.6.1 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.

20.6.2 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

20.6.3 Defined values

Parameter	Type	Description
<socket>	Number	See <socket>.
<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 [176]. The range is 0-255. The default value is 0 o 2: time-to-live <opt_val>: unsigned 8 bit value representing the TTL. The range is 0-255. The default value is 0. • 6: TCP Protocol <opt_name> for TCP protocol level may be: o 1: no delay option: do not delay send to coalesce packets <opt_val>: numeric parameter, it enables/disables the "no delay" option - 0 (default value): disabled - 1: enabled o 2: keepidle option: send keepidle probes when idle for <opt_val> milliseconds <opt_val>: signed 32 bit number value representing the milliseconds for "keepidle" option. The range 0-2147483647. The default value is 7200000 (2 hours) • 65535: socket <opt_name> for the socket level options may be: o 4: local address re-use <opt_val>: numeric parameter, it configures the "local address re-use" option: - 0 (default value): disabled - 1: enabled o 8: keep connections alive <opt_val>: numeric parameter, it configures the "keep connections alive" option: - 0 (default value): disabled - 1: enabled o 32: sending of broadcast messages <opt_val>: numeric parameter, it configures the "sending of broadcast messages": - 1: enabled - 0 (default value): disabled

Parameter	Type	Description
		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 seconds. 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

20.6.4 Notes

LENA-R8

- If <level>=128 (linger on close if data present), the range of <opt_val2> parameter goes from 0 to 65535 s.

20.7 Close Socket +USOCL

+USOCL						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	Appendix B.4	+CME Error

20.7.1 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 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.

☞ The command response time may vary depending on the module series. For more details, see the Appendix B.4.

20.7.2 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

20.7.3 Defined values

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

20.8 Get Socket Error +USOER

+USOER						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	TCP/UDP/IP Error +CME Error

20.8.1 Description

Retrieves the last error occurred in the last socket operation, stored in the BSD standard variable error.

20.8.2 Syntax

Type	Syntax	Response	Example
Action	AT+USOER	+USOER: <socket_error> OK	+USOER: 104 OK
Set	AT+USOER=<cid>	+USOER: <socket_error> OK	+USOER: 104 OK

20.8.3 Defined values

Parameter	Type	Description
<cid>	Number	Retrieve error on the specific <cid> listed using +CGDCONT AT command. Minimun and maximum values depends on platform specification.
<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

20.9 Connect Socket +USOCO

+USOCO						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	Appendix B.4	+CME Error

20.9.1 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.

20.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCO=<socket>,<remote_addr>,<remote_port>[,<async_connect>]	OK	AT+USOCO=3,"151.63.16.9",1200 OK AT+USOCO=2,"151.63.16.9",8200,1 OK +UUSOCO: 2,0 AT+USOCO=2,"151.63.16.9",8230,0 OK

Type	Syntax	Response	Example
Test	AT+USOCO=?	+USOCO: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <async_connect>s) OK	+USOCO: (0-6),"remote_host",(1-65535),(0-1) OK
URC		+UUSOCO: <socket>,<socket_error>	+UUSOCO: 2,0

20.9.3 Defined values

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

20.9.4 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.

20.10 Write socket data +USOWR

+USOWR						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	Appendix B.4	+CME Error

20.10.1 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.

20.10.2 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

20.10.3 Defined values

Parameter	Type	Description
<socket>	Number	See <socket>.
<length>	Number	Number of data bytes to write: • Base syntax normal mode: range 1-1024 • Base syntax HEX mode: range 1-512 • Binary extended syntax: range 1-1024
<data>	String	Data bytes to be written. Not all of the ASCII charset can be used.

20.10.4 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 [87], 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.

20.11 SendTo command (UDP only) +USOST

+USOST						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	Appendix B.4	+CME Error

20.11.1 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 binary extended syntax only where 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.

20.11.2 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

Type	Syntax	Response	Example
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

20.11.3 Defined values

Parameter	Type	Description
<socket>	Number	See <socket>.
<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: • LENA-R8 o Base syntax normal mode: range 1-1024 o Base syntax HEX mode: range 1-512 o Binary syntax mode: range 1-1024
<data>	String	Data bytes to be written (not all of the ASCII charset can be used)

20.11.4 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 [87], 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

20.12 Read Socket Data +USORD

+USORD						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	< 1 s (except URC)	+CME Error

20.12.1 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.

20.12.2 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

20.12.3 Defined values

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

20.12.4 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>.

20.13 Receive From command (UDP only) +USORF

+USORF						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 1 s (except URC)	+CME Error

20.13.1 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.

20.13.2 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

20.13.3 Defined values

Parameter	Type	Description
<socket>	Number	See <socket>.
<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:

Parameter	Type	Description
		• LENA-R8 - 0-1024
<data>	String	Data bytes to be read

20.13.4 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>.

20.14 Set Listening Socket +USOLI

+USOLI						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 1 s (except URC)	+CME Error

20.14.1 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.

20.14.2 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

Type	Syntax	Response	Example
			+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

20.14.3 Defined values

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

20.14.4 Notes

- In case of notification via the URC +UUSOLI <port> is intended as the remote port.

20.15 HEX mode configuration +UDCONF=1

+UDCONF=1						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

20.15.1 Description

Enables/disables the HEX mode for +USOWR, +USOST, +USORD and +USORF AT commands.

20.15.2 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

20.15.3 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

Parameter	Type	Description
		• 1: HEX mode enabled

20.16 Set socket in Direct Link mode +USODL

+USODL						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	< 1 s	+CME Error

20.16.1 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.

☞ LENA-R8
The +UDCONF=5, +UDCONF=6, +UDCONF=7, +UDCONF=8 commands allow the configuration of UDP and TCP direct link triggers.

⚠ When using Direct Link with UDP sockets, if no network signal is available, outgoing UDP packet may be lost.

20.16.2 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

20.16.3 Defined values

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

20.16.4 Enhanced Direct Link

The enhanced DL functionality allows the user set up to three kinds of trigger for data transmission:

- Timer Trigger
- Data Length Trigger
- Character Trigger

The triggers can be applied independently to each socket. A socket may be set with more than one trigger.

The trigger must be set after the socket creation and before switching to direct link mode.

By default Timer Trigger and Data Length Trigger are enabled for UDP sockets.

By default no triggers are enabled for TCP sockets.

☞ LENA-R8
See the +UDCONF=5, +UDCONF=6, +UDCONF=7, +UDCONF=8 commands description for the transmission triggers configuration.

20.16.4.1 Timer Trigger (TT)

The user can configure a timeout for sending the data. The timer starts every time a character is read from the serial interface. When the timer expires, buffered data is sent.

The timer range is between 100 and 120000 ms.

☞ LENA-R8
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.

20.16.4.2 Data Length Trigger (DLT)

The user can configure a maximum buffered data length to reach before sending the data. When this length is reached the data is sent.

The minimum data length is 3, the maximum data length is 2048 bytes for TCP and 1472 bytes for UDP.

☞ LENA-R8
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.

20.16.4.3 Character Trigger (CT)

The user can configure a character that will trigger the data transmission. When the character is detected the data (including the trigger character) is sent.

☞ LENA-R8
The character trigger is not sent as part of the data.

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.

20.16.4.4 Combined Triggers

The user can enable multiple triggers together. The triggers work with an OR logic. This means that the first trigger reached fires the data transmission.

20.16.4.5 About serial data chunks

A data chunk is the amount of data that SIO recognizes as a single data transmission.

☞ If the baud rate is lower than 115200 b/s the time to receive 255 characters is always calculated with timings for 115200 b/s.

20.16.4.6 Data from the network

The data received from the network is immediately forwarded to the serial interface.

20.16.4.7 Congestion timer

The congestion timer represents the time after which, in case of network congestion, the module exits from direct link.

- LENA-R8 - The timer range is between 1000 and 720000 ms, the special value 0 (zero) means that the timer is disabled. By default the congestion timer is set to 60000 (60 s) for both TCP and UDP sockets. The +UDCONF=8 command can configure the congestion timer.

20.17 Timer Trigger configuration for Direct Link +UDCONF=5

+UDCONF=5						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

20.17.1 Description

Sets the timer trigger of the interested socket identifier for the data transmission enhanced Direct Link.

20.17.2 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

20.17.3 Defined values

Parameter	Type	Description
<socket>	Number	See <socket>. To be used when changing the UDP Direct Link settings.
<timer_trigger>	Number	Enhanced Direct Link sending timer trigger (in milliseconds); valid range is 0 (trigger disabled), 100-120000; • LENA-R8 - the factory-programmed value is 500 ms for UDP, 0 ms for TCP.

20.18 Data Length Trigger configuration for Direct Link +UDCONF=6

+UDCONF=6						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

20.18.1 Description

Sets the data length trigger of the interested socket identifier for the data transmission enhanced Direct Link.

20.18.2 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

20.18.3 Defined values

Parameter	Type	Description
<socket>	Number	See <socket>. To be used when changing the UDP Direct Link settings.
<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.

20.19 Character trigger configuration for Direct Link +UDCONF=7

+UDCONF=7						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

20.19.1 Description

Sets the character trigger of the interested socket identifier for the data transmission enhanced Direct Link.

20.19.2 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

20.19.3 Defined values

Parameter	Type	Description
<socket>	Number	See <socket>. To be used when changing the Direct Link settings.
<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.

20.20 Congestion timer configuration for Direct Link +UDCONF=8

+UDCONF=8						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	+CME Error

20.20.1 Description

Sets the congestion timer of the interested socket identifier for the data transmission enhanced Direct Link.

20.20.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=8,<socket_id>,<congestion_timer>	OK	AT+UDCONF=8,0,120000 OK
Read	AT+UDCONF=8,<socket_id>	+UDCONF: 8,<socket_id>,<congestion_timer> OK	AT+UDCONF=8,0 +UDCONF: 8,0,120000 OK

20.20.3 Defined values

Parameter	Type	Description
<socket>	Number	See <socket>. To be used when changing the Direct Link settings.
<congestion_timer>	Number	Enhanced Direct Link congestion timer (in milliseconds); valid range is 0, 1000-72000 0; the factory-programmed value is 60000, 0 means trigger disabled.

20.21 Socket control +USOCTL

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

20.21.1 Description

Allows interaction with the low level socket layer.

20.21.2 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

20.21.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. See <socket>.
<param_id>	Number	Control request identifier: • 0: query for socket type • 1: query for last socket error • 2: get the total amount of bytes sent from the socket • 3: get the total amount of bytes received by the socket • 4: query for remote peer IP address and port • 10: query for TCP socket status (only TCP sockets) • 11: query for TCP outgoing unacknowledged data (only TCP sockets) • 5-9, 12-99: RFU Allowed values: • LENA-R8 - 0, 1, 2, 3, 4, 10, 11
<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" [184]) • 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.

21 Device and data security

21.1 Introduction

Nowadays the security is very important to secure personal or confidential data from unauthorized access and therefore it is important to secure the IoT devices to protect the business and the data.

In the IoT security, a weak point is a defect which is called a vulnerability and it may become a safety issue; IoT devices connects/links physical objects and so in IoT it is needed to secure of course data traffic and networks but also the network of "things" or physical objects (i.e. medical devices, infrastructure, utility meters, vehicles, etc.) must be secured.

Some definitions are needed to understand the foundations of security:

- **Integrity** is about making sure that some pieces of data have not been altered from some "reference version".
- **Authentication** is about making sure that a given entity (with whom you are interacting) is who the user believes it to be.
- **Authenticity** is a special case of integrity, where the "reference version" is defined as "whatever it was when it was under control of a specific entity".
- **Confidentiality** means no unauthorized access to data (i.e. encryption/cryptography).

The u-blox security solution lets secure the IoT devices from end-to-end:

- **Device security**, the privacy of data is protected from the devices to the cloud (confidentiality, integrity and authenticity).
- **Data security**, the devices are protected from attack, they can be trusted and controlled (identity, authenticity and firmware protection).
- **Access Management**, it can be controlled who has access to data and products (device policies, data policies and feature authorization)

The pillars of the u-blox security are:

- **Unique device identity**, an immutable chip ID and a robust Root-of-Trust (RoT) provides the foundational security.
- **Secure boot sequence and updates**, only authenticated and authorized firmware and updates can run on the device.
- **Hardware-backed crypto functions**, a Secure Client Library (SCL) generates keys and crypto functions to securely connect to the cloud.

The IoT device is secured through different steps:

- **Provision trust**: insert Root-of-Trust at production. An immutable chip ID and hardware-based Root-of-Trust provide foundational security and a unique device identity.
- **Leverage trust**: derive trusted keys. Secure libraries allow generation of hardware-backed crypto functions and keys that securely connect to the cloud.
- **Guarantee trust**: use keys to secure any function. It ensures authenticity, integrity, and confidentiality to maintain control of device and data.

21.2 Data security provided by secure connections (SSL/TLS/DTLS)

21.2.1 Introduction

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.

21.2.2 SSL/TLS certificates and private keys manager +USECMNG

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

21.2.2.1 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 [203].

The number and the format of the certificates and the private keys accepted depend on the module series:

- LENA-R8 - 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 16 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.

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.

☞ All the imported certificates or private keys are listed if the type of the security data is omitted.

☞ 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).

☞ The USECMNG private key import command does not support private keys in PEM format with extension headers (i.e. "EC PARAMETERS").

21.2.2.2 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"

Type	Syntax	Response	Example
			"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

21.2.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	Type of operation: • 0: import a certificate or a private key (data provided by the stream of byte) • 1: import a certificate or a private key (data provided from a file on FS) • 2: remove an imported certificate or private key • 3: list imported certificates or private keys • 4: retrieve the MD5 of an imported certificate or private key
<type>	Number	Type of the security data: • 0: trusted root CA (certificate authority) certificate • 1: client certificate • 2: client private key • 3: server certificate • 4: signature verification certificate • 5: signature verification public key Allowed values: • LENA-R8 - 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: • LENA-R8 - "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. • LENA-R8 - The maximum length is 64 characters.
<data_size>	Number	Size in bytes of a certificate or private key being imported. • LENA-R8 - The maximum allowed size is 8192 bytes.
<password>	String	Decryption password; applicable only for PKCS8 encrypted client private keys. The maximum length is 128 characters.
<filename>	String	Name of the FS file containing the certificate or private key data to be imported. • LENA-R8 - The maximum allowed file size is 8192 bytes.
<md5_string>	String	MD5 formatted string.
<common_name>	String	Certificate subject (issued to) common name; applicable only for trusted root and client certificates.
<expiration_date>	String	Certificate expiration (valid to date); applicable only for trusted root and client certificates.
<param1>	Number/ String	Type and supported content depend on the related <op_code> parameter; see the <op_code> specification.

Parameter	Type	Description
<param2>	Number/ String	Type and supported content depend on the related <op_code> parameter; see the <op_code> specification.

21.2.2.4 Notes

LENA-R8

- The USECMNG parameter <password> is not supported.
- The import of the following client private key format is not supported:
  - PKCS8 encrypted private key

21.2.3 +USECMNG AT command example

☞ LENA-R8
For more examples on +USECMNG AT command, see the LENA-R8 series application development guide [21].

21.2.4 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).

21.2.5 SSL/TLS/DTLS security layer profile manager +USECPRF

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

21.2.5.1 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
- **SSL/TLS version to be used:**
  - Any of the TLS versions supported by the module
  - TLS 1.0
  - TLS 1.1
  - TLS 1.2
  - TLS 1.3
- **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 14 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 14 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 14 for the supported cipher suites.

☞ For the applicability of cipher suite depending on the series module, 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 to reestablish a SSL/(D)TLS secure session. Since the secure session data are available, the full SSL/(D)TLS handshake is not performed during the session resumption. Once the session resumption feature is enabled, the session resumption type and the secure session data (negotiated during the SSL/(D)TLS handshake) are displayed via +UUSECPRF 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. Once the session data related to the session resumption via session ticket (<sess_type>=1 or <sess_type>=11) or via the session resumption via PSK-based session ticket (<sess_type>=3 or <sess_type>=13) are properly retrieved from the server, they are directly configured in the USECPRF profile and a +UUSECPRF URC message reporting the session resumption status is issued. Conversely, once the session data related to the session resumption via session ID (<sess_type>=0 or <sess_type>=10) are properly retrieved from the server, an +UUSECPRF URC message reporting the session resumption type and an +UUSECPRF URC message reporting the session resumption data are issued, furthermore the session resumption data are not stored in the USECPRF profile.
- **ZTP-provided credentials.** The credentials to establish the secure connection will be provided by Zero Touch Provisioning (ZTP). In the specific case the credentials provided by the ZTP will be the CA certificate, or/and the client certificates and client private key. The CA certificate, and if applicable, the client certificate, are sent to the server during the handshake. The CA certificate and the client certificate are concatenated in a certificate chain.
- **Application Layer Protocol Name (ALPN).** With ALPN the client sends the list of supported application protocols as part of the TLS ClientHello message. The server can select one protocol and send it as part of the TLS ServerHello message. The application protocol negotiation can thus be accomplished within the TLS handshake, without adding network round-trips, and allows the server to associate a different certificate according to the indicated application protocol, if desired. For more details on ALPN, Extension protocol see RFC 7301 [189].

☞ When ZTP-provided credentials feature is enabled (<op_code>=14) for a certain USECPRF profile, the client certificate and client key set by the <op_code>=5 (client certificate internal name) and <op_code>=6 (client private key internal name) are ignored, and the underlying SSL/TLS uses the ZTP provided ones.

☞ 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.

21.2.5.2 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

Type	Syntax	Response	Example
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			
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,<sess_tag>,<param_val1>[,<param_val2>]	OK	AT+USECPRF=0,13,0,1 OK
Read	AT+USECPRF=<profile_id>,13,<sess_tag>	+USECPRF: <profile_id>,13,<sess_tag>,<param_val1>[,<param_val2>] OK	AT+USECPRF=0,13,0 +USECPRF: 0,13,0,1 OK
URC		+UUSECPRF: <profile_id>,13,<sess_tag>,<param_val1>[,<param_val2>] OK	+UUSECPRF: 0,13,1,0 OK
(D)TLS session resumption status			

Type	Syntax	Response	Example
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
URC		+UUSECPRF: <profile_id>,13,0,<sess_status>	+UUSECPRF: 0,13,0,2
(D)TLS session resumption session type			
Set	AT+USECPRF=<profile_id>,13,1,<sess_type>	OK	AT+USECPRF=0,13,1,0 OK
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_b64>,<master_secret_b64>	OK	AT+USECPRF=0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo" OK
Read	AT+USECPRF=<profile_id>,13,2	+USECPRF: <profile_id>,13,2,<session_id_b64>,<master_secret_b64> OK	AT+USECPRF=0,13,2 +USECPRF: 0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo" OK
URC		+UUSECPRF: <profile_id>,13,2,<session_id_b64>,<master_secret_b64>	+UUSECPRF: 0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo"
(D)TLS session resumption session data having session ticket as session resumption type			
Set	AT+USECPRF=<profile_id>,13,3,<session_data_b64>,<session_data_b64_size>	OK	AT+USECPRF=0,13,3, "MIHOAgECAgMAzKgEMDZV [...] NuPf3pFw4tJjU2gjKg2ipCBW0rTrfTyQ==",332 OK
Read	AT+USECPRF=<profile_id>,13,3	+USECPRF: <profile_id>,13,3,<session_data_b64>,<session_data_b64_size> OK	AT+USECPRF=0,13,3 +USECPRF: 0,13,3, "MIHOAgECAgMAzKgEMDZV [...] NuPf3pFw4tJjU2gjKg2ipCBW0rTrfTyQ==",332 OK
(D)TLS session resumption session data having PSK-based session ticket as session resumption type			
Set	AT+USECPRF=<profile_id>,13,5,<session_data_b64_size> > <session_data_b64>	OK	AT+USECPRF=0,13,5,2320 > NjQwM0IwMDEzMDgyMDFB0QzAyMDEwMTAyMDEwMDAy0MDEwMTAyMDIxQzIwMDIw

Type	Syntax	Response	Example
			[...] MDAwMDAwMDAwMDAwMDAw0 MDAwMDAwMDAwMDAwMDAw0 MDAwMDAwMDAyMDIxMzAy OK
Read	AT+USECPRF=<profile_id>,13,5	+USECPRF: <profile_id>,13,5, <session_data_b64>,<session_ data_b64_size> OK	AT+USECPRF=0,13,5 +USECPRF: 0,13,5,"Nj0QwM0 IwMDEzMDgyMDFBQz0 AyMDEwMTAyMDEwMDAyMD [...] AwMDAwMDAwMDAwMDAwMD0 AwMDAwMDAwMDAwMDAwMD0 AwMDAyMDIxMzAy",2320 OK
(D)TLS session resumption session data having encrypted session ID with local encryption as session resumption type			
Set	AT+USECPRF=<profile_id>,13,12, <enc_session_data_b64>,<enc_ session_data_b64_size>	OK	AT+USECPRF=0,13,12, "AAECAwQFBgcICQoLDA0 ODxAREhMUFRYXGBkaGxwdHh/ Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0 in6aGVISJGBWCAAKJo6Qw5Q +ugXaRZFquG0 O69WeHnPRBkcwY2SN4bwnDbyR +709i0pt2nIaYMSCL77MAA=",156 OK
Read	AT+USECPRF=<profile_id>,13,12	+USECPRF: <profile_id>,13,12,<enc_ session_data_b64>,<enc_session_ data_b64_size> OK	AT+USECPRF=0,13,12 +USECPRF: 0,13,12, "AAECAwQFBgcICQoLDA0 ODxAREhMUFRYXGBkaGxwdHh/ Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0 in6aGVISJGBWCAAKJo6Qw5Q +ugXaRZFquG0 O69WeHnPRBkcwY2SN4bwnDbyR +709i0pt2nIaYMSCL77MAA=",156 OK
URC		+UUSECPRF: <profile_id>,13,12, <enc_session_data_b64>,<enc_ session_data_b64_size>	+UUSECPRF: 0,13,12, "AAECAwQFBgcICQoLDA0 ODxAREhMUFRYXGBkaGxwdHh/ Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0 in6aGVISJGBWCAAKJo6Qw5Q +ugXaRZFquG0 O69WeHnPRBkcwY2SN4bwnDbyR +709i0pt2nIaYMSCL77MAA=",156
(D)TLS session resumption session data having encrypted session ticket with local encryption as session resumption type			
Set	AT+USECPRF=<profile_id>,13,13, <enc_session_data_b64>,<enc_ session_data_b64_size>	OK	AT+USECPRF=0,13,13, "MIHOAgECAgMAzKwsa64L [...] dQE2VcxYvD0VcrR2jKg2ipCBW0 rTrfTyQ==",364 OK
Read	AT+USECPRF=<profile_id>,13,13	+USECPRF: <profile_id>,13,13,<enc_ session_data_b64>,<enc_session_ data_b64_size> OK	AT+USECPRF=0,13,13 +USECPRF: 0,13,13, "MIHOAgECAgMAzKwsa64L [...] QE2VcxYvD0VcrR2jKg2ipCBW0 rTrfTyQ==",364 OK

Type	Syntax	Response	Example
(D)TLS session resumption session data having PSK-based session ticket with local encryption as session resumption type			
Set	AT+USECPRF=<profile_id>,13,15,<enc_session_data_b64_size> > <enc_session_data_b64>	OK	AT+USECPRF=0,13,15,2408 > MDBGMDRCREYwODYwREYw0RDFDNjk1NUU5OUY5NjAw0MDA1QjlCN0QxMUYzM0Qy [...] Njg4MkEzQzJCRjA5NEFF0QzJFQUFFOTNBNjY2RkNE0QzM3RDJERTYyRDIxNQ== OK
Read	AT+USECPRF=<profile_id>,13,15	+USECPRF: <profile_id>,13,15,<enc_session_data_b64>,<enc_session_data_b64_size> OK	AT+USECPRF=0,13,15 +USECPRF: 0,13,15,"M0DBGMDRCREYwODYwREYwR0DFDNjk1NUU5OUY5NjAwM [...] EzQzJCRjA5NEFFQzJFQU0FFOTNBNjY2RkNEQzM3RD0JERTYyRDIxNQ==",2408 OK
ZTP-provided credentials			
Set	AT+USECPRF=<profile_id>,14,<ZTP_tag>	OK	AT+USECPRF=0,14,0 OK
Read	AT+USECPRF=<profile_id>,14	+USECPRF: <profile_id>,14,<ZTP_tag> OK	AT+USECPRF=0,14 +USECPRF: 0,14,2 OK
ALPN extension protocol			
Set	AT+USECPRF=<profile_id>,15,<string_type>	OK	AT+USECPRF=0,15,"FTP" OK
Read	AT+USECPRF=<profile_id>,15	+USECPRF: <profile_id>,15,<string_type> OK	AT+USECPRF=0,15 +USECPRF: 0,15,"FTP" OK
Test	AT+USECPRF=?	+USECPRF: (list of supported <profile_id>s),(list of supported <op_code>s) OK	+USECPRF: (0-4),(0-14) OK

21.2.5.3 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. The factory-programmed value for <param_val1> is: o LENA-R8 - 0

Parameter	Type	Description
		• 1: SSL/TLS version to use; allowed values for <param_val1>(number): o 0: any; the server can use any TLS version, which is supported by the module, for the connection. For more details on the supported TLS versions, see Notes. 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 o 4: TLS v1.3; connection allowed only to TLS/SSL servers which support TLS v1.3 The factory-programmed value for <param_val1> is: o LENA-R8 - 0 • 2: cipher suite; allowed values for <legacy_cs> (number) legacy cipher suites are listed in Table 14. 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 14. 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 14. ☞ 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 series module, 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 • 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

Parameter	Type	Description
		- 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; • 14: ZTP-provided credentials; o <ZTP_tag> (number) defines the ZTP-provided credentials level. Allowed values for <ZTP_tag>: - 0: no credentials are obtained via ZTP - 1: CA certificate and client certificate/key are obtained via ZTP. The CA certificate and client certificate will be concatenated together in a certificate chain and provided to the server - 2: client certificate/key are provided via ZTP. The client certificate will be provided to the server • 15: Application-Layer Protocol Negotiation (ALPN); o <string_type> (string) value for the protocol name to be added in the Application Layer Protocol Negotiation Extension used in SSL/TLS connection negotiation; the maximum length is 255 characters. It is possible to set a protocol IDs listed at https://www.iana.org/assignments/tls-extensiontype-values/tls-extensiontype-values.xhtml#alpn-protocol-ids or a custom string. The factory-programmed value is an empty string. Allowed values: • LENA-R8 - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12
<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
<sess_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 • 3: session resumption data when the session resumption type is session ticket. • 5: session resumption data when the session resumption type is PSK-based session ticket. TLS v1.3 must be enabled (+USECPRF: <profile_id>,1,4). • 12: session resumption data when the session resumption type is encrypted session ID with local encryption • 13: session resumption data when the session resumption type is encrypted session ticket with local encryption • 15: session resumption data when the session resumption type is encrypted PSK-based session ticket with local encryption. TLS v1.3 must be enabled (+USECPRF: <profile_id>,1,4).

Parameter	Type	Description
		Allowed values: • LENA-R8 - (D)TLS session resumption is not supported
<sess_status>	Number	(D)TLS session resumption status. Allowed values: • 0 (factory-programmed value): disabled • 1: enabled • 2: session data configured Allowed values: • LENA-R8 - (D)TLS session resumption is not supported
<sess_type>	Number	(D)TLS session resumption type. Allowed values: • 0: session ID • 1: session ticket • 3: PSK-based session ticket. TLS v1.3 must be enabled (+USECPRF: <profile_id>,1,4) • 10: encrypted session ID with local encryption • 11: encrypted session ticket with local encryption • 13: encrypted PSK-based session ticket with local encryption. TLS v1.3 must be enabled (+USECPRF: <profile_id>,1,4) Allowed values: • LENA-R8 - (D)TLS session resumption is not supported
<session_id_b64>	String	Base64 encoded session ID value. The maximum length is 44 characters.
<master_secret_b64>	String	Base64 encoded session master key. The maximum length is 64 characters.
<session_data_b64_size>	Number	Length of base64 encoded session data value. The maximum size is 8192.
<session_data_b64>	String	Base64 encoded session data value. The string length is determined by <session_data_b64_size>.
<enc_session_data_b64>	String	Base64 encoded session data value encrypted with local encryption. The string length is determined by <enc_session_data_b64_size>
<enc_session_data_b64_size>	Number	Length of base64 encoded session data value encrypted with local encryption. The maximum size is 8192.
<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)

21.2.5.4 Notes

LENA-R8

- The configurations of the <op_code>=10 (SNI) and the <op_code>=4 (expected server hostname) are interchangeable. The latest applied configuration of either the expected server hostname or the SNI will be used for both the fields in the ClientHello of the secure connection handshake.

21.2.5.5 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"

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
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"
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"

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
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"
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"

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
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"
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"
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"
0x1301	TLS_AES_128_GCM_SHA256		"13"	"01"
0x1302	TLS_AES_256_GCM_SHA384		"13"	"02"
0x1303	TLS_CHACHA20_POLY1305_SHA256		"13"	"03"

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
0x1304	TLS_AES_128_CCM_SHA256		"13"	"04"
0x1305	TLS_AES_128_CCM_8_SHA256		"13"	"05"

Table 14: Supported cipher suite

21.2.6 Cipher suite applicability

21.2.6.1 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:

- (0x002F) TLS_RSA_WITH_AES_128_CBC_SHA (D)
- (0x003C) TLS_RSA_WITH_AES_128_CBC_SHA256 (D)
- (0x0035) TLS_RSA_WITH_AES_256_CBC_SHA (D)
- (0x003D) TLS_RSA_WITH_AES_256_CBC_SHA256 (D)
- (0x000A) TLS_RSA_WITH_3DES_EDE_CBC_SHA (D)
- (0x008C) TLS_PSK_WITH_AES_128_CBC_SHA (D)
- (0x008D) TLS_PSK_WITH_AES_256_CBC_SHA (D)
- (0x008B) TLS_PSK_WITH_3DES_EDE_CBC_SHA (D)
- (0x0094) TLS_RSA_PSK_WITH_AES_128_CBC_SHA (D)
- (0x0095) TLS_RSA_PSK_WITH_AES_256_CBC_SHA (D)
- (0x0093) TLS_RSA_PSK_WITH_3DES_EDE_CBC_SHA (D)
- (0x00AE) TLS_PSK_WITH_AES_128_CBC_SHA256 (D)
- (0x00AF) TLS_PSK_WITH_AES_256_CBC_SHA384 (D)
- (0x00B6) TLS_RSA_PSK_WITH_AES_128_CBC_SHA256 (D)
- (0x00B7) TLS_RSA_PSK_WITH_AES_256_CBC_SHA384 (D)
- (0x00A8) TLS_PSK_WITH_AES_128_GCM_SHA256 (D)
- (0x00A9) TLS_PSK_WITH_AES_256_GCM_SHA384 (D)
- (0x00AC) TLS_RSA_PSK_WITH_AES_128_GCM_SHA256 (D)
- (0x00AD) TLS_RSA_PSK_WITH_AES_256_GCM_SHA384 (D)
- (0xC008) TLS_ECDHE_ECDSA_WITH_3DES_EDE_CBC_SHA (D)
- (0xC009) TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA (D)
- (0xC00A) TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA (D)
- (0xC012) TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA (D)
- (0xC013) TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA (D)
- (0xC014) TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA (D)
- (0xC023) TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 (D)
- (0xC024) TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384 (D)
- (0xC027) TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256 (D)
- (0xC028) TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384 (D)
- (0xC02B) TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 (D)
- (0xC02C) TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 (D)

- (0xC02F) TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (D)
- (0xC030) TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384 (D)

22 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. The FTP client requires an active connection to work. Some products require additional commands to provide connectivity to the application.

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.

22.1 FTP service configuration +UFTP

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

22.1.1 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.

☞ When the FTP client is using secure connection, only explicit mode is supported (ftpes://). In the explicit mode the secure connection will be established after the FTP connection (before login) on the same port of the control channel.

☞ When the FTP client is using secure connection, the FTPS server may request that the session data of the control channel connection should be reused to establish secure connection on the data channel. In this case the session resumption feature for the FTPS client should be configured via +USECPRF AT command.

22.1.2 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			

Type	Syntax	Response	Example
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
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
FTP context id			
Set	AT+UFTP=20,<cid>[,<preferred_protocol_type>]	OK	AT+UFTP=20,2 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>] +UFTP: 20,<cid>[,<preferred_protocol_type>] 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 +UFTP: 20,2 OK
Test	AT+UFTP=?	+UFTP: (list of supported <param_tag>s) OK	+UFTP: (0-12,20) OK

22.1.3 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 • 7: remote FTP server listening port • 8: control connection security • 9: timer trigger • 10: data length trigger • 11: character trigger • 12: data connection security • 20: PDP context id Allowed values: • LENA-R8 - 0, 1, 2, 3, 4, 5, 6, 7, 8, 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/TLS encryption • 1: enable SSL/TLS encryption of FTP (control channel or data channel).
<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.
<cid>	Number	Specifies the PDP context that will be used for the FTP data. For the parameter range see product <cid> number. For more details on the default value of the parameter (where supported), see FTP.
<preferred_protocol_type>	Number	In the case of a context id with IPv4v6 PDP type, this value specifies which IP protocol type will be used: • 0: IPv4

Parameter	Type	Description
		• 1: IPv6 For more details on the default value of the parameter (where supported), see FTP.
<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.

22.1.4 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.

22.2 FTP command +UFTPC

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

22.2.1 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.

22.2.2 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

Type	Syntax	Response	Example
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
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
URC		+UUFTPCD: 100,<stored_byte>,<total_byte>	+UUFTPCD: 100,131072,1000000
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

22.2.3 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.

Parameter	Type	Description
		• 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. • 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 or the +UUFTPCD: 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: suspend 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

Parameter	Type	Description
		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)

22.2.4 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.

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- <op_code>=6, 7, 9, 12 are not supported.
- The +UUFTPCD: 100,<stored_byte>,<total_byte> URC is not supported.

22.3 FTP error +UFTPER

+UFTPER						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error Appendix A.7.1

22.3.1 Description

This command retrieves the error class and code of the last FTP operation.

22.3.2 Syntax

Type	Syntax	Response	Example
Action	AT+UFTPER	+UFTPER: <error_class>,<error_code> OK	+UFTPER: 1,1 OK

22.3.3 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.

23 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. The HTTP client requires an active connection to work. Some products require additional commands to provide connectivity to the application.

When these commands report an HTTP error, the error code can be queried using the +UHTTPER AT command.

23.1 HTTP control +UHTTP

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

23.1.1 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>

23.1.2 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			
Set	AT+UHTTP=<profile_id>,2,<username>	OK	AT+UHTTP=2,2,"my_user" OK

Type	Syntax	Response	Example
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
HTTP context id			
Set	AT+UHTTP=<profile_id>,20,<cid>[,<preferred_protocol_type>]	OK	AT+UHTTP=2,20,2 OK
Read	AT+UHTTP=<profile_id>,20	+UHTTP: <profile_id>,20,<cid>,<preferred_protocol_type> OK	AT+UHTTP=2,20 +UHTTP: 2,20,2,0 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)	+UHTTP: (0-3),(0-9,20) OK

Type	Syntax	Response	Example
		OK	

23.1.3 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 • 20: HTTP context id and preferred IP type Allowed values: • LENA-R8 - 0, 1, 2, 3, 4, 5, 6, 7, 9
<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: • LENA-R8 - 1024 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. ☞ LENA-R8 The HTTP server port is not set automatically according to the configured <HTTP_secure>. Configure the HTTP server port by the AT+UHTTP=<profile_id>,5,<HTTP_port> command.
<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 (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

Parameter	Type	Description
		• "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 (:) The hdr_name and hdr_value have a maximum length of: • LENA-R8 - 256 characters
<cid>	Number	Specifies the PDP context that will be used for the HTTP data. For the parameter range, see <cid>. For more details on the default value of the parameter (where supported), see HTTP.
<preferred_protocol_type>	Number	In case of a context id with IPv4v6 PDP type it is possible to select: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see HTTP.
<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.

23.1.4 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.

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- The read command for <op_code>=9 (HTTP add custom request headers) reads only the last custom header.
- When <HTTP_secure>=1 (HTTPS enabled), the <HTTP_port> parameter is not updated automatically. The <HTTP_port> has to be set to the desired value (typically 443) issuing the proper command (e.g. AT +UHTTP=<profile_id>,5,443).
- The <linger_timer> parameter is not supported.

23.2 HTTP advanced control+UHTTPAC

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

23.2.1 Description

Configures, reads or resets (to the factory-programmed values) the HTTP application profile advanced parameters.

☞ The configured HTTP profile advanced parameters are not saved in the non volatile memory.

23.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UHTTPAC=<profile_id>,<param_tag>,<key>,<value>	OK	AT+UHTTPAC=0,0,0,"UBLX_SESSION_COOKIE_0" OK
Read	AT+UHTTPAC=<profile_id>,<param_tag>,<key>	+UHTTPAC: <profile_id>,<param_tag>,<key>,<value> OK	AT+UHTTPAC=0,0,0 +UHTTPAC: 0,0,0,"UBLX_SESSION_COOKIE_0" OK

Type	Syntax	Response	Example
Test	AT+UHTTPAC=?	+UHTTPAC: (list of supported <profile_id>s),(list of supported <param_tag>s),(list of supported <key>s) OK	+UHTTPAC: (0-3),(0),(0-3) OK

23.2.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<param_tag>	Number	• 0: HTTP request COOKIES; manage request COOKIES sent to the HTTP server. o <key>: index of the cookie (number); range 0-3. Identifies the cookie to be read if <value> is omitted or configured if <value> is a valid string. o <value>: value of the cookie (string); the maximum length is 512 characters. The cookie values respect the following rules: - Empty string (""): the cookie will be cleared and will not be present in the request; - Simple one-value cookie: the cookie will be set and sent in the request; - Complex multi-value cookie: the cookies will be set and sent in the request. The multiple cookies must be separated by a left-attached semicolon(";") and a space(" ");
<key>	Number/ String	Content depends on the related <param_tag> (see above).
<value>	Number/ String	Content depends on the related <param_tag> (see above).

23.2.4 Examples and use cases

In this section some +UHTTPAC AT command examples and use cases are listed.

Command	Response	Description
Example 1		
AT+UHTTPAC=0,0,0,""	OK	Clear the HTTP request cookie at index 0.
Example 2		
AT+UHTTPAC=0,0,0,"SIMPLE_COOKIE"	OK	Set a simple HTTP request cookie at index 0.
Example 3		
AT+UHTTPAC=0,0,0,"COMPLEX_COOKIE; COMPLEX_COOKIE"	OK	Overwrite the HTTP request cookie at index 0 with a complex cookie.

23.2.5 Notes

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- If <param_tag>=0 (HTTP request COOKIES) the maximum length for the <value> parameter is 256 characters.

23.3 HTTP command +UHTTPC

+UHTTPC						
Modules	All products					
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 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.

23.3.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UHTTPC=<profile_id>,<http_command>,<path>,<filename>[,<param1>[,<param2>[,<param3>]]]	OK	AT+UHTTPC=0,1,"/path/file.html","responseFilename" OK
HEAD command			
Set	AT+UHTTPC=<profile_id>,0,<path>,<filename>	OK	AT+UHTTPC=0,0,"/path/file.html","responseFilename" OK
GET command			
Set	AT+UHTTPC=<profile_id>,1,<path>,<filename>	OK	AT+UHTTPC=0,1,"/path/file.html","responseFilename" OK
DELETE command			
Set	AT+UHTTPC=<profile_id>,2,<path>,<filename>	OK	AT+UHTTPC=0,2,"/path/file.html","responseFilename" OK
PUT command			
Set	AT+UHTTPC=<profile_id>,3,<path>,<filename>,<filesystem_name>[,<HTTP_content_type>[,<user_defined_content_type>]]	OK	AT+UHTTPC=0,3,"/path/file.html","responseFilename","filesystemName" OK
POST file command			
Set	AT+UHTTPC=<profile_id>,4,<path>,<filename>,<filesystem_name>,<HTTP_content_type>[,<user_defined_content_type>]	OK	AT+UHTTPC=0,4,"/path/file.html","responseFilename","filesystemName",0 OK
POST data command			
Set	AT+UHTTPC=<profile_id>,5,<path>,<filename>,<data>,<HTTP_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

23.3.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<http_command>	Number	• 0: HEAD command; issue an HEAD request to the HTTP server • 1: GET command; perform a GET request to the HTTP server • 2: DELETE command; send a DELETE request to the HTTP server • 3: PUT command; perform a PUT request to the HTTP server. • 4: POST a file command; issue a POST request for sending a file to the HTTP server

Parameter	Type	Description
		• 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: • LENA-R8 - 128 characters
<filename>	String	Filename where the HTTP server response will be stored. If the file already exists, it will be overwritten. If the parameter is an empty string ("""), the default "http_last_response_<profile_id>" filename will be used. For file system file name and data size limits see File system limits.
<filesystem_name>	String	File system filename representing the file system filename to be sent to the HTTP server within the POST / PUT request. For file system file name and data size limits see File system limits.
<HTTP_content_type>	Number	HTTP Content-Type identifier. It represents the HTTP Content-Type identifier. Allowed values: • 0: application/x-www-form-urlencoded • 1: text/plain • 2: application/octet-stream • 3: multipart/form-data • 4: application/json (supported only for PUT and POST file command) • 5: application/xml • 6: user defined with <user_defined_content_type>
<user_defined_content_type>	Number	Used only when <HTTP_content_type>=6 (user defined Content-Type). The maximum length is 64 characters.
<data>	String	It represents the data to be sent to the HTTP server with the POST request. The maximum length is 128 bytes. The data must be formatted according to the Content-Type specified in <HTTP_content_type> parameter.
<param1>	String	Content depends on the related <http_command> (see above).
<param2>	Number	Content depends on the related <http_command> (see above).
<param3>	String	Content depends on the related <http_command> (see above).
<http_result>	Number	• 0: fail • 1: success
<http_status_code>	Number	HTTP status code reported in the server response header after a GET FOTA update file request. This parameter is issued only for AT+UHTTPC=<profile_id>,100,<path> AT command.
<md5_sum>	String	MD5 checksum of the FOTA update file. This parameter is issued only for AT +UHTTPC=<profile_id>,100,<path> AT command.

23.3.4 Notes

- The +UHTTPC command has a default timeout setting set to 180 s. The timeout is counted from the last successful network read or send operation performed by the HTTP application, so in a real timeout case the application might be executing a command more than 180 s.
- The data string must not exceed the maximum length of 128 bytes.
- If <http_command>=4 (POST a file) and the <HTTP_content_type>=3 (multipart/form-data), then the module automatically encapsulates the file content in the following multipart/form-data HTTP request:

```
--U1Blox2Http3Unique4Boundary5\r\n
Content-Disposition: form-data; name="file_post"; filename="<user_defined_content_type>"\r\n
Content-Length: <length of file specified with <user_defined_content_type>>\r\n
Content-Type: application/octet-stream\r\n
\r\n
<content of file specified with <user_defined_content_type>>\r\n
--U1Blox2Http3Unique4Boundary5--\r\n
\r\n
```

- The response headers string (headers received in the HTTP response) must not exceed the maximum length of 255 bytes.

23.4 HTTP protocol error +UHTTPER

+UHTTPER						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error Appendix A.7

23.4.1 Description

Retrieves the error class and code of the latest HTTP operation on the specified HTTP profile.

23.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UHTTPER=<profile_id>	+UHTTPER: <profile_id>,<error_class>,<error_code> OK	AT+UHTTPER=1 +UHTTPER: 1,0,0 OK

23.4.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<error_class>	Number	List of the allowed values is available in Appendix A.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

24 Ping

The ping service requires the user to define and activate a connection profile before executing the +UPING AT command. Some products require additional commands to provide connectivity to the application.

24.1 Ping command +UPING

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

24.1.1 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 [179]. 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.

24.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UPING=<remote_host>[,<retry_num>,<p_size>,<timeout>,<ttl>[,<cid>[,<preferred_protocol_type>]]]	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>,(list of supported <cid>),(list of supported <preferred_protocol_type>) 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

24.1.3 Defined values

Parameter	Type	Description
<remote_host>	String	IP address (dotted decimal representation) or domain name of the remote host: • 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: • LENA-R8 - The range goes from 4 to 1460. The default value is 32.
<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
<cid>	Number	PDP context identifier used for the PING communication. The allowed range is product specific, see <cid>. For more details on the default value of the parameter (where supported), see PING.
<preferred_protocol_type>	Number	Preferred protocol type to be specified when the <cid> protocol type is IPv4v6. Allowed values: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see PING.
<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.

24.1.4 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 <cid> and <preferred_protocol_type> parameters are not supported.
- When the TTL used in the ping request is too low and expires the "Request timed out" URC is returned.

24.2 ICMP echo reply configuration +UDCONF=4

+UDCONF=4						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

24.2.1 Description

Enables/disables the ICMP echo reply (ping response).

☞ Not all the network operators allow the ping traffic on their network.

24.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=4,<icmp_echo_reply>	OK	AT+UDCONF=4,1 OK
Read	AT+UDCONF=4	+UDCONF: 4,<icmp_echo_reply> OK	AT+UDCONF=4 +UDCONF: 4,1 OK

24.2.3 Defined values

Parameter	Type	Description
<icmp_echo_reply>	Number	Enables or disables the ping response when a remote host performs a ping request to the module • 0: ping response disabled (the module does not reply to remote pings) • 1 (factory-programmed value): ping response enabled (the module replies to remote pings)

25 Positioning

25.1 NMEA

u-blox cellular modules support reading NMEA strings and URCs from the GNSS receiver through AT commands.

The NMEA standard differentiates between GPS, GLONASS, GALILEO, BeiDou and multi-GNSS receivers using a different 'Talker ID'. Depending upon device model and system configuration, the u-blox receiver could output messages using any one of these Talker IDs.

By default, the receivers configured to support GPS, SBAS and QZSS use the 'GP' Talker ID, receivers configured to support GLONASS use the 'GL' Talker ID, receivers configured to support BeiDou use the 'GB' Talker ID, receivers configured to support GALILEO use the 'GA' Talker ID and receivers configured for any combinations of multiple GNSS use the 'GN' Talker ID.

Even if the NMEA specification indicates that the GGA message is GPS specific, u-blox receivers support the output of a GGA message for each of the Talker IDs.

To read a specific NMEA string, it must be activated.

Where supported, the +UGNMEA AT command can activate or deactivate specific NMEA strings at a desired rate. For every NMEA type, strings can be output as URCs, or stored in an internal buffer, or can be routed to the UART of the GNSS receiver. When internal buffer is activated, the NMEA strings are stored there and can be read by +UGNMEA read command. In this case, all the NMEA strings are output and the buffer is then emptied.

Otherwise the legacy NMEA commands, +UGZDA, +UGGGA, +UGGLL, +UGGSV, +UGRMC, +UGVTG, +UGGSA AT commands can be used to activate the storage of the last value of specific types of NMEA strings. If storing a particular NMEA string has not been activated, the information text response to the query will be "0,NULL". The last value of a specific NMEA string is saved in RAM and is available even after the GNSS receiver switch off.

☞ As a factory-programmed setting, the cellular modules configure the GNSS receiver through +UGPS AT command to not provide the NMEA sentences.

☞ Using legacy NMEA commands when reading an NMEA message, if the response value is "1,Not available" then the storing of the NMEA string is activated but this information has not been still sent to the user, if this persists check that the relative NMEA message is enabled. To enable it use the +UGUBX AT command (for further information see the UBX-CFG-MSG message in the u-blox GNSS protocol specification).

25.2 AssistNow services

Users would ideally like GNSS receivers to provide accurate position information the moment they are turned on. With standard GNSS receivers there can be a significant delay in providing the first position fix, principally because the receiver needs to obtain data from several satellites and the satellites transmit that data slowly. Under adverse signal conditions, data downloads from the satellites to the receiver can take minutes, hours or even fail altogether.

GNSS AT commands provides the means for delivering assistance data to u-blox receivers obtained from the u-blox AssistNow Online or AssistNow Offline services.

AssistNow Online is u-blox' end-to-end Assisted GNSS (A-GNSS) solution for use cases that have access to the Internet. Data supplied by the AssistNow Online service can be directly uploaded to a u-blox receiver to substantially reduce Time To First Fix (TTFF), even under poor signal conditions.

AssistNow Offline service is targeted at use cases that only have occasional Internet access and so cannot use AssistNow Online. AssistNow Offline speeds up Time To First Fix (TTFF), typically to considerably less than 10 s. Cellular modules using AssistNow Offline download data from the AssistNow Offline service when an Internet connection is available. Data are stored locally to the cellular module file system and are subsequently uploaded to a u-blox receiver, so that it can estimate the positions of the satellites, when no better data is available. Using these estimates will not provide as accurate a position fix as if current ephemeris data is used, but it will allow much faster TTFFs in nearly all cases.

Both the AssistNow Online and Offline services use a simple, stateless, HTTP interface. Therefore, they work on all standard mobile communication networks that support Internet access.

UDP protocol for the AssistNow Online service is deprecated.

Both the AssistNow Online and Offline services are only available for use by u-blox customers. To use the services, customers will need to obtain an authorization token from u-blox. This token must be issued as a parameter of +UGSRV AT command.

AssistNow Autonomous feature provides a functionality similar to AssistNow Offline without the need for a host and a connection. Based on a broadcast ephemeris downloaded from the satellite the receiver can autonomously generate an accurate satellite orbit representation («AssistNow Autonomous data») that is usable for navigation much longer than the underlying broadcast ephemeris was intended for.

Local Aiding feature provides a functionality so that u-blox receivers is instructed to dump the current state of their internal navigation database to the cellular module file system. This information is sent back to the receiver (e.g. after a period when the receiver was turned off) restoring the database to its former state, and thus allows the receiver to restart rapidly. Local aiding feature does not need for a access to the Internet.

The +UGPS AT command allows the activation/deactivation of AssistNow Online, Offline, Autonomous and Local Aiding features.

The AssistNow Offline and AssistNow Autonomous features are exclusive and should not be used at the same time. Every satellite will be ignored by AssistNow Autonomous if there is AssistNow Offline data available for it.

Table 15 summarizes the GNSS AT commands related with AssistNow services:

AT command	AssistNow Online	AssistNow Offline	AssistNow Autonomous	Local Aiding
+UGPS	Enable/disable the feature	Enable/disable the feature	Enable/disable the feature	Enable/disable the feature
+UGAOP	Configure UDP for A-GPS (deprecated)			
+UGAOF		Configure HTTP for A-GPS (deprecated)		
+UGSRV	Configure HTTP for A-GNSS Configure Auth Token for A-GNSS	Configure HTTP for A-GNSS Configure Auth Token for A-GNSS		
+UGAOS	Force AssistNow Online data download request	Force AssistNow Offline data download request	Force AssistNow Autonomous operation	Download/Upload of local aiding data from/to GNSS receiver to cellular module

Table 15: AssistNow services Overview

25.3 GNSS

25.3.1 GNSS power management +UGPS

+UGPS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

25.3.1.1 Description

Switches on or off a u-blox GNSS receiver connected to the cellular module via a dedicated DDC (I^2C) interface. For more details about the connection between cellular module and u-blox GNSS receiver, see the corresponding module system integration manual.

Furthermore the command sets the aiding type to be used to enhance GNSS performance, e.g. decreasing Time To First Fix (TTFF). The supported aiding types are: Local aiding, AssistNow Online, AssistNow Offline, AssistNow Autonomous.

For a more detailed description on aiding modes and possible suggestions, see AssistNow services.

The AssistNow Autonomous feature may be not fully supported on all Multi-GNSS receivers. For more details on AssistNow Autonomous feature see the corresponding u-blox-GNSS receiver description.

☞ It is possible to combine different aiding modes: to enable them the sum of the <mode> value of the interested aiding modes is needed (e.g.: aiding <aid_mode>=3 means local aiding plus AssistNow Offline). Moreover it is also possible to switch from one aiding mode to another one without powering off the GNSS receiver. If the following sequence is provided (AT+UGPS=1,1 and then AT+UGPS=1,5) at the beginning the GNSS receiver will power on with local aiding support and after the second command will be added the AssistNow Online. After the second command the local aiding is not restarted, therefore the +UUGIND URC for it will not be sent again.

u-blox concurrent GNSS receivers can acquire and track satellites from more than one GNSS system at the same time. The <GNSS_systems> parameter configures the GNSS receiver into the required mode of operation. It is possible to combine different GNSS systems depending on the receivers capability to receive several carrier frequencies. See the corresponding GNSS receiver data sheet for the supported GNSS systems. If the Assisted GNSS unsolicited indication is enabled, the +UUGIND URC will provide the current activated combinations of systems.

25.3.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPS=<mode>[,<aid_mode>[,<GNSS_systems>]]	OK	AT+UGPS=1,0,1 OK
Read	AT+UGPS?	+UGPS: <mode>[,<aid_mode>[,<GNSS_systems>]] OK	+UGPS: 1,0,1 OK
Test	AT+UGPS=?	+UGPS: (list of supported <mode>s),(list of supported <aid_mode>s),(list of supported <GNSS_systems>s) OK	+UGPS: (0-1),(0-15),(1-511) OK

25.3.1.3 Defined values

Parameter	Type	Description
<mode>	Number	• 0 (default value): GNSS receiver powered off • 1: GNSS receiver powered on
<aid_mode>	Number	Supported aiding modes; the parameter is mandatory if <mode>=1; all these allowed values can be combined together: • 1: automatic local aiding • 2: AssistNow Offline • 4: AssistNow Online • 8: AssistNow Autonomous If <aid_mode> is set to 0 (default value), all the aiding modes are disabled (no aiding).
<GNSS_systems>	Number	Bitmask for combining the supported GNSS types and relative signals (in brackets); the parameter is optional and the allowed values can be combined together. The default value is 3 (GPS+SBAS): • 1: GPS (L1CA) • 2: SBAS (L1CA) • 4: Galileo (E1) • 8: BeiDou (B1I) • 16: IMES (L1) • 32: QZSS (L1CA) • 64: GLONASS (L1) • 128: BEIDOU B1C • 256: QZSS L1S Allowed bits: • LENA-R8 - 1, 2, 4, 8, 16, 32, 64, 128, 256

25.3.1.4 Notes

- If <GNSS_systems> type is not supported by the GNSS receiver, the set command turns on the GNSS receiver with built-in supported type. The current <GNSS_systems> can be queried by means of the read command or the +UUGIND URC.
- An error result code is provided in the following cases:
  - <mode>, <aid_mode> or <GNSS_systems> values are out of range

- <mode> is set to 1 without <aid_mode> value
- Attempt to power off the GNSS when it is already off
- The value of <aid_mode> to be set is equal to the current GNSS aiding mode and the value of <GNSS_systems> to be set is equal to the last requested <GNSS_systems>

25.3.2 Assisted GNSS unsolicited indication +UGIND

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

25.3.2.1 Description

Enables or disables sending of URCs from MT to TE in the case of GNSS aiding operations. The <mode> parameter controls the processing of URCs specified within this command.

The URC returns the result of an assisted GNSS operation. This information is sent to all the interfaces. The URC is provided only if one or more aiding modes are enabled (for more details, see the +UGPS and +UGAOP (where supported) command descriptions). A URC is issued for each check in of an MGA server (primary and secondary).

There can be more than a +UUGIND URC for a single aiding operation: the +UUGIND is reported for each error. For instance if the local aiding is enabled and there are no space left in the file system after the AT+UGPS=0 command, there will be an error for every failure writing on FFS.

The AT+UGAOS=0 and AT+UGAOS=1 commands both relate to the GNSS local aiding, so the unsolicited message will be +UUGIND: 1,x in both cases.

Local aiding and AssistNow Autonomous will produce URC both after GNSS power on and before GNSS power off because some data are transferred from the GNSS receiver to the cellular module.

As the GNSS receiver can be configured for multi-GNSS, an additional +UUGIND: 0,<GNSS_systems> URC for the currently activated GNSS systems is displayed.

25.3.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGIND=<mode>	OK	AT+UGIND=1 OK
Read	AT+UGIND?	+UGIND: <mode> OK	+UGIND: 1 OK
Test	AT+UGIND=?	+UGIND: (list of supported <mode>'s) OK	+UGIND: (0-1) OK
URC		**Current activated GNSS system:** +UUGIND: 0,<GNSS_systems>	+UUGIND: 0,3
		GNSS aiding status: +UUGIND: <aid_mode>,<result>	+UUGIND: 4,5

25.3.2.3 Defined values

Parameter	Type	Description
<mode>	Number	URC configuration: • 0 (default value): disabled • 1: enabled
<aid_mode>	Number	Provides the supported aiding mode: • 0: GNSS system(s) • 1: automatic local aiding • 2: AssistNow Offline • 4: AssistNow Online • 8: AssistNow Autonomous

Parameter	Type	Description
<GNSS_systems>	Number	Current activated GNSS types; the allowed values can be combined together: • 1: GPS • 2: SBAS • 4: Galileo • 8: BeiDou • 16: IMES • 32: QZSS • 64: GLONASS
<result>	Number	Represents the result of the aiding operation: • 0: no error • 1: wrong URL (for AssistNow Offline) • 2: HTTP error (for AssistNow Offline) • 3: create socket error (for AssistNow Online) • 4: close socket error (for AssistNow Online) • 5: write to socket error (for AssistNow Online) • 6: read from socket error (for AssistNow Online) • 7: connection/DNS error (for AssistNow Online) • 8: file system error • 9: generic error • 10: no answer from GNSS (for local aiding and AssistNow Autonomous) • 11: data collection in progress (for local aiding) • 12: GNSS configuration failed (for AssistNow Autonomous) • 13: RTC calibration failed (for local aiding) • 14: feature not supported (for AssistNow Autonomous) • 15: feature partially supported (for AssistNow Autonomous) • 16: authentication token missing (required for aiding for u-blox M8 and future versions)

25.3.2.4 Notes

LENA-R8

- The command setting is not stored in the NVM.

25.3.3 GNSS profile configuration +UGPRF

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

25.3.3.1 Description

Configures the data flow to and from a u-blox GNSS receiver connected to the cellular module. The data flow is possible to and from the:

- UART (via multiplexer)
- USB (or alternatively AUX UART)
- Over the air to a remote host: To send data over the air an internet connection must be active and there must be at least one free TCP socket (the GNSS shares the socket pool with the other applications). Setting up an internet connection and network registration is not part of this command and must be handled by the user separately from this command.
- Into a file on the cellular module: A file with GNSS data can be accessed via the +ULSTFILE AT command. The filename is automatically chosen by the cellular module as a unique ID based on date and time or a further incremental number (e.g. "GPS_200910061500" or "GPS_20091006_001" according to the used cellular module). When the files size reaches 500 kB the file is closed and no more data is saved. It is possible to save further data by restarting the GNSS (this will create a new file)

It is possible to send GNSS data to multiple destinations at the same time by summing the <GNSS_I/O_configuration> values of each required destinations (e.g. if AT+UGPRF=6 the data will be sent on multiplexer and stored in a file in the file system).

The messages to be output by the u-blox GNSS receiver need to be activated separately with UBX-CFG-MSG configuration messages according to the GNSS receiver protocol specification.

☞ It is not possible to select the GNSS data flow to and from USB (or alternatively AUX UART) and multiplexer concurrently.

☞ The configuration of the GNSS profile must be performed only when GNSS is switched off, otherwise an error result code will be displayed.

25.3.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPRF=<GNSS_I/O_configuration>[,<IP Port>,<server address string>]	OK	AT+UGPRF=0 OK
Read	AT+UGPRF?	+UGPRF: <GNSS_I/O_configuration>,<IP port>,<server address string> OK	+UGPRF: 0,0,"" OK
Test	AT+UGPRF=?	+UGPRF: (list of supported <GNSS_I/O_configuration>),(list of supported <IP port>),<server address string> OK	+UGPRF: (0-512),(0-65535),"addr" OK

25.3.3.3 Defined values

Parameter	Type	Description
<GNSS_IO_configuration>	Number	• 0: no data flow to multiplexer, file or IP address • 1: GNSS data flow to and from USB (or alternatively AUX UART) • 2: GNSS data flow to and from multiplexer • 4: GNSS data flow saved to file • 8: GNSS data flow over the air to an internet host • 16: GNSS data ready function • 32: GNSS RTC sharing function • 64: reserved • 128: reset the GNSS after the GNSS power on (see AT+UGPS command description) • 256: reserved • 512: AssistNow Online deep scan for DB feeding Allowed values: • LENA-R8 - 0 (factory-programmed value), 1, 4, 8, 16
<IP port>	Number	IP port of the server where the GNSS data are sent (default and factory-programmed value: 0). If GNSS data flow over the air is enabled the parameter is mandatory otherwise is forbidden.
<server address string>	String	Address string of the server where the GNSS data are sent (default and factory-programmed value: ""). If GNSS data flow over the air is enabled the parameter is mandatory otherwise is forbidden. The address could be provided in both URL or IP format and the maximum length of the string is 47 characters.

25.3.4 Aiding server configuration +UGSRV

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

25.3.4.1 Description

Configures the network connection to a Multi GNSS Assistance (MGA) server. The configuration is saved in NVM and applied at the next GNSS power cycle. By default, the cellular module connects to u-blox' primary MGA server; if the connection fails then the cellular module connects to u-blox' secondary MGA server. The set command registers a token for gathering assistance data from MGA servers.

☞ Setting up an internet connection and network registration is not part of this command and must be handled by the user separately to this command.

☞ For more details about Multi GNSS Assistance (MGA) feature, see to AssistNow services.

25.3.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGSRV=[<mga_primary_server>],[<mga_secondary_server>],<auth_token>[,<days>[,<period>[,<resolution>[,<GNSS_types>[,<mode>[,<datatype>[,<cid>]]]]]]]	OK	AT+UGSRV="cell-live1.services.u-blox.com","cell-live2.services.u-blox.com","123456789abcdefghijklm",14,4,1,65,0,1,1 OK
Read	AT+UGSRV?	+UGSRV: <mga_primary_server>,<mga_secondary_server>,<auth_token>,<days>,<period>,<resolution>,<GNSS_types>,<mode>,<datatype>,<cid> OK	+UGSRV: "cell-live1.services.u-blox.com","cell-live2.services.u-blox.com","123456789abcdefghijklm",14,4,1,65,0,1,1 OK
Test	AT+UGSRV=?	+UGSRV: <mga_primary_server>,<mga_secondary_server>,<auth_token>,(list of supported <days>s),(list of supported <period>s),(list of supported <resolution>s),(list of supported <GNSS_types>s),(list of supported <mode>s),(list of supported <datatype>s),(list of supported <cid>s) OK	+UGSRV: "srv1","srv2","token",(1,2,3,5,7,10,14),(1-5),(1-3),(1-77),(0-2),(0-15),(0,254) OK

25.3.4.3 Defined values

Parameter	Type	Description
<mga_primary_server>	String	Host name of the primary MGA server; the maximum length is 254 characters. Empty string is not allowed. If the primary MGA server is omitted, the current stored value is preserved. • LENA-R8 - The default and factory-programmed value is "lscellapi.services.ublox.com".
<mga_secondary_server>	String	Host name of the secondary MGA server; the maximum length is 254 characters. Empty string is not allowed. The default and factory-programmed value is "cell-live2.services.u-blox.com". If the secondary MGA server is omitted, the current stored value is preserved.
<auth_token>	String	Authentication Token for MGA server access.
<days>	Number	The number of days into the future the Offline data for u-blox 7 and previous version should be valid for. The allowed values are: 1, 2, 3, 5, 7, 10 and 14. The default and factory-programmed value is 14.
<period>	Number	The number of weeks into the future the Offline data for u-blox M8 should be valid for. The range of the allowed values goes from 1 to 5. The default and factory-programmed value is 4.
<resolution>	Number	Resolution of offline data for u-blox M8. Allowed values: • 1 (default and factory-programmed value): every day • 2: every other day • 3: every third day
<GNSS_types>	Number	Bitmask for combining the desired GNSS for the (offline) aiding • 1: GPS • 4: Galileo • 8: BeiDou • 64: GLONASS The default and factory-programmed value is GPS+GLONASS (65). If the parameter is omitted, the current stored value is preserved. Allowed bits: • LENA-R8 - 1, 4, 8, 64

Parameter	Type	Description
<mode>	Number	Mode of operation of AssistNow Online data management • 0 (default and factory-programmed value): AssistNow Online data are downloaded at GNSS receiver power up • 1: AssistNow Online data automatically kept alive • 2: manual AssistNow Online data download
<datatype>	Number	Bitmask for combining the desired data types for the (online) aiding • 0: time • 1: position • 2: ephemeris • 4: almanac • 8: auxiliary • 16: ephemeris of satellites which are likely to be visible from the position estimated by current registered network. This flag has no effect if the ephemeris flag is set to 0. The default and factory-programmed value is all aidings without filter on visible satellites (15)
<cid>	Number	PDP context identifier. See <cid>. For more details on the default and factory-programmed value, see the command description.

25.3.5 AssistNow Online configuration +UGAOP

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

25.3.5.1 Description

Configures the network connection to an AssistNow Online server. Use of this command is only necessary if changes to the factory-programmed configuration are required.

As GNSS shares the socket pool with the other applications, to execute AssistNow Online the cellular module will try to open a new socket without dropping any opened socket, if there is no socket available then the GNSS will start and no aiding operation is performed. By default, the cellular module connects to the u-blox' AssistNow Online server. The access to a proxy server is possible.

☞ Setting up Internet connection and network registration is not part of this command and must be handled by the user separately to this command.

☞ For more details about AssistNow Online feature please refer to AssistNow services.

25.3.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGAOP=<hostname>,<server_port>,<latency>,<mode>	OK	AT+UGAOP="eval1-les.services.u-blox.com",46434,1000,0 OK
Read	AT+UGAOP?	+UGAOP: <hostname>,<server_port>,<latency>,<mode> OK	+UGAOP: "eval1-les.services.u-blox.com",46434,1000,0 OK

25.3.5.3 Defined values

Parameter	Type	Description
<hostname>	String	Host name of the server (factory-programmed value: eval1-les.services.u-blox.com); the maximum length is 47 characters
<server_port>	Number	Value in the range 0 - 65535. (factory-programmed value: 46434)
<latency>	Number	Expected network latency value from AssistNow Online server to client, in milliseconds. The range goes from 0 to 3600 ms. (factory-programmed value: 1000 ms)
<mode>	Number	Mode of operation of AssistNow Online data management

Parameter	Type	Description
		• 0 (factory-programmed value): AssistNow Online data are downloaded at GNSS receiver power up • 1: AssistNow Online data automatically kept alive • 2: manual AssistNow Online data download

25.3.6 AssistNow Offline configuration +UGAOF

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

25.3.6.1 Description

Configures the network connection to an AssistNow Offline server. Use of this command is only necessary if changes to the factory-programmed configuration are required.

As GNSS shares the socket pool with the other applications, to execute AssistNow Offline the cellular module will try to open a new socket without dropping any opened socket, if there is no socket available then the GNSS will start and no aiding operation is performed. By default, the cellular module connects to the 14 day file on the u-blox' AssistNow Offline server.

☞ Setting up Internet connection and network registration is not part of this command and must be handled by the user separately from this command.

☞ For more details about AssistNow Offline feature please refer to AssistNow services.

25.3.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGAOF=<file_url>,<reserved>,<retry timeout>,<max_retry_attempts>	OK	AT+UGAOF="http://alp.u-blox.com/current_14d.alp",0,1,3 OK
Read	AT+UGAOF?	+UGAOF: <file_url>,0,<retry timeout>,<max_retry_attempts> OK	+UGAOF: "http://alp.u-blox.com/current_14d.alp",0,1,3 OK

25.3.6.3 Defined values

Parameter	Type	Description
<file_url>	String	URL of AssistNow Offline file (the maximum length is 255 characters including "http://"). Allows choosing the size/validity of the file. The factory-programmed value is http://alp.u-blox.com/current_14d.alp
<Reserved>		RFU
<Retry Timeout>	Number	Timeout in minutes after a failed download for the next download attempt (0 ... 999) (factory-programmed value: 1)
<max_retry_attempts>	Number	Maximum number of attempts in case of failed download (0-5); the factory-programmed value is 3.

25.3.7 GNSS aiding request command +UGAOS

+UGAOS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

25.3.7.1 Description

Triggers the manual download of AssistNow Online and AssistNow Offline data from the configured server in case automatic AssistNow operation is not enabled. The command returns only when the received data from the server are valid or an error occurs.

The command is also used to trigger the manual upload of local aiding data (e.g. ephemeris, almanac, last position, time, etc) from a u-blox GNSS receiver prior to shutting it down and to restore it into the receiver after the power up of the GNSS receiver (for more details, see the +UGPS AT command).

25.3.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGAOS=<aid_mode>	OK	AT+UGAOS=0 OK
Test	AT+UGAOS=?	AT+UGAOS: (list of supported <aid_mode>s) OK	+UGAOS: (0-8) OK

25.3.7.3 Defined values

Parameter	Type	Description
<aid_mode>	Number	Allowed values: • 0: upload of local aiding data from GNSS receiver to cellular module • 1: download of local aiding data from the cellular module to the GNSS receiver • 2: AssistNow Offline file download request (file loaded into cellular module) • 4: AssistNow Online data download request (data loaded into the GNSS receiver). This is only needed if AssistNow Online is not used with automatic operation • 8: AssistNow autonomous • Other values are reserved for future use

25.3.8 Send of UBX string +UGUBX

+UGUBX						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

25.3.8.1 Description

Sends UBX protocol messages, embedded in an AT command, to a u-blox GNSS receiver. The command is transparent, that is the data is sent to the GNSS receiver without any check: it is up to the user to control if the UBX data is valid. The checksum in +UGUBX command string is ignored, this is calculated when the data is sent to the GNSS receiver.

When the GNSS receiver is off the UBX string is saved in cellular module RAM and, later, passed to the GNSS as configuration for "GNSS data ready" function when the GNSS receiver is used. In this case the UBX checksum bytes must be filled correctly.

☞ It is recommended to not send UBX messages to reset the GNSS receiver while it is in use, this will cause a misalignment between the cellular system configuration and the one of the GNSS system.

☞ UBX messages of "input" type do not provide back information messages to the cellular module. In this case the information text response to set command is +UGUBX: "no message" followed by the final result code.

☞ Be aware that the navigation/measurement rate of the GNSS receiver can be set via UBX message and this might impact the internal timeout (10 s) of this command, in fact setting a navigation rate higher than 10 s might cause the +UGUBX AT command to go into timeout. For more details on the navigation/measurement rate of GNSS receiver and the corresponding UBX message, see the GNSS receiver protocol specification.

25.3.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGUBX=<UBX_string>	+UGUBX: <UBX_string_response> OK	AT+UGUBX="B562012100002267" +UGUBX: "B56201211400F82D140 70F000000C38A0200E60706140 83B05375A6E" OK

25.3.8.3 Defined values

Parameter	Type	Description
<UBX_string>	String	UBX message in hexadecimal format. The messages can include spaces to simplify copy/paste from u-center separated with spaces, e.g. AT+UGUBX="B5 62 0A 09 00 0 0 13 43" (this is important when copying messages from u-center).
<UBX_string_ response>	String	The response message depends by the request sent: query/poll UBX messages will return the requested data in hexadecimal format, while the configuration message will return the corresponding acknowledge or not-acknowledge. See the UBX protocol specification

25.3.8.4 Notes

- If a +UGUBX command triggers multiple strings answer only a single UBX string is returned. E. g. polling GPS Aiding Ephemeris Data (AID-EPH) is done by sending a single message to the receiver but returns 32 messages; only the first one is sent to AT interface.
- The answer can be split in multiple information text responses all starting with "+UGUBX:".
- The UBX protocol is slightly different when a UBX-M10 GNSS receiver is addressed, especially if configuration commands (UBX-CFG) are used. To properly set the UBX message, see the proper GNSS receiver interface description.

25.3.9 GNSS indications timer +UGTMR

+UGTMR						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

25.3.9.1 Description

Sets the date and time format. With the <time_zone> parameter is possible to set the time zone value; the time and the date will be updated as the local time. With the action command is possible to synchronize the UTC timing.

25.3.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGTMR=<time_zone>	OK	AT+UGTMR=-1 OK
Read	AT+UGTMR?	+UGTMR: <time_zone> OK	+UGTMR: -1 OK
Test	AT+UGTMR=?	+UGTMR: (list of supported <time_ zone>s) OK	+UGTMR: (-96 - 96) OK

25.3.9.3 Defined values

Parameter	Type	Description
<time_zone>	Number	Indicates the time zone value set by the user; the module can provide an error result code if the offset has not been calculated. The factory-programmed time zone value is 0. • -96, 96: defined range

25.3.9.4 Notes

- The time zone is expressed in quarters of hour.
- The time is updated with the current UTC time plus the time zone and the time zone is unchanged, for example:

Command	Response	Remarks
AT+UGTMR=-36	OK	The command returns the "OK" final result code and sets the new date and time if the GNSS has this information, otherwise a generic error result code is returned.
AT+CCLK?	+CCLK: "12/05/23,21:54:21+00"	

25.3.10 Get GNSS time and date +UGZDA

+UGZDA						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	NVM	No	< 10 s	+CME Error

25.3.10.1 Description

Enables/disables the storing of the last value of NMEA $ZDA messages, and get the current messaging state. If the <state> parameter is enabled, the last value of NMEA $ZDA messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $ZDA messages are volatile.

25.3.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGZDA=<state>	OK	AT+UGZDA=1 OK
Read	AT+UGZDA?	+UGZDA: <state>,<$ZDA msg> OK	+UGZDA: 1,$GPZDA,142351.00,12,12,2013,00,00*66 OK +UGZDA: 0,NULL OK
Test	AT+UGZDA=?	+UGZDA: (list of supported <state>s) OK	+UGZDA: (0-1) OK

25.3.10.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): disable the NMEA $ZDA messages • 1: enable the NMEA $ZDA messages
<$ZDA msg>	String	NMEA $ZDA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

25.3.11 Get GNSS fix data +UGGGA

+UGGGA						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	NVM	No	< 10 s	+CME Error

25.3.11.1 Description

Enables/disables the storing of the last value of NMEA $GGA messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $GGA messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GGA messages are volatile.

25.3.11.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGGA=<state>	OK	AT+UGGGA=1 OK
Read	AT+UGGGA?	+UGGGA: <state>,<$GGA msg> OK	+UGGGA: 1,$GPGGA,142351.00,,,,,0,00,99.99,,,,,,*66 OK +UGGGA: 0,NULL OK

Type	Syntax	Response	Example
Test	AT+UGGGA=?	+UGGGA: (list of supported <state>s) OK	+UGGGA: (0-1) OK

25.3.11.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GGA messages • 1: to enable the NMEA $GGA messages
<$GGA msg>	String	NMEA $GGA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

25.3.12 Get geographic position +UGGLL

+UGGLL						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	NVM	No	< 10 s	+CME Error

25.3.12.1 Description

Enables/disables the storing of the last value of NMEA $GLL messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $GLL messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GLL messages are volatile.

25.3.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGLL=<state>	OK	AT+UGGLL=1 OK
Read	AT+UGGLL?	+UGGLL: <state>,<$GLL msg> OK	+UGGLL: 1,$GPGLL,,,,,142351.00,V,N*4A OK +UGGLL: 0,NULL OK
Test	AT+UGGLL=?	+UGGLL: (list of supported <state>s) OK	+UGGLL: (0-1) OK

25.3.12.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GLL messages • 1: to enable the NMEA $GLL messages
<$GLL msg>	String	NMEA $GLL messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

25.3.13 Get number of GNSS satellites in view +UGGSV

+UGGSV						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	NVM	No	< 10 s	+CME Error

25.3.13.1 Description

Enable/disables the storing of the last value of NMEA $GSV messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $GSV messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GSV messages are volatile.

25.3.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGSV=<state>	OK	AT+UGGSV=1 OK
Read	AT+UGGSV?	+UGGSV: <state>,<$GSV msg> OK	+UGGSV: 1,$GPGSV,3,1,11,03,67,298,22,06,88,149,29,07,06,302,,08,05,332,25*73 $GPGSV,3,2,11,09,02,334,25,14,02,141,,15,10,041,43,16,46,209,16*7D $GPGSV,3,3,11,18,48,066,35,21,26,070,35,27,80,314,25*40 $GLGSV,1,1,03,73,13,248,,74,23,298,20,75,09,348,19*51 OK +UGGSV: 0,NULL OK
Test	AT+UGGSV=?	+UGGSV: (list of supported <state>s) OK	+UGGSV: (0-1) OK

25.3.13.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GSV messages • 1: to enable the NMEA $GSV messages
<$GSV msg>	String	NMEA $GSV messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

25.3.13.4 Notes

- Since the $GSV message reports satellite information, the output of the different GNSS systems is not combined, but it is reported in sequence as in the example above with GPS and GLONASS.

25.3.14 Get recommended minimum GNSS data +UGRMC

+UGRMC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	< 10 s	+CME Error

25.3.14.1 Description

Enable/disables the storing of the last value of NMEA $RMC messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $RMC messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $RMC messages are volatile.

25.3.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGRMC=<state>	OK	AT+UGRMC=1 OK
Read	AT+UGRMC?	+UGRMC: <state>,<$RMC msg> OK	+UGRMC: 1,$GPRMC,142351.00,V,,,,,,,121213,,,N*7F OK +UGRMC: 0,NULL OK

Type	Syntax	Response	Example
Test	AT+UGRMC=?	+UGRMC: (list of supported <state>s) OK	+UGRMC: (0-1) OK

25.3.14.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $RMC messages • 1: to enable the NMEA $RMC messages
<$RMC msg>	String	NMEA $RMC messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

25.3.15 Get course over ground and ground speed +UGVTG

+UGVTG						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	NVM	No	< 10 s	+CME Error

25.3.15.1 Description

Enables/disables the storing of the last value of NMEA $VTG messages, and gets know the current messaging state. If the <state> parameter is enabled, the last value of NMEA $VTG messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $VTG messages are volatile.

25.3.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGVTG=<state>	OK	AT+UGVTG=1 OK
Read	AT+UGVTG?	+UGVTG: <state>,<$VTG msg> OK	+UGVTG: 1,$GPVTG,,,,,,,,,N*30 OK +UGVTG: 0,NULL OK
Test	AT+UGVTG=?	+UGVTG: (list of supported <state>s) OK	+UGVTG: (0-1) OK

25.3.15.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $VTG messages • 1: to enable the NMEA $VTG messages
<$VTG msg>	String	NMEA $VTG messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

25.3.16 Get satellite information +UGGSA

+UGGSA						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	NVM	No	< 10 s	+CME Error

25.3.16.1 Description

Enables/disables the storing of the last value of NMEA $GSA messages, and gets the current messaging state. If <state> parameter is enabled, the last value of NMEA $GSA messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GSA messages are volatile.

25.3.16.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGSA=<state>	OK	AT+UGGSA=1 OK
Read	AT+UGGSA?	+UGGSA: <state>,<$GSA msg> OK	+UGGSA: 1,$GPGSA,A,1,,,,,,,,,,,,99.99,99.99,99.99*30 OK +UGGSA: 0,NULL OK
Test	AT+UGGSA=?	+UGGSA: (list of supported <state>s) OK	+UGGSA: (0-1) OK

25.3.16.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GSA messages • 1: to enable the NMEA $GSA messages
<$GSA msg>	String	NMEA $GSA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

25.4 CellLocate® and hybrid positioning

25.4.1 Ask for localization information +ULOC

+ULOC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

25.4.1.1 Description

Requests cellular module to provide the location data; the location can be determined using:

- GNSS receiver
- CellLocate® (location based on network cells data)
- SpotNow sensor (location based on GPS signal processed through cellular module)
- Combination of different technologies (hybrid)

The final result code indicates if sending the command request to the localization information process was successful or not. The URC is issued to provide the requested information via +ULOC set command.

In order to use simultaneously GNSS interface and CellLocate®, the GNSS shall not be a sensor for +ULOC: if the GNSS sensor is reserved to another interface (e.g. +UGPS) and is selected as a sensor also for +ULOC, an error result code is provided ("+CME ERROR: GPS busy" if +CMEE: 2).

It is possible to configure the hybrid positioning through +ULOCGNSS and +ULOCCELL AT commands even if it is running: the parameters are stored in NVM and will be applied at the next +ULOC command.

☞ If the +ULOC command is sent while a previous +ULOC activity is still in progress the previous activity is aborted, the available position is immediately output and the next +ULOC request is served.

☞ The data connection cannot be immediately dropped at the +ULOC timeout expiration. This could lead to a delay in the expected response time.

☞ Depending on the aiding chosen, a data connection could be required; see the +UGPS AT command description.

☞ If no position is available (no GNSS coverage, no network information and no previous data available) then the <lat> latitude and <long> longitude will be set to '0'.

☞ If the previous position degradated by the elapsed time satisfies the desired accuracy then the sensor '0' is reported in the information text response.

☞ If multi-hypothesis is required the GNSS solution and the CellLocate® solutions are reported, if available. If no GNSS, CellLocate® or SpotNow solutions are present, the previous position degradated is used instead.

☞ If a valid GNSS fix with an accuracy below the required value (<accuracy>) occurs before the end of the network scan, the GNSS-only solution will be available, even if multi-hypothesis has been required.

25.4.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULOC=<mode>,<sensor>,<response_type>,<timeout>,<accuracy>[,<num_hypothesis>]	OK	AT+ULOC=2,3,0,120,1 OK
Read	AT+ULOC?	+ULOC: <mode>,<sensor>,<response_type>,<timeout>,<accuracy>,<num_hypotesis> OK	+ULOC: 2,3,1,0,20,0 OK
Test	AT+ULOC=?	+ULOC: (list of supported <mode>s),(list of supported <sensor>s),(list of supported <response_type>s),(list of supported <timeout>s),(list of supported <accuracy>s),(list of supported <num_hypotesis>s) OK	+ULOC: (0-2),(0-3),(0-2),(1-999),(1-999999),(1-16) OK
URC		**If <response_type>=0:** +UULOC: <date>,<time>,<lat>,<long>,<alt>,<uncertainty>	+UULOC: 13/04/2011,09:54:51.000,45.6334520,13.0618620,49,1
		If <response_type>=1: +UULOC: <date>,<time>,<lat>,<long>,<alt>,<uncertainty>,<speed>,<direction>,<vertical_acc>,<sensor_used>,<SV_used>,<antenna_status>,<jamming_status>	+UULOC: 25/09/2013,10:13:29.000,45.7140971,13.7409172,266,17,0,0,18,1,6,3,9
		If <response_type>=2, <sensor_used>= 1 and <num_hypothesis>= N: +UULOC: <sol>,<num>,<sensor_used>,<date>,<time>,<lat>,<long>,<alt>,<uncertainty>,<speed>,<direction>,<vertical_acc>,<SV_used>,<antenna_status>,<jamming_status>	+UULOC: 1,2,1,08/04/2015,09:02:32.000,45.7141652,13.7410666,266,47,0,0,40,3,0,0
		If <response_type>=2, <sensor_used> = 2 and <num_hypothesis>= N: +UULOC: <sol>,<num>,<sensor_used>,<date>,<time>,<lat>,<long>,<alt>,<lat50>,<long50>,<major50>,<minor50>,<orientation50>,<confidence50>[,<lat95>,<long95>,<major95>,<minor95>,<orientation95>,<confidence95>]	+UULOC: 2,2,2,08/04/2015,09:02:19.000,45.7140665,13.7411681,0,45.7240260,13.7511276,113,10,0,50,45.7240260,13.7511276,143,41,0,95
		If <response_type>=2, <sensor_used>= 0: +UULOC: <sol>,<num>,<sensor_used>,<date>,<time>,<lat>,<long>,<alt>,<uncertainty>	+UULOC: 1,1,0,08/04/2015,09:03:45.000,45.7140290,13.7410695,0,32

25.4.1.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 0: reserved

Parameter	Type	Description
		• 1: reserved • 2: single shot position
<sensor>	Number	Sensor selection: it is possible to combine different sensors summing <sensor> values of the selected sensors: • 0: use the last fix in the internal database and stop the GNSS receiver • 1: use the GNSS receiver for localization • 2: use cellular CellLocate® location information • 8: use external sensor CellLocate® location information • 16: use SpotNow sensor (location based on GPS signal processed through cellular module) Allowed sensors: • LENA-R8 - 0, 1, 2
<response_type>	Number	Type of response: • 0: standard (single-hypothesis) response • 1: detailed (single-hypothesis) response • 2: multi-hypotheses response
<timeout>	Number	Timeout period in seconds (1 - 999)
<accuracy>	Number	Target accuracy in meters (1 - 999999)
<num_hypothesis>	Number	Maximum desired number of responses from CellLocate® (up to 16): multiple positions followed by their ellipsoidal uncertainties. This value has to be increased by 1 (GNSS solution) to get the maximum number of possible solutions. This optional parameter can be used only if <response_type>=2. The default value is 1.
<date>	String	GPS date[2] (DD/MM/YY) of the estimated position
<time>	String	GPS time[2] (hh:mm:ss.sss) of the estimated position
<lat>	String	Estimated latitude, in degrees
<long>	String	Estimated longitude, in degrees
<alt>	Number	Estimated altitude, in meters[3]
<uncertainty>	Number	Estimated 50% confidence level error, in meters (0 - 20000000)
<speed>	Number	Speed over ground m/s[3]
<direction>	Number	Course over ground in degree (0 deg - 360 deg)(3)
<vertical_acc>	Number	Vertical accuracy, in meters[3]
<sensor_used>	Number	Sensor used for the position calculation
<SV_used>	Number	Number of satellite used to calculate the position[3]
<sol>	Number	Solution index (between 1 and <num>)
<num>	Number	Total number of the available hypotheses (less than or equal to <num_hypothesis>)
<lat50>/<lat95>	String	Estimated latitude (50/95% confidence levels), in degrees
<long50>/<long95>	String	Estimated longitude (50/95% confidence levels), in degrees
<major50>/ <major95>	Number	Semi-major axis of the ellipse (50/95% confidence levels), in meters
<minor50>/ <minor95>	Number	Semi-minor axis of the ellipse (50/95% confidence levels), in meters
<orientation50>/ <orientation95>	Number	Orientation of the ellipse (50/95% confidence levels), in degrees
<confidence50>/ <confidence95>	Number	50/95% confidence levels, in percentage
<antenna_status>	Number	Antenna status (0 - 4)(3). For more details, see the u-blox GNSS receiver protocol specification
<jamming_status>	Number	Jamming status[3]. For more details, see the u-blox GNSS receiver protocol specification

25.4.1.4 Notes

- If AssistNow Online aiding data has been configured by means of the <aiding> parameter of +ULOCGNSS AT command, the +ULOC request using <sensor>=1 (GNSS receiver only) can provide a +UULOC URC reporting a CellLocate® solution (<sensor_used>=2). This can happen if:
  - a GNSS fix is not available.

[2] Coming either from the CellLocate® server or the GNSS receiver (GPS time)
[3] only for GNSS positioning, 0 in case of CellLocate®

  - the CellLocate® solution is more accurate (i.e. CellLocate® solution's uncertainty is better than the GNSS's one).
- If <sensor>=1 (use the GNSS receiver for localization), <response_type>=2 (multi-hypotheses response) is not supported.
- The <jamming_status> value must be ignored if the jamming is disabled through +ULOCGNSS command.
- The <date>, <time>, <lat>, <long> values are not enclosed in double quotes in the URC.

LENA-R8

- The <num_hypothesis> parameter is not supported.
- <response_type>=2 and 255 are not supported.

25.4.2 Localization information request status unsolicited indication +ULOCIND

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

25.4.2.1 Description

Configures sending of URCs from MT to TE in the case of +ULOC operations. The URC provides the result of the steps of an +ULOC operation.

A URC is issued for each check in of an MGA server (primary and secondary).

25.4.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULOCIND=<mode>	OK	AT+ULOCIND=1 OK
Read	AT+ULOCIND?	+ULOCIND: <mode> OK	+ULOCIND: 1 OK
Test	AT+ULOCIND=?	+ULOCIND: (list of supported <mode>'s) OK	+ULOCIND: (0-1) OK
URC		**If <mode>=1:** +UULOCIND: <step>,<result>	+UULOCIND: 1,0

25.4.2.3 Defined values

Parameter	Type	Description
<mode>	Number	URC configuration: • 0 (default value): disabled • 1: enabled • 2: reserved Allowed values: • LENA-R8 - 0, 1
<step>	Number	Informs the user about the operation in progress: • 0: network scan start • 1: network scan end • 2: requesting data to the server • 3: received data from the server • 4: sending feedback to the server
<result>	Number	Represents the result of the aiding operation: • 0: no error • 1: wrong URL • 2: HTTP error • 3: create socket error • 4: close socket error

Parameter	Type	Description
		• 5: write to socket error • 6: read from socket error • 7: connection/DNS error • 8: authentication token missing or wrong (required for aiding for u-blox M8 and future versions) • 9: generic error • 10: user terminated • 11: no data from server

25.4.3 GNSS sensor configuration +ULOCGNSS

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

25.4.3.1 Description

Configures the GNSS sensor that can be used with the +ULOC AT command.

25.4.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULOCGNSS=<aiding>[,<psv_mode>[,<minSV>[,<minCNO>[,<ini_3d_fix>[,<staticHoldMode>[,<SBAS>[,<jamming>[,<antenna>[,<BBthreshold>[,<CWthreshold>[,<GNSS_system>[,<reserved1>[,<reserved2>]]]]]]]]]]]]	OK	AT+ULOCGNSS=15 OK
Read	AT+ULOCGNSS?	+ULOCGNSS: <aiding>,<psv_mode>,<minSV>,<minCNO>,<ini_3d_fix>,<staticHoldMode>,<SBAS>,<jamming>,<antenna>,<BBthreshold>,<CWthreshold>,<GNSS_system>,<reserved1>,<reserved2> OK	+ULOCGNSS: 15,1,6,8,0,1,1,1,1,1,1,0,0,0 OK
Test	AT+ULOCGNSS=?	+ULOCGNSS: (list of supported <aiding>s),(list of supported <psv_mode>s),(list of supported <minSV>s),(list of supported <minCNO>s),(list of supported <ini_3d_fix>s),(list of supported <staticHoldMode>s),(list of supported <SBAS>s),(list of supported <jamming>s),(list of supported <antenna>s),(list of supported <BBthreshold>s),(list of supported <CWthreshold>s),(list of supported <GNSS_system>s),(0),(0) OK	+ULOCGNSS: (0-15),(0-1),(3-32),(0-50),(0-1),(0-255),(0-1),(0-1),(0-2),(0-15),(0-31),(1-127),(0),(0) OK

25.4.3.3 Defined values

Parameter	Type	Description
<aiding>	Number	GNSS aiding mode configuration; it is possible the combination of different aiding modes: to enable more aiding modes it is needed to sum the value of the interested aiding modes: • 1: local aiding (including RTC sharing) • 2: AssistNow Offline • 4: AssistNow Online • 8: AssistNow Autonomous

Parameter	Type	Description
		If <aiding> is set to 0, all the aiding modes are disabled (no aiding). All the modes (15) are enabled as a factory programmed setting.
<psv_mode>	Number	Power Save Mode (UBX-CFG-RXM): • 0 (factory-programmed value): disabled • 1: enabled
<minSV>	Number	Minimum number of satellites for navigation (UBX-CFG-NAVX5). The range goes from 3 to 32, and the factory-programmed value is 3.
<minCNO>	Number	Minimum satellite signal level for navigation (UBX-CFG-NAVX5). The range goes from 0 to 50, and the factory-programmed value is 7.
<ini_3d_fix>	Number	Initial Fix must be 3D flag (UBX-CFG-NAVX5): • 0 (factory-programmed value): disabled • 1: enabled
<staticHoldMode>	Number	Static Hold Mode (UBX-CFG-NAV5). The range goes from 0 to 255 cm/s. (factory-programmed value: 0). If the parameter is omitted, the Static Hold Mode threshold will not be configured to GNSS.
<SBAS>	Number	SBAS configuration: • 0 (factory-programmed value): disabled • 1: enabled
<jamming>	Number	Jamming indicator (UBX-CFG-ITFM): • 0 (factory-programmed value): disabled • 1: enabled
<antenna>	Number	Antenna setting: • 0 (factory-programmed value): unknown • 1: passive • 2: active
<BBthreshold>	Number	Broadband jamming detection threshold (dB) (UBX-CFG- ITFM). The range goes from 0 to 15. (factory-programmed value: 0)
<CWthreshold>	Number	Continuous wave jamming detection threshold (dB) (UBX-CFG- ITFM). The range goes from 0 to 31. (factory-programmed value: 0)
<GNSS_systems>	Number	Bitmask for combining the supported GNSS types and relative signals (in brackets); the parameter is optional and the allowed values can be combined together. The default value is 3 (GPS+SBAS): • 1 (factory-programmed value): GPS (L1CA) • 2: SBAS (L1CA) • 4: Galileo (E1) • 8: BeiDou (B1I) • 16: IMES (L1) • 32: QZSS (L1CA) • 64: GLONASS (L1) • 128: BEIDOU B1C • 256: QZSS L1S Allowed bits: • LENA-R8 - 1, 2, 4, 8, 16, 32, 64, 128, 256
<Reserved1>	Number	0 (reserved value)
<Reserved2>	Number	0 (reserved value)

25.4.3.4 Notes

- To enable SBAS system opportunely configure both <SBAS> and <GNSS_systems> parameters.
- If a parameter is omitted, the current set value is kept.
- For more details on parameter description see the corresponding u-blox-GNSS receiver description.

25.4.4 Configure cellular location sensor (CellLocate®) +ULOCCELL

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

25.4.4.1 Description

Configures the cellular location sensor (CellLocate®) used with the +ULOC command.

☞ This command influences the amount of data exchanged with the server.

25.4.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULOCCELL=<scan_mode>[,<reserved1>[,<reserved2>[,<reserved3>[,<reserved4>[,<reserved5>]]]]]	OK	AT+ULOCCELL=0 OK
Read	AT+ULOCCELL?	+ULOCCELL: <scan_mode>,<reserved1>,<reserved2>,<reserved3>,<reserved4>,<reserved5> OK	+ULOCCELL: 0,0,"","",0,0 OK
Test	AT+ULOCCELL=?	+ULOCCELL: (list of supported <scan_mode>s),(list of supported <reserved1>),(list of supported <reserved2>),(list of supported <reserved3>),(list of supported <reserved4>),(list of supported <reserved5>) OK	+ULOCCELL: (0-1),(0),"","",(0),(0) OK

25.4.4.3 Defined values

Parameter	Type	Description
<scan_mode>	Number	Network scan mode: • 0 (factory-programmed value): normal • 1: deep scan Allowed values: • LENA-R8 - 0
<reserved1>	Number	RFU
<reserved2>	String	RFU
<reserved3>	String	"" (reserved value)
<reserved4>	Number	0 (reserved value)
<reserved5>	Number	0 (reserved value)

26 Constrained Application Protocol (CoAP)

26.1 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.

26.2 CoAP profile configuration +UCOAP

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

26.2.1 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.

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.

26.2.2 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

Type	Syntax	Response	Example
			+UCOAP: "PROFILE_NUM",2 +UCOAP: "STATUS FLAG",1 +UCOAP: "USECMNG PROFILE" +UCOAP: "RAI FLAG",0 +UCOAP: "CID",1,0 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			
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

Type	Syntax	Response	Example
			OK
RAI configuration			
Set	AT+UCOAP=9,<rai_flag>	OK	AT+UCOAP=9,0 OK
PDP context configuration			
Set	AT+UCOAP=20,<cid>,<preferred_protocol_type>	OK	AT+UCOAP=20,1,0 OK
Test	AT+UCOAP=?	+UCOAP: (list of supported <op_code>s) OK	+UCOAP: (0-9,20) OK

26.2.3 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) • 20: PDP context configuration Allowed values: • LENA-R8 - 1, 2, 3, 4, 5, 6, 7, 8, 9
<COAP_server_IP_address>	String	Remote CoAP server IP address in IPv4 format. For IP address format reference see the IP addressing.
<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 schemes 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: • LENA-R8 - The maximum supported length of the URI is 783 characters. ☞ LENA-R8 URI_HOST, URI_PATH and URI_QUERY options are limited to 255 characters each as per RFC 7252 [201].
<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

Parameter	Type	Description
<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.
<cid>	Number	Specifies the PDP context that will be used for the CoAP data. For the parameter range, see <cid>. For more details on the default and factory-programmed value of the parameter (where supported), see Constrained Application Protocol (CoAP).
<preferred_protocol_type>	Number	In case of a context id with IPv4v6 PDP type it is possible to select: • 0: IPv4 • 1: IPv6 For more details on the default and factory-programmed value of the parameter (where supported), see Constrained Application Protocol (CoAP).
<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.

26.2.4 Notes

- No profiles are defined by factory-programmed setting.

26.3 CoAP command +UCOAPC

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

26.3.1 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.

☞ The payload size in downlink is dependent upon the data packeting scheme of the CoAP server.

☞ For more details, see the RFC 7252 [201].

26.3.2 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

26.3.3 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 • 4: POST request to the CoAP server
<payload>	String	Hexadecimal payload to be sent or received. The maximum data size in uplink is 512 bytes for a single block. For PUT (<coap_command>=3) and POST (<coap_command>=4) commands, if <more_block>=1 (more blocks available), allowed length values for payload are 16, 32, 64, 128, 256, 512 bytes. For more details, see RFC 7959 [205].
<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

26.4 CoAP error reporting +UCOAPER

+UCOAPER						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error Appendix A.7

26.4.1 Description

Returns the error code of the latest CoAP operation.

26.4.2 Syntax

Type	Syntax	Response	Example
Action	AT+UCOAPER	+UCOAPER: <error_class>,<error_code> OK	AT+UCOAPER +UCOAPER: 15,4 OK

26.4.3 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.

27 MQTT

27.1 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 [222].

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 active before using MQTT AT commands. Some products require additional commands to provide connectivity to the application.

27.2 MQTT profile configuration +UMQTT

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

27.2.1 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.

27.2.2 Syntax

Type	**Syntax**	**Response**	**Example**
Generic syntax			
Set	AT+UMQTT=<op_code>[,<param1>[,<param2>]]	+UMQTT: <op_code>,<result> OK	AT+UMQTT=12,1 +UMQTT: 12,1 OK
MQTT unique client ID			

Type	Syntax	Response	Example
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
Keep alive and linger time			
Set	AT+UMQTT=10,<keep_alive>[,<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
MQTT server response time			
Set	AT+UMQTT=13,<server_response_time>	OK	AT+UMQTT=13,60 OK
MQTT PDP context configuration			
Set	AT+UMQTT=20,<cid>[,<preferred_protocol_type>]	OK	AT+UMQTT=20,2,1

Type	Syntax	Response	Example
			OK
Read	AT+UMQTT=<op_code>	+UMQTT: <op_code>,<param1>[,<param2>] OK	AT+UMQTT=4 +UMQTT: 4,"my_username" OK
Read	AT+UMQTT?	+UMQTT: 0,<client_id> +UMQTT: 2,<server_name>,<server_port> +UMQTT: 3,IP_address>,<server_port> +UMQTT: 4,<username> +UMQTT: 6,<will_QoS> +UMQTT: 7,<will_retain> +UMQTT: 8,<will_topic> +UMQTT: 9,<wm_length>,<will_message> +UMQTT: 10,<keep_alive>,<linger_time> +UMQTT: 11,<MQTT_secure>[,<USECMNG_profile>] +UMQTT: 13,<server_response_time> +UMQTT: 20,<cid>,<preferred_protocol_type> OK	+UMQTT: 0,"352848080012186" +UMQTT: 2,"",1883 +UMQTT: 3,"",1883 +UMQTT: 4,"" +UMQTT: 6,0 +UMQTT: 7,0 +UMQTT: 8,"" +UMQTT: 9,0,"" +UMQTT: 10,0,10 +UMQTT: 11,0 +UMQTT: 13,30 +UMQTT: 20,1,0 OK
Test	AT+UMQTT=?	+UMQTT: (list of supported <op_code>s) OK	+UMQTT: (0,2-4,6-11,13,20) OK
URC		+UUMQTT<op_code>: <param1>[,<param2>]	+UUMQTT0: "352753090041680"

27.2.3 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 keep alive time period and linger time • 11: MQTT secure • 12: MQTT clean session • 13: MQTT server response time • 14: MQTT terse/verbose mode; the set command is not supported • 20: MQTT PDP context configuration Allowed values: • LENA-R8 - 0, 2, 3, 4, 6, 7, 8, 9, 10, 11
<result>	Number	Allowed values: • 0: failure • 1: success

Parameter	Type	Description
<client_id>	String	Client identifier for the MQTT session. • LENA-R8 - 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. • LENA-R8 - 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. • LENA-R8 - the set command also accepts 0: it is used to automatically reset the <server_port> to the default value (1883 or 8883).
<username>	String	User name for the MQTT login procedure. The default value is an empty string: • LENA-R8 - The maximum length is 512 characters.
<password>	String	Password for the MQTT login procedure. The default value is an empty string: • LENA-R8 - The maximum length is 512 characters.
<keep_alive>	Number	Keep alive time 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 keep alive time. If the keep alive value is 0 the server is not required to disconnect. 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. • LENA-R8 - The maximum length is 256 characters.
<will_message>	String	Last will message: string of characters (ASCII or hexadecimal octets). • LENA-R8 - The maximum length is 256 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

Parameter	Type	Description
<cid>	Number	PDP context identifier used for the MQTT communication. The allowed range is product specific, see <cid>. For more details on the default value of the parameter (where supported), see MQTT.
<preferred_protocol_type>	Number	Preferred protocol type to be specified when the <cid> protocol type is IPv4v6. Allowed values: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see MQTT.
<server_response_time>	Number	Indicates the maximum waiting time of a server response after a request was sent to the server via +UMQTTC AT command. It is expressed in seconds. The default value is 30 s. The range goes from 5 s to 255 s (corresponding to 4 minutes and 15 seconds).
<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.

27.2.4 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.

27.3 Save/Restore MQTT profile from NVM +UMQTTNV

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

27.3.1 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.

27.3.2 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

27.3.3 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

27.4 MQTT command +UMQTTC

+UMQTTC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	Appendix B.4	+CME Error

27.4.1 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.

☞ LENA-R8
An MQTT command can be considered completed only after receiving the related +UUMQTTC URC. Before issuing a new MQTT command, wait for the previous one to complete.

☞ LENA-R8
The +UUMQTTC: 0,100 URC is notified when the MQTT broker releases the connection after a period of inactivity (keep alive time expired).
The +UUMQTTC: 0,101 URC is notified when the network connection is lost.

☞ LENA-R8
The +UUMQTTC: 0,102 URC is notified when the MT releases the connection because there is a protocol violation in receiving an MQTT message.

27.4.2 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","3233206465677265657320 43656C73697573" 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

Type	Syntax	Response	Example
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		+UUMQTTC: 4,<MQTT_result>[,<QoS>,<topic_name>] **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>][,<hex_mode_out>]]	+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 AT+UMQTTC=6,,1 +UMQTTC: 6,0,31,13,"sensor/heat/#",18,"32332064656772656573202 43656C73697573" OK
URC		+UUMQTTC: 6,<num_unread_msgs>,<memory_full>	+UUMQTTC: 6,3,0
Ping MQTT broker			
Set	AT+UMQTTC=8,<ping_ON_OFF>	OK	AT+UMQTTC=8,1 OK
URC (only in case of no ping response received)		+UUMQTTC: 8,0	+UUMQTTC: 8,0
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

27.4.3 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

Parameter	Type	Description
		• 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: • LENA-R8 - 0, 1, 2, 3, 4, 5, 6, 8, 9
<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: keep alive time expired, 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
<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. • LENA-R8 - The maximum parameter length is 1024 characters if <hex_mode>=0 or 512 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. • LENA-R8 - The maximum parameter length is 64 characters and the maximum file content depends on the file system, see File system limits.
<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 [222]. • 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. • LENA-R8 - The maximum length is 256 characters.
<topic_name>	String	Indicates the topic to which the given MQTT message was published. • LENA-R8 - The maximum length is 256 characters.
<reason>	Number	Result of an MQTT subscribe request: • 0-2: success • 128: failure

Parameter	Type	Description
<num_unread_msgs>	Number	• LENA-R8 - For values greater than 0 the parameter represents the number of unread received messages. The maximum number of unread messages is 100. Negative values or 0 indicate a failure during message reception; for more details, see the +UMQTTER AT command.
<format>	Number	Specifies the format of the messages when read using the <op_code>=6. Allowed values: • 0: no formatting. All messages will be concatenated into a single line with no separation between messages • 1 (default value): each message will contain the <topic_name> and <message> • 2: each message 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. • LENA-R8 - The maximum length is 12288 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 keep alive time period expires. See AT+UMQTT=10.
<memory_full>	Number	Indicates the message memory status. Allowed values: • 0: message memory is available • 1: message memory is full
<pub_msg_length>	Number	Specifies the number of octets in <pub_bin_message>. • LENA-R8 - The maximum length is 1024 octets.
<pub_bin_message>	String	Data bytes to be published.
<hex_mode_out>	Number	Allowed values: • 0 (default value): ASCII output for <read_msg> • 1: hexadecimal output for <read_msg>

27.4.4 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.

LENA-R8

- The <hex_mode_out> parameter is not supported.

27.5 MQTT error +UMQTTER

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

27.5.1 Description

Retrieves the error class and code of the last MQTT operation that provided an error.

27.5.2 Syntax

Type	Syntax	Response	Example
Action	AT+UMQTTER	+UMQTTER: <error_code1>,<error_code2> OK	AT+UMQTTER +UMQTTER: 1,1 OK

27.5.3 Defined values

Parameter	Type	Description
<error_code1>	Number	• LENA-R8 - Value of error class. Values are listed in Internet suite error classes.
<error_code2>	Number	• LENA-R8 - Value of class-specific error code. The values are listed in MQTT class error codes.

28 MQTT-SN

28.1 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 [223].

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.

☞ Since MQTT-SN is implemented over UDP protocol, the maximum length of a MQTT-SN message should not exceed the Maximum Transmission Unit supported by the network (to read the MTU, see the +CGCONTRDP AT command). IPv4 fragmentation support depends upon the network operator, not all operators support it, incomplete messages could be received or sent in case their length exceeds the MTU. IPv6 does not support IP fragmentation by design.

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".

Three types of topic are defined:

- **Topic id** - A long topic name is replaced by a short, two-byte long topic identifier as a result of a client registration procedure made to map a normal topic to a server defined identifier. This identifier will then be used in the following publish commands.
- **Predefined topic id** - Predefined topic ids are a two-byte long replacement of the topic name, their mapping to the topic names is known in advance by both the client and server, no registration is required.
- **Short topic name** - Short topic names are topic names with fixed length of two octets, no registration is required.

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.

☞ LENA-R8
Broadcast messages are not supported so it is not possible to send a search gateway message or receive an advertisement from the gateway.

A PSD connection must be active before using MQTT-SN AT commands. Some products require additional commands to provide connectivity to the application.

28.2 MQTT-SN profile configuration +UMQTTSN

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

28.2.1 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.

28.2.2 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

Type	Syntax	Response	Example
			OK
MQTT-SN server response time			
Set	AT+UMQTTSN=11,<server_response_time>	OK	AT+UMQTTSN=11,30 OK
MQTT-SN PDP context configuration			
Set	AT+UMQTTSN=20,<cid>[,<preferred_protocol_type>]	OK	AT+UMQTTSN=20,2,1 OK
Read	AT+UMQTTSN=<op_code>	+UMQTTSN: <op_code>,<param1>[,<param2>] OK	AT+UMQTTSN=2 +UMQTTSN: 2,"192.168.1.10",8883 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: 9,<secure>[,<USECMNG_profile>] +UMQTTSN: 10,<clean_session> +UMQTTSN: 11,<server_response_time> +UMQTTSN: 20 ,<cid>,<preferred_protocol_type> OK	+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" +UMQTTSN: 8,20 +UMQTTSN: 9,1,1 +UMQTTSN: 10,1 +UMQTTSN: 11,25 +UMQTTSN: 20,1,0 OK
Test	AT+UMQTTSN=?	+UMQTTSN: (list of supported <op_code>s) OK	+UMQTTSN: (0-2,4-11,20) OK

28.2.3 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 • 11: MQTT-SN server response time • 20: MQTT-SN PDP context configuration Allowed values: • LENA-R8 - 0, 1, 2, 4, 5, 6, 7, 8, 10

Parameter	Type	Description
<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.
<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 [223], 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: • LENA-R8 - 0-65535 (corresponding to 18 hours, 12 minutes and 15 seconds). The default value is 0, which 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
<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.
<cid>	Number	PDP context identifier used for the MQTT-SN communication. The allowed range is product specific, see <cid>. For more details on the default value of the parameter (where supported), see MQTT-SN.
<preferred_protocol_type>	Number	Preferred protocol type to be specified when the <cid> protocol type is IPv4v6. Allowed values: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see MQTT-SN.
<server_response_time>	Number	Indicates the maximum waiting time of a server response after a request was sent to the server via +UMQTTSNC AT command. It is expressed in seconds. The default value is 15 s. The range goes from 5 s to 255 s (corresponding to 4 minutes and 15 seconds).
<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.

28.2.4 Notes

LENA-R8

- <op_code>=1 (server name) and <op_code>=2 (IP address) are mutually exclusive: if value for <op_code>= 1 is specified by user, then value for <op_code>=2 is reset or vice versa.
- <op_code>=10 (clean session) is supported only to maintain server-side persistence (subscription and will data persistency).

28.3 Save/Restore MQTT-SN profile from NVM +UMQTTSNNV

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

28.3.1 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.

28.3.2 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

28.3.3 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

28.4 MQTT-SN command +UMQTTSNC

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

28.4.1 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.

28.4.2 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>]]	AT+UMQTTSNC=1 +UMQTTSNC: 1,1

Type	Syntax	Response	Example
		OK	OK
MQTT-SN disconnect			
Set	AT+UMQTTSNC=0[,<duration>]	OK	AT+UMQTTSNC=0 OK
URC		+UUMQTTSNC: 0,<logout_result>	+UUMQTTSNC: 0,1
MQTT-SN connect			
Set	AT+UMQTTSNC=1	OK	AT+UMQTTSNC=1 OK
URC		+UUMQTTSNC: 1,<MQTTSN_result>	+UUMQTTSNC: 1,1
MQTT-SN register			
Set	AT+UMQTTSNC=2,<topic_name>	OK	AT+UMQTTSNC=2,"sensor/heat/SD" OK
URC		+UUMQTTSNC: 2,<MQTTSN_result>,<topic_id>	+UUMQTTSNC: 2,1,1
MQTT-SN publish			
Set	AT+UMQTTSNC=4,<QoS>,<retain>,<hex_mode>,<topic_type>,<topic_pub>,<message>	OK	AT+UMQTTSNC=4,1,0,0,0,"1","23 degrees Celsius" OK
URC		+UUMQTTSNC: 4,<MQTTSN_result>	+UUMQTTSNC: 4,1
MQTT-SN subscribe			
Set	AT+UMQTTSNC=5,<max_QoS>,<topic_type>,<topic>	OK	AT+UMQTTSNC=5,1,0,"sensor/heat/SD" OK
URC		+UUMQTTSNC: 5,<MQTTSN_result>,<g_QoS>,<topic_id_sub>	+UUMQTTSNC: 5,1,0,1
MQTT-SN unsubscribe			
Set	AT+UMQTTSNC=6,<topic_type>,<topic>	OK	AT+UMQTTSNC=6,1,"1" 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/lastwill" OK
URC		+UUMQTTSNC: 7,<MQTTSN_result>	+UUMQTTSNC: 7,1
MQTT-SN will message update			
Set	AT+UMQTTSNC=8,<will_message>	OK	AT+UMQTTSNC=8,"Unrequested disconnect" OK
URC		+UUMQTTSNC: 8,<MQTTSN_result>	+UUMQTTSNC: 8,1
MQTT-SN read message			
Set	AT+UMQTTSNC=9[,<one_message>]	+UMQTTSNC: 9,<QoS>,<topic_type>,<topic_msg_length>,<topic_length>,<topic_pub>,<msg_length>,<message> OK	AT+UMQTTSNC=9,1 +UMQTTSNC: 9,1,0,19,1,"1",18,"23 degrees Celsius" OK
URC		+UUMQTTSNC: 9,<num_unread_msgs>	+UUMQTTSNC: 9,2
MQTT-SN ping			
Set	AT+UMQTTSNC=10,<ping_ON_OFF>	OK	AT+UMQTTSNC=10,1 OK

Type	Syntax	Response	Example
URC (only in case of no ping response received)		+UUMQTTSNC: 10,0	+UUMQTTSNC: 10,0
MQTT-SN publish a file to a topic			
Set	AT+UMQTTSNC=11,<QoS>,<retain>,<topic_type>,<topic_pub>,<filename>	OK	AT+UMQTTSNC=11,1,0,0,"2","msg.txt" OK
URC		+UUMQTTSNC: 11,<MQTTSN_result>	+UUMQTTSNC: 11,1
MQTT-SN publish a binary message to a topic			
Set	AT+UMQTTSNC=12,<QoS>,<retain>,<topic_type>,<topic_pub>,<pub_msg_length> After the ">" prompt <pub_msg_length> bytes of data are entered	OK	AT+UMQTTSNC=12,1,0,0,"1",33 >AABB--> execute this \nand "this" OK
URC	+UUMQTTSNC: 12,<MQTTSN_result>	+UUMQTTSNC: 12,1	
Test	AT+UMQTTSNC=?	+UMQTTSN: (list of supported <op_codes>s) OK	+UMQTTSNC: (0-2,4-12) OK
URC		+UUMQTTSNC: <op_code>,<param1>[,<param2>,...,<paramN>]	+UUMQTTSNC: 5,1,0,1

28.4.3 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 • 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 • 12: publish a binary message to a topic Allowed values:
<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.

Parameter	Type	Description
<topic_name>	String	Indicates a topic with variable length. It must be used with the register command and can be used with the subscribe or unsubscribe commands. • LENA-R8 - The maximum length is 256 characters.
<topic_id>	Number	Indicates the topic ID value: an unique number generated by the server and sent back to the module as a response to a register request or to a subscribe request.
<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.
<topic_pub>	String	Contains the topic ID value (a number between 1 and 65535) or the short topic name (a two characters string) for which the data is published.
<message>	String	ASCII or hexadecimal data. The maximum length is: • LENA-R8 - 1024 characters if <hex_mode>=0 or 512 octets if <hex_mode>=1. The maximum length can be limited by the maximum packet size supported by the network (for more details, see MQTT-SN introduction).
<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
<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	• LENA-R8 - For values greater than 0 the parameter represents the number of unread received messages. The maximum number of unread messages is 100.

Parameter	Type	Description
		Negative values or 0 indicate a failure during message reception; for more details, see the +UMQTTSNER AT command.
<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 1024 characters.
<pub_msg_length>	Number	Specifies the number of octets in <pub_bin_message>.
<pub_bin_message>	String	Data bytes to be published.

28.5 MQTT-SN error +UMQTTSNER

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

28.5.1 Description

Retrieves the error class and code of the last MQTT-SN operation that provided an error.

28.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMQTTSNER	+UMQTTSNER: <error_class>, <error_code> OK	AT+UMQTTSNER +UMQTTSNER: 14,1 OK

28.5.3 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.

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
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)
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

Numeric error code	Description
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
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

Numeric error code	Description
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
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

Numeric error code	Description
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 restore pending
1687	SEC RoT IO error
1688	SEC RoT IO pending
1689	SEC disabled
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
2000	Command timeout
3000	Command aborted
4000	APN configuration mismatch
4001	IP type configuration mismatch
5000	FOTA package download state or name mismatch

Numeric error code	Description
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
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

Numeric error code	Description
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
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

Numeric error code	Description
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
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

Numeric error code	Description
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
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

Numeric error code	Description
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

A.3 +CEER error result codes

A.3.1 LENA-R8 series

The following table lists the supported values for <cause> (number) and <error_description> (string) for +CEER AT command if <type> assumes one of these values:

- "CC setup error"
- "CC modification error"
- "CC release"
- "SM attach error"
- "SM detach"
- "SM activation error"
- "SM deactivation

<cause>	<error_description>	LENA-R8
0	No cause information available	x
1	Unassigned (unallocated) number	x
2	SIM not provisioned	x
3	No route to destination	x
3	SIM not allowed	x
4	Call Failed	x
5	Call Failed	x
6	Channel unacceptable	x
6	Phone not allowed	x
7	GPRS Service not allowed	x
8	Operator determined barring	x
8	GPRS Service and Non GPRS service not allowed	x
9	MS Identity cannot be Derived by network	x
10	Implicitly Detached	x
11	SOS/Emergency calls only,PLMN not allowed	x
12	SOS/Emergency calls only,LA not allowed	x
13	SOS/Emergency calls only,roaming not allowed in LA	x
15	No Suitable cells in Location Area	x

<cause>	<error_description>	LENA-R8
16	Normal call clearing	x
16	MSC Temporarily Not Reachable	x
17	User busy	x
18	No user responding	x
19	User alerting, no answer	x
20	MAC (Message Authentication Code) failure	x
21	Call rejected	x
21	Synch failure	x
22	Number changed	x
22	Error Congestion	x
23	SIM not allowed	x
26	Non selected user clearing	x
27	Destination out of order	x
28	Invalid number format (incomplete number)	x
29	Facility rejected	x
30	Response to STATUS ENQUIRY	x
31	Normal, unspecified	x
32	Service Option Not supported	x
33	Requested Service option not subscribed	x
34	No circuit/channel available	x
34	Service temporarily out of order	x
38	Network out of order	x
38	Call cannot be Identified	x
40	NO PDP Context Active	x
41	Temporary failure	x
42	Switching equipment congestion	x
43	Access information discarded	x
44	Requested circuit/channel not available	x
47	Resources unavailable, unspecified	x
48	Retry on New Cell beginning	x
49	Quality of service unavailable	x
50	Requested facility not subscribed	x
55	Incoming calls barred within the CUG	x
57	Bearer capability not authorized	x
58	Bearer capability not presently available	x
63	Service or option not available, unspecified	x
63	Retry on New Cell End	x
65	Bearer service not implemented	x
68	ACM equal to or greater than ACMmax	x
69	Requested facility not implemented	x
70	Only restr. digital information bearer capability	x
79	Service or option not implemented, unspecified	x
81	Invalid transaction identifier value	x
87	User not member of CUG	x
88	Incompatible destination	x
95	Semantically incorrect message	x
96	Invalid mandatory information	x
97	Message type non-existent or not implemented	x
98	Message type not compatible with protocol state	x

<cause>	<error_description>	LENA-R8
99	Information element non-existent or not implemented	x
100	Conditional IE error	x
101	Message not compatible with protocol state	x
102	Recovery on timer expiry	x
103	Illegal MS	x
106	Illegal ME	x
107	GPRS service not allowed	x
111	Protocol error, unspecified	x
112	Location area not allowed	x
113	Roaming not allowed in this location area	x
125	LLC or SNDCP failure	x
126	Insufficient resources	x
127	Missing or unknown APN	x
127	Interworking, unspecified	x
128	Unknown PDP address or PDP type	x
129	User authentication failed	x
130	Activation rejected by GGSN, Serving GW or PDN GW	x
131	Activation reject,unspecified	x
132	Service not supported	x
133	Requested service option not subscribed	x
134	Service option temporarily out of order	x
135	NSAPI already used	x
136	Regular PDP context deactivation	x
137	QoS not accepted	x
138	Network failure	x
139	Reactivation requested	x
140	Feature not supported	x
141	Semantic error in the TFT operation	x
142	Syntactical error in the TFT operation	x
143	Unknown PDP context	x
144	Semantic errors in packet filter(s)	x
145	Syntactical errors in packet filter(s)	x
146	PDP context without TFT already activated	x
148	Unspecified GPRS error	x
149	PDP authentication error	x
152	Single address bearers only allowed	x
153	ESM information not received	x
154	PDN connection does not exist	x
155	Multiple PDN connections for a given APN not allowed	x
156	Collision with network initiated request	x
159	Unsupported QCI value	x
160	Bearer handling not supported	x
165	Maximum number of EPS bearers reached	x
166	Requested APN not supported in current RAT and PLMN combination	x
181	Invalid PTI value	x
182	APN restriction value incompatible with active EPS bearer context	x
183	PTI already in use	x
184	EPS QoS not accepted	x

<cause>	<error_description>	LENA-R8
185	Invalid EPS bearer identity	x
186	PTI mismatch	x
187	Last PDN disconnection not allowed	x
188	PDN type IPv4 only allowed	x
189	PDN type IPv6 only allowed	x
212	APN resriction	x
256	Internal, unspecified	x
257	Out of memory	x
258	Invalid parameters	x
259	Data call active	x
260	Speech call active	x
262	Missing ACM information	x
263	Temporary forbidden	x
264	Called party is blacklisted	x
265	Blacklist is full	x
266	No service	x
267	Limited service	x
268	Client conflict	x
269	Dual service call active	x
271	Unknown SIM error	x
274	Active Client is Gone	x
277	SIM status failure	x
278	Rejected by call control	x
279	FDN failed	x
280	BDN failed	x
283	CCBS possible	x
284	Invalid alternate service line	x
285	LND overflow	x
287	MM network failure unspecified	x
288	MM no service	x
289	MM access class barred	x
290	MM RR no resource	x
291	MM ME busy	x
292	MM unspecified	x
296	Dual sim radio conflict	x
297	No service due to dual sim radio conflict	x
301	MMI not registered	x
303	Rejected by user	x
304	Rejected due to time out	x
306	Disconnected due to SIM-Toolkit call setup	x
307	Pending SIM-Toolkit call setup	x
310	SIM reset	x
340	MM sapi3 release	x
341	MM lower layer failure	x
342	MM authentication failure	x
343	MM PS reject	x
344	MM service rejected	x
345	MM abort by network	x
346	MM timeout	x
347	MM detach	x
348	MM RR connection release	x
349	MM not registered	x
350	MM re-establishment failure	x
351	Failure due to handover	x

<cause>	<error_description>	LENA-R8
352	Link establishment failure	x
353	Random access failure	x
354	Radio link aborted	x
355	Lower layer failure in Layer 1	x
356	Immediate Assignment Reject	x
357	Failure due to paging	x
358	Abnormal release unspecified	x
359	Abnormal release channel unacceptable	x
360	Abnormal release timer expired	x
361	Abnormal release no act on radio path	x
362	Preemptive release	x
363	UTRAN configuration unknown	x
364	Handover impossible	x
365	Channel mode unacceptable	x
366	Frequency not implemented	x
367	Originator leaving call group area	x
368	Lower layer failure from network	x
369	Call already cleared	x
370	Semantically incorrect message	x
371	Invalid mandatory info	x
372	Message type non existing	x
373	Message type incompatible in state	x
374	Conditional information element error	x
375	No cell allocation available	x
376	Protocol error unspecified	x
377	Normal event	x
378	Unspecified	x
379	Preemptive release	x
380	Congestion	x
381	RE establishment reject	x
382	Directed sig conn establishment	x
383	User inactivity	x
384	Lower layer failure downlink	x
385	Lower layer failure uplink	x
386	Cell barred due to authentication failure	x
387	signalling connection release	x
388	CS connection release triggered by MM	x
389	RRC connection establishment failure	x
390	RRC connection establishment reject with redirection	x
391	resource conflict	x
392	Layer 2 sequence error	x
393	Layer 2 T200 exp N200 plus 1 times	x
394	Layer 2 unsolicited DM resp MFES	x
395	Layer 2 contention resolution	x
396	Layer 2 normal cause	x
397	RR connection release due to BAND change (2G)	x
400	MM RR connection error while release	x
500	Local user disconnect/normal call clearing	x
510	Remote user or NW disconnect\normal call clearing,during any other call state than "CALL PROCEEDING"	x

<cause>	<error_description>	LENA-R8
511	Remote user or NW disconnect\normal call clearing,during the call state "CALL PROCEEDING"	x
512	Request rejected, BCM violation	x

Table 16: LENA-R8 series supported +CEER error result code list

A.4 Firmware install final result codes

The +UFWINSTALL AT 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.4.1 LENA-R8 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.4.1.1 LENA-R8 final result codes from end of update procedure

A.4.1.1.1 LENA-R8 final result codes table

Here below are listed the allowed final result codes that can be issued at the finalization of the install procedure by means of the +UFWINSTALL and +UFWUPD AT commands.

Error result code	Description	URC UART port and baud rate
128	Firmware install successfully performed	Set by +UFWINSTALL and +UFWUPD
129	Firmware install generic failure	Set by +UFWINSTALL and +UFWUPD
130	Flash access failure	Set by +UFWINSTALL and +UFWUPD
131	Delta file access problem	Set by +UFWINSTALL and +UFWUPD
140	Generic decompression engine error	Set by +UFWINSTALL and +UFWUPD
141	RAM error	Set by +UFWINSTALL and +UFWUPD
144	Requested file does not exist during installation (it could be a working file/partition in flash or FW file/partition to be updated. It could be a flash error)	Set by +UFWINSTALL and +UFWUPD
148	Delta file is corrupted	Set by +UFWINSTALL and +UFWUPD
158	Delta file not recognized. It happens trying to update from a non-delta file format	Set by +UFWINSTALL and +UFWUPD
160	Flash writing failure	Set by +UFWINSTALL and +UFWUPD
168	Source firmware in flash mismatch with the one expected by the delta file.	Set by +UFWINSTALL and +UFWUPD
173	Calculated digital signature does not match package header value - probably wrong signature or some byte corrupted	Set by +UFWINSTALL and +UFWUPD
174	Delta file version is not supported	Set by +UFWINSTALL and +UFWUPD
178	RAM memory corruption (Null Pointer assignment)	Set by +UFWINSTALL and +UFWUPD
180	Size of the delta file in flash mismatch with the real delta file size	Set by +UFWINSTALL and +UFWUPD
195	Data corruption found in a component/partition/file updated in flash. Probably cause by power loss cause or flash problem	Set by +UFWINSTALL and +UFWUPD
224	Generic error in finalizing the end of the install procedure. Last check before exiting install.	Set by +UFWINSTALL and +UFWUPD
227	FOTA public key is not found or invalid	Set by +UFWINSTALL and +UFWUPD
247	Pre-validation of the delta file failed	Set by +UFWINSTALL and +UFWUPD

A.5 FOAT error result codes

See +UFWUPD command description.

A.5.1 LENA-R8 error result codes

Error result code	Description
ERROR1	The operation has been interrupted and the actual FW is unchanged; the module drops out from Firmware Update Mode
ERROR2	The operation has been interrupted during FW updating; the actual firmware is corrupted and the module remains in Firmware Update Mode
ERROR3	The signature check fails
ERROR4	The module has received unexpected EOT because not all excepted bytes have been received
ERROR5	The boot does not support the selected baudrate
ERROR6	Invalid AT command sent during boot
FLS header decoding failed	An error occurs during decoding of file header
Buffer Data Overrun	The buffers are not filled at least with a 1029 packet: data comes too slowly
Timeout	The command must be re-sent: no data is coming

A.5.2 LENA-R8 extended error result codes

For the allowed final result codes that can be issued at the finalization of the install procedure by means of the +UFWUPD AT command, see Final result codes from end of update procedure.

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

Numeric error code	Description	Resulting from the following commands
22	EINVAL - Invalid argument	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
32	EPIPE - Broken pipe (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
38	ENOSYS - Function not implemented	+USOSO, +USOGO
64	ENONET - Machine is not on the internet	+USOCR, +USOWR, +USOST, +USORD, +USORF, +USOLI
65	EEOF - End of file	+USOWR, +USOST, +USORD, +USORF
71	EPROTO - Protocol error	+USOWR, +USOST, +USORD, +USORF
77	EBADFD - File descriptor in bad state (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
78	EREMCHG - Remote address changed	+USOWR, +USOST, +USORD, +USORF, +USOCL
89	EDESTADDRREQ - Destination address required	+USOCO, +USOST
91	EPROTOTYPE - Wrong protocol type for socket	+USOCR
92	ENOPROTOOPT - Protocol not available	+USOCR
93	EPROTONOSUPPORT - Protocol not supported	+USOCR
94	ESOCKTNNOSUPPORT - Socket type not supported	+USOCR
95	EOPNOTSUPP - Operation not supported on transport endpoint	+USOWR, +USOST, +USORD, +USORF, +USOCL
96	EPFNOSUPPORT - Protocol family not supported	+USOCR
97	EAFNOSUPPORT - Address family not supported by protocol	+USOCR
98	EADDRINUSE - Address already in use	+USOLI
99	EADDRNOTAVAIL - Cannot assign requested address	+USOCR, +USOLI, +USOCO
100	ENETDOWN - Network is down	+USOCR, +USOLI, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOCL
101	ENETUNREACH - Network is unreachable	+USOCO, +USOST, +USORF
102	ENETRESET - Network dropped connection because of reset	+USOCR, +USOLI, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOCL
103	ECONNABORTED - Software caused connection abort	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
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

Numeric error code	Description	Resulting from the following commands
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:

- LENA-R8 - +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
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

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

Numeric error code	Description
8	Unknown FTP command
9	Unknown file action
10	Wrong FTP state
11	Wrong parameter
12	PSD or CSD connection not established
13	No memory available for allocation
14	Reserved internal code
15	Length of given web server (address or hostname) too long or too short
16	Hostname of given web server invalid
17	Address of given web server is invalid
18	Username too long or too short
19	Password too long or too short
20	Account too long or too short
21	Operation not allowed because FTP client is busy
22	Not possible to connect to FTP server
23	Error occurred in FTP request
24	Reserved internal code
25	FFS filename pointer is null or its length is 0
26-30	Reserved internal code
31	Timeout elapsed while performing requested operation
32	Internal processing error
33	Not logged in
34	Login incorrect
35	File unavailable (not found or no access)
36	File not ready
37	Filename not allowed
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

Numeric error code	Description
67	FFS invalid handle
68	FFS cannot open file
69	FFS cannot seek file
70	FFS cannot get file size
71	FFS cannot read
72	FFS bad offset
73	FFS cannot write
74	Direct link internal error
75	Failed to open extended passive mode
76	Failed to parse extended passive mode server reply
77	Internal error
78	Client IP protocol not supported - try passive mode
79	Data transfer error. The transferred (received/sent) data is not complete
226	Closing data connection; requested file action successful (for example, file transfer or file abort)
250	Requested file action okay, completed
350	Requested file action pending further information
421	Service not available, closing control connection. User limit reached Not authorized to make the connection Maximum connections reached Maximum connections exceeded
425	Cannot open data connection
426	Connection closed; transfer aborted. The command opens a data connection to perform an action, but that action is cancelled, and the data connection is closed
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
554	Requested action not taken. Invalid REST parameter
555	Requested action not taken. Type mismatch

For all the errors not listed in the table see the RFC 959 [180], RFC 2428 [182] and RFC 1123 [181].

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

Numeric error code	Description
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
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

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

Numeric error code	Description
11	Illegal mode
12	File range error
13	The operation is not possible
14	Write error
15	User id error
16	Internal fatal error
17	Memory resource error
18	Maximum number of files exceeded
19	Memory not available
20	Invalid filename
21	Streaming not enabled
22	Operation not allowed on static file
23	Memory table inconsistency
24	Not a factory default file
25	Requested memory temporary not available
26	Operation not allowed for a directory
27	Space in the directory space not available
28	Too many streaming files opened
29	Requested dynamic memory temporary not available
30	The user provided a NULL parameter instead of a suitable buffer

A.7.4 MQTT error codes

A.7.4.1 LENA-R8 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
4-7	Internal error
8	Cannot set secure socket
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

Numeric error code	Description
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
46	MQTT client invalid internal state
47	MQTT client TLS connect error
48	MQTT client STDIN Wake error
49	Incoming message cannot be saved, the buffer is full
50	PSD or CSD connection not established
51	Error in callback
52	Malformed packet
53	MQTT session active, profile configuration not allowed
54	Incoming publish packet too long
55	Keep alive time is 0, ping loop not activated
56	Communication closed by server
57	Cannot enter in binary mode

A.7.5 LENA-R8 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 LENA-R8 MQTT-SN class error codes

Numeric error code	Description
0	Operation performed with success
1	Memory failure
2	Invalid parameter
3	Invalid parameter range
4-7	Internal error
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 address length out of range
14	Gateway port out of range
15	Invalid topic
16	Topic length out of range
17	QOS out of range
18	Retain out of range
19	Will message out of range
20	Publish message out of range
21	Timeout error
22	No Network service

Numeric error code	Description
23	Gateway not connected
24	Not specified error returned by gateway
25	Congestion
26	Ivalid topic ID
27	Not supported
28	MQTT-SN client: out of buffer
29	MQTT-SN client: malformed remaining length
30	MQTT-SN client: packet type mismatch
31	MQTT-SN client: packet ID mismatch
32	MQTT-SN client: invalid internal state
33	MQTT-SN client: STDIN Wake
34	Incoming message cannot be saved, the buffer is full
35	PSD or CSD connection not established
36	Incoming publish packet too long
37	Keep alive time is 0, ping loop not activated
38	Security mode out of range
39	Wrong security manager profile
40	Security manager profile out of range
41	Missing message or filename
42	Cannot get file size
43	File size out of range
44	Cannot open file
45	Cannot read file
46	Error receiving a publish message
47	Communication closed by server
48	Cannot enter in binary mode

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
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

Numeric error code	Description
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.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)

B Appendix: AT Commands List

	AT command	Call control				
		+CHUP	A	D	S0	
LENA	R8001M10-00C	•	•	•	•	
	R8001-00C	•	•	•	•	

AT command		File System					
		+UDELFILE	+UDWNFILE	+ULSTFILE	+URDBLOCK	+URDFILE	
LENA	R8001M10-00C	•	•	•	•	•	
	R8001-00C	•	•	•	•	•	

	AT command	General commands											
		+CCID	+CGMI	+CGMM	+CGMR	+CGSN	+CIMI	+CSCS	+GMI	+GMM	+GMR	+GSN	I
LENA	R8001M10-00C	•	•	•	•	•	•	•	•	•	•	•	•
	R8001-00C	•	•	•	•	•	•	•	•	•	•	•	•

AT command		GPIO interface			
		+UGPIOC	+UGPIOR	+UGPIOW	
LENA	R8001M10-00C	•	•	•	
	R8001-00C	•	•	•	

	AT command	Internet suite										
		+UDCONF=4	+UDNSRN	+UFTP	+UFTPC	+UFTPER	+UHTTP	+UHTTPAC	+UHTTPC	+UHTTPER	+UPING	
LENA	R8001M10-00C	•	•	•	•	•	•	•	•	•	•	
	R8001-00C	•	•	•	•	•	•	•	•	•	•	

AT command		Device and data security		
		+USECMNG	+USECPRF	
LENA	R8001M10-00C	•	•	
	R8001-00C	•	•	

AT command		IP Multimedia Subsystem (IMS)	
		+SETVOLTE	
LENA	R8001M10-00C	•	
	R8001-00C	•	

AT command		Localization features																				
		+UGAOF	+UGAOP	+UGAOS	+UGGGA	+UGGLL	+UGGSA	+UGGSV	+UGIND	+UGPRF	+UGPS	+UGRMC	+UGSRV	+UGTMR	+UGUBX	+UGVTG	+UGZDA	+ULOC	+ULOCCELL	+ULOCGNSS	+ULOCIND	
LENA	R8001M10-00C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R8001-00C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

AT command		Mobile equipment control and status										
		+CCLK	+CEER	+CFUN	+CIND	+CLCC	+CMEE	+CMER	+CPWROFF	+CSGT	+CTZR	+CTZU
LENA	R8001M10-00C	•	•	•	•	•	•	•	•	•	•	•
	R8001-00C	•	•	•	•	•	•	•	•	•	•	•

AT command		Network service												
		+CCED	+CNUM	+COPN	+COPS	+CPOL	+CREG	+CSCON	+CSQ	+GTCCINFO	+SETBAND	+SETLOCK	+UJAD	+URAT
LENA	R8001M10-00C	•	•	•	•	•	•	•	•	•	•	•	•	•
	R8001-00C	•	•	•	•	•	•	•	•	•	•	•	•	•

AT command		Packet switched data services																	
		+CDNSCFG	+CEREG	+CFGDFTPDN	+CGACT	+CGATT	+CGCLASS	+CGCONTRDP	+CGDATA	+CGDCONT	+CGEREP	+CGPADDR	+CGQMIN	+CGQREQ	+CGREG	+UAUTHREQ	+VERCTRL	D*	H
LENA	R8001M10-00C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R8001-00C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

AT command		Device lock					
		+CLCK	+CPIN	+CPWD	+UPINCNT	+USIMLCK	
LENA	R8001M10-00C	•	•	•	•	•	
	R8001-00C	•	•	•	•	•	

AT command		Serial interface																			
		&C	&D	&F	&K	&S	&V	&W	+CMUX	+ICF	+IFC	+IPR	E	O	Q	S3	S4	S5	V	Z	
LENA	R8001M10-00C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R8001-00C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

	AT command	Short Messages Service																
		+CGSMS	+CMGD	+CMGF	+CMGL	+CMGR	+CMGS	+CMGW	+CMSS	+CNMA	+CNMI	+CPMS	+CSCA	+CSDH	+CSMP	+CSMS	+MTSMSCLASS0	
LENA	R8001M10-00C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R8001-00C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

AT command		SIM functionalities		
		+CRSM	+CSIM	
LENA	R8001M10-00C	•	•	
	R8001-00C	•	•	

AT command		Supplementary services	
		+CLIP	
LENA	R8001M10-00C	•	
	R8001-00C	•	

AT command		System features								
		+SYSNV	+UANTR	+UCTS	+UDCONF=0	+UFACTORY	+UFWINSTALL	+UFWUPD	+USTS	
LENA	R8001M10-00C	•	•	•	•	•	•	•	•	
	R8001-00C	•	•	•	•	•	•	•	•	

AT command		Power management	
		+UPSV	
LENA	R8001M10-00C	•	
	R8001-00C	•	

AT command		Internet protocol transport layer																			
		+UDCONF=1	+UDCONF=5	+UDCONF=6	+UDCONF=7	+UDCONF=8	+USOCL	+USOCO	+USOCR	+USOCTL	+USODL	+USOER	+USOGO	+USOLI	+USORD	+USORF	+USOSEC	+USOSO	+USOST	+USOWR	
LENA	R8001M10-00C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R8001-00C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

	AT command	MQTT								
		+UMQTT	+UMQTTC	+UMQTTER	+UMQTTNV	+UMQTTSN	+UMQTTSNC	+UMQTTSNER	+UMQTTSNNV	
LENA	R8001M10-00C	•	•	•	•	•	•	•	•	
	R8001-00C	•	•	•	•	•	•	•	•	

AT command		CoAP			
		+UCOAP	+UCOAPC	+UCOAPER	
LENA	R8001M10-00C	•	•	•	
	R8001-00C	•	•	•	

B.1 Parameters stored in profiles

The parameter settings of some commands can be stored in the profiles available in the memory module.

☞ LENA-R8
To store, display, reset to default value the available profile, see the AT&W, AT&V, and ATZ commands description.

☞ Some AT commands have a unique configuration for all the AT interfaces while for other AT commands it is possible to set a different configuration for each AT interface: the "AT interface configuration sharing" column in the next table provides this information.
Some AT command interfaces have a dynamic activation, which means they are not statically activated at boot time (MUX AT channel is activated when the MUX protocol is established, USB AT channel is activated if/when the USB cable is plugged-in, deactivated when it is removed). Since the activation reloads the AT command profile from NVM for the activated interface, the shared "AT interface configurations" could be overwritten. It is suggested to reconfigure them at the requested value if an AT command interface is dynamically activated.

The following table lists the AT commands which setting can be stored in the profiles with their parameters as well as the factory-programmed values.

AT command	Description	AT interface configuration sharing	Factory-programmed value / Remarks
&C	DCD status	No	1 (DCD enabled)
&D	DTR status	No	1 (DTR enabled)
&K	Flow control status	No	• LENA-R8 - 3 (RTS/CTS DTE flow control enabled)
&S	DSR override	No	1 (DSR line set to ON in data mode and to OFF in command mode)
+CGREG	GPRS network registration status reporting	Yes	• LENA-R8 - The command settings is not stored in the personal profile
+CMEE	Mobile termination error reporting	Yes	• LENA-R8 - 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	• 0 (autoregistration enabled) • 0 (operator expressed in long alphanumeric format) • FFFFF (undefined PLMN to register when +COPS: 1)
+CPMS	Preferred message storage	No	• LENA-R8 - The command setting is stored in the NVM
+CREG	Network registration status reporting	Yes	• LENA-R8 - The command settings is not stored in the personal profile
+CSCA	Service center address	No	• LENA-R8 - The command stores the SMS Service Center Address in the SIM card.
+CSMP	Select message service	No	• LENA-R8 - The command setting is stored in the NVM
+CSCS	Select character set configuration	No	• LENA-R8 - "IRA" (Chinese character set)
+CSMS	Select message service	No	• LENA-R8 - The command setting is not stored in the personal profile
+CTZR	Time zone reporting	Yes	• LENA-R8 - 0 (disable the time zone change event reporting)
+ICF	DTE-DCE character framing	No	• LENA-R8 - 3, 1 (framing format: 8 data 1 stop, no parity)
+IFC	DTE-DCE local flow control	No	2 (<DCE_by_DTE> on circuit 106 (CTS)), 2 (<DTE_by_DCE> on circuit 105 (RTS))

AT command	Description	AT interface configuration sharing	Factory-programmed value / Remarks
+IPR	Baud rate	No	• LENA-R8 - 0 (autobauding enabled)
+SETVOLTE	Configure VoLTE support	Yes	1 (VoLTE enabled)
+UPSV	Power saving control	Yes	• LENA-R8 - 0 (power saving disabled)
+USTS	Smart temperature supervisor	Yes	• LENA-R8 - 0 (smart temperature feature disabled)
E	Echo status	No	1 (echo enabled)
Q	Result code suppression	No	0 (DCE transmits result codes)
S0	Automatic answer	No	• LENA-R8 - 0 (automatic answering disabled)
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	• LENA-R8 - The command setting is stored in the personal profile
&C	DCD status	• LENA-R8 - The command setting is stored in the personal profile
&D	DTR status	• LENA-R8 - The command setting is stored in the personal profile
&K	Flow control status	• LENA-R8 - The command setting is stored in the personal profile
&S	DSR override	• LENA-R8 - The command setting is stored in the personal profile
+CCLK	Clock	• LENA-R8 - "00/01/01,00:00:11+00"
+CFGDFTPDN	Default PDP context configuration	• LENA-R8 - 1 (IP), "" (blank APN), 0 (no authentication), "" (no username), "" (no password)
+CGDCONT	PDP context definition	• LENA-R8 - all contexts are undefined
+CGQMIN	Quality of service profile (minimum acceptable)	• LENA-R8 - The command setting is not stored in NVM
+CGQREQ	Quality of service profile (requested)	• LENA-R8 - The command setting is not stored in NVM
+CGSMS	Select service for MO SMS messages	• 1 (CS service selected)
+COPS	Operator selection	• LENA-R8 - The command setting is stored in the personal profile
+CPMS	Preferred message storage	• LENA-R8 - <mem1>, <mem2> and <mem3> are set to "SM"
+CSCA	Service center address setting	• LENA-R8 - The command stores the SMS Service Center Address in the SIM card.
+CSCON	Connection status signalling	• LENA-R8 - 0 (URC disabled)
+CSCS	Select character set configuration	• LENA-R8 - The command setting is not stored in the NVM
+CSGT	Set greeting text	• LENA-R8 - 1 (greeting text enabled), "+UUSTATUS: READY"
+CSMP	Select message service	• LENA-R8 - 17 <fo>, 167 <vp>, 0 <pid>, 0 <dcs>

AT command	Description	Factory-programmed value / Comment
+CSMS	Message service configuration	• LENA-R8 - The command setting is not stored in NVM
+CTZR	Time zone reporting	• LENA-R8 - The command setting is stored in the personal profile
+CTZU	Automatic time zone update	• LENA-R8 - 1 (automatic time zone via NITZ enabled)
+IPR	Baud rate	• LENA-R8 - The command setting is stored in the personal profile
+SETBAND	Configure GSM supported bands	0 (900P, 900E, 850, 1800, 1900 GSM bands enabled)
+SETLOCK	Configure LTE supported bands	All supported LTE bands are enabled
+SYSNV	System configuration	• "usbmode": 2 (8 serials logical interfaces on USB) • "nat_cfg": 0 (NAT disabled)
+UAUTHREQ	Configure the authentication parameters of a PDP/EPS bearer	• LENA-R8 - 0 (no authentication), "" (no username), "" (no password)
+UCOAP	CoAP profile configuration	Empty profile
+UCTS	CTS line state in case of disabled HW flow control	0 (legacy behavior: CTS line is set to ON state if HW flow control is disabled)
+UFACTORY	Restore factory configuration	0 (no FS factory restore), 0 (no NVM factory restore)
+UGAOF	AssistNow Offline configuration	"http://alp.u-blox.com/current_14d.alp" (AssistNow Offline URL file),0, 1 (One minute of timeout after a fail download), 3 (3 attempts in case of failed download)
+UGAOP	AssistNow Online configuration	"eval1-les.services.u-blox.com" (Host name server), 46434 (Server port), 1000 (Expected network latency: 1000 ms), 0 (AssistNow Online data downloaded at GPS receiver power up)
+UGGGA	Get GPS fix data	0 (NMEA $GGA messages disabled)
+UGGLL	Get geographic position	0 (NMEA $GLL messages disabled)
+UGGSA	Get satellite information	0 (NMEA $GSA messages disabled)
+UGGSV	Get number of GNSS satellites in view	0 (NMEA $GSV messages disabled)
+UGIND	Assisted GNSS unsolicited indication	• LENA-R8 - The command setting is not stored in the NVM
+UGPIOC	GPIO functionality setting	• LENA-R8 - GPIO1: 255, GPIO2: 3, GPIO3: 4, GPIO4: 0, GPIO5: 7
+UGPRF	GNSS profile configuration	0 (No data flow on multiplexer, file and IP address), 0 (IP port not defined), "" (Server address string not defined)
+UGRMC	Get recommended minimum GNSS data	0 (NMEA $RMC messages disabled)
+UGSRV	Aiding server configuration	"cell-live1.services.u-blox.com" (primary MGA server), "cell-live2.services.u-blox.com" (secondary MGA server), 14 (Number of days for validation of Offline data), 4 (Number of weeks for validation of Offline data), 1 (Resolution of offline data for MGA), 65 (Desired GNSS for the (offline) aiding: GPS and GLONASS), 0 (AssistNow Online data are downloaded at GNSS receiver power up), 15 (all the desired data types for the (online) aiding are set), 1 (PDP context identifier)
+UGVTG	Get course over ground and ground speed	0 (NMEA $VTG messages disabled)
+UGZDA	Get GPS time and date	0 (NMEA $ZDA messages disabled)
+UJAD	Smart jamming detection	• LENA-R8 - 0 (smart jamming detection disabled)
+ULOCCELL	Configure cellular location sensor (CellLocate®)	0 (normal mode enabled)
+ULOCGNSS	Configure GNSS sensor	• 15 (Local aiding, AssistNow online, AssistNow offline, AssistNow autonomous enabled), 0 (power saving disabled), 3 (Minimum number of satellites for navigation), 7 (Minimum satellite signal level for navigation), 0 (Disabled initial Fix must be 3D flag), 0 (Static Hold Mode), 0 (SBAS disabled), 0 (Jamming indicator disabled), 0 (Antenna settings unknown), 0 (Broadband jamming

AT command	Description	Factory-programmed value / Comment
		detection threshold: 0 dB), 0 (Continuous wave jamming detection threshold: 0 dB), 1 (GPS), 0, 0
+ULOCIND	Localization information request status unsolicited indication	• LENA-R8 - 0 (URC disabled)
+UPSV	Power saving control	• LENA-R8 - The command setting is stored in the personal profile
+URAT	Selection of Radio Access Technology	• LENA-R8 - 5 (GSM / LTE RAT), 3 (LTE as preferred RAT)
+VERCTRL	Auto PDP configuration	• LENA-R8 - 0 (storeroom), 0 (auto PDP activation is disabled)
S0	Automatic answering	• LENA-R8 - The command setting is not stored in NVM
V	DCE response format	• LENA-R8 - The command setting is stored in the personal profile

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:

- LENA-R8 - 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:

- LENA-R8 - Since the permanently saving of NVM content is achieved by a low priority process, the time depends on all the other activities as network procedures, call management, and so on. To be sure to save suddenly the run-time configuration of the commands listed in Appendix B.2, it is advisable to use +CPWROFF or +CFUN=15 or +CFUN=16. If the +CPWROFF has been issued the module, perform a reboot of the device

B.4 Estimated maximum command response time

After having sent a command to a u-blox cellular module, the time to obtain a result code depends on the SIM and the network. Immediate response is possible, if the command does not interact with either the SIM or the network.

The following table reports the maximum time to get the result code for the AT commands, which are grouped by categories.

Category	Estimated maximum time to get response	Commands
Power off	< 40 s	+CPWROFF
Set module functionality	• LENA-R8 - Up to 3 min	+CFUN
Call control	< 20 s	A, H, +CHUP
Dial	Up to 3 minutes	D
Supplementary services	< 20 s	+CHUP
Supplementary services	Up to 3 minutes	+CLIP
Data connection commands	• LENA-R8 - Up to 3 minutes	+CGATT, +CGDATA
Network commands	• LENA-R8 - Up to 3 minutes	+COPS
Network commands	< 10 s	+URAT
Security	Up to 3 minutes	+CLCK, +CPWD
Delete all SMSes	< 55 s	+CMGD
Send SMS	• LENA-R8 - Up to 3 minutes (< 1 s for prompt ">")	+CMGS
SMS acknowledgement to MT	< 150 s	+CNMA
SMS	Up to 3 minutes (< 1 s for prompt ">")	+CPMS, +CMGL, +CMSS
SIM management	< 10 s	+CMGW, +CMGR, +CNUM, +CPIN, +CPOL, +CRSM, +CSCA, +CSMP
PDP context activation	• LENA-R8 - < 150 s	+CGACT

Category	Estimated maximum time to get response	Commands
PDP context deactivation	• LENA-R8 - < 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)	• LENA-R8 - < 120 s	+USOCO
Internet suite (socket connect with SSL)	• LENA-R8 - < 120 s	+USOSEC
Internet suite (socket write)	• LENA-R8 - < 1 s	+USOWR
Internet suite (UDP socket write)	• LENA-R8 - < 1 s	+USOST
Internet suite (socket closure)	• LENA-R8 - < 1 s	+USOCL
Internet suite	• LENA-R8 - < 1 s	+USODL, +USOLI, +USORD, +USORF
Resolve name/IP number through DNS	• LENA-R8 - < 120 s	+UDNSRN
GNSS commands	< 10 s (except +UGPS for which timeout is according to the performed operation)	+UGAOS, +UGGGA, +UGGLL, +UGGSA, +UGGSV, +UGPS, +UGRMC, +UGTMR, +UGUBX, +UGVTG, +UGZDA, +ULOC
MQTT command	• LENA-R8 - immediate	+UMQTTC
Firmware update	• LENA-R8 - immediate	+UFWUPD

B.5 Multiple AT command interfaces

u-blox cellular modules support multiple AT command interfaces, that means a certain number of virtual or physical channels that work as described in Definitions.

Each interface maintains its own run-time AT commands configuration (AT command profile), which can be different among the interfaces.

At the module start-up, since there is only a set of the profiles (not one for each interface), all the interfaces are configured in the same way (AT commands configuration for the commands in the profile is the same for all the interfaces). Subsequently, each interface can change its run-time AT profile (stored in RAM). The commands AT&W, AT&V manage this run-time AT commands configuration for the interface where they are issued.

The USB interface implements multiple AT command interfaces. Unlike the other physical interfaces (e.g. UART, SPI), AT command interfaces over USB only exist when the module is connected to DTE by USB. If the USB connection between the module and the DTE is interrupted (e.g. by USB cable removal), all the AT command interfaces running on it are destroyed. This has two main consequences:

- Any data connection (both circuit switched and packet switched) established over an AT command interface associated to the USB interface is released.
- Whenever the USB connection between the module and the DTE is re-established, the AT command interfaces running on it are created, and for each of these interfaces the AT command profile is reloaded from NVM and applied.

☞ The reload of the AT command profile from the NVM also results in the re-application of the +UPSV setting, which is a shared "AT interface configuration". This must be kept in mind, since the change could have impacts on the communication over the UART interface.

As mentioned in Definitions, generally there is not difference in the execution of an AT command among the interfaces. But, there are some exceptions due to interface restrictions. In particular, the differences relate to AT commands that configure the DCE-DTE interface.

Table 17 provides the major differences.

AT command	UART / AUX UART (where available)	Multiplexer	USB (where available)	SPI (where available)
&K	Effective	When it returns OK (the configuration is allowed), it is effective	When it returns OK (the configuration is allowed), it is not effective (only	When it returns OK (the configuration is allowed), it is not effective (only

AT command	UART / AUX UART (where available)	Multiplexer	USB (where available)	SPI (where available)
			change the value in the AT command profile)	change the value in the AT command profile)
+ICF	Effective	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)
+IFC	Effective	When it returns OK (the configuration is allowed), it is effective	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)
+IPR	Effective	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)
+UPSV	Effective	Returns OK, but it changes UART setting	Returns OK, but it changes UART setting	Returns OK, but it changes UART setting

Table 17: Interface comparison

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
PSK	Private Shared Key
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

Abbreviation	Definition
UDP	User Datagram Protocol
UI	Unnumbered Information
UICC	Universal Integrated Circuit Card
UIH	Unnumbered Information with header Check
URC	Unsolicited Result Code
USIM	UMTS Subscriber Identity Module
UTRAN	Universal Terrestrial Radio Access Network
UUS1	User-to-User Signalling Supplementary Service 1
WLAN	Wireless Local Area Network
ZTP	Zero Touch Provisioning

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
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130. 3GPP TS 24.341 Support of SMS over IP networks; Stage 3
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134. 3GPP TS 25.133 Requirements for support of radio resource management (FDD)
135. 3GPP TS 22.071 Location Services (LCS); Service description
136. 3GPP TS 36.331 Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 10)
137. 3GPP TS 24.167 3GPP IMS Management Object (MO); Stage 3
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Revision history

Revision	Date	Name	Comments
R01	10-Oct-2022	lpah	Initial release
R02	11-Apr-2023	lpah	New commands: +CLCC, +CHUP, +SETLOCK, +SETBAND, +SETVOLTE, +MTSMSCLASS0, +CLIP, +CDNSCFG, +SYSNV, +UGPS, +UGIND, +UGPRF, +UGSRV, +UGAOP, +UGAOF, +UGAOS, +UGUBX, +UGTMR, +UGZDA, +UGGGA, +UGGLL, +UGGSV, +UGRMC, +UGVTG, +UGGSA, +ULOC, +ULOCIND, +ULOCGNSS, +ULOCCELL. Modified commands: Operational mode of the AT interface, +CMUX, +CFUN, +CSGT, +COPS, Class 0 SMS, <index> parameter range, +IPR, Multiple PDP contexts, D*, +CGDATA, +UAUTHREQ, +UFWINSTALL, +UFWUPD, +UPSV, GPIO introduction, File System limits, DNS introduction, Internet protocol transport layer Introduction, +USOSO, +USOGO, +USOST, +USECMNG, +USOCR, FTP introduction, HTTP introduction, +UHTTP, Ping Introduction, +UPING, +UGPS, +UGIND, +UGPRF, +ULOC, +ULOCGNSS, +ULOCCELL, MQTT introduction, +UMQTTC, MQTT-SN introduction. Review the command applicability for these commands: +UPSD, +UPSDA, +USOAO.
R03	21-Sep-2023	lpah	New commands: +CSCON, +CCED, +GTCCINFO, +CGCONTRDP, +VERCTRL. Modified commands: +CSGT, +CREG, +COPS, +SETLOCK, +CSMP, +CSCA, &D, +USECPRF, Internet protocol transport layer introduction, +USOST, +USODL Character Trigger (CT), FTP introduction, +UFTPC, HTTP introduction, +UHTTPAC, PING introduction, +UGSRV, +UGIND, +ULOCIND, MQTT introduction, +UMQTTC, MQTT-SN introduction, Estimated maximum command response time.

Contact

u-blox AG

Address: Zürcherstrasse 68
8800 Thalwil
Switzerland

For further support and contact information, visit us at www.u-blox.com/support.