SARA-R4 series

Size-optimized LTE Cat M1 / NB1 modules

AT Commands Manual

Abstract

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

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Document Information		
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Preface

Applicable products

This document applies to the following products:

Name	Type number	Modem version	Application version	PCN reference
SARA-R404M	SARA-R404M-00B-00	K0.0.00.00.07.06	TBD	UBX-17047084
SARA-R410M	SARA-R410M-01B-00	L0.0.00.00.01	TBD	UBX-17013995
	SARA-R410M-02B-00	TBD	TBD	TBD

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 by 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). In each row the modules are grouped by: form factor (i.e. SARA, LISA), platform technology (e.g. SARA-G), platform generation (e.g. SARA-G3), product name (e.g. SARA-G350) and ordering code (e.g. SARA-G350-00S). In example: if 'LISA-U2' is reported, the command applies to all the modules having LISA form factor, second chipset version provided with any release of firmware.
- **Attributes**
  - **Syntax**
    - **full**: the command syntax is fully compatible among all the products listed in the "Modules" section
    - **partial**: the products support different syntaxes (usually backward compatible with respect to previous cellular standards)
  - **PIN required**
    - **Yes**: it is necessary to insert the PIN before the set and/or read command execution
    - **No**: the PIN insertion is not needed to execute the command
  - **Settings saved**
    - **Profile**: the command setting can be saved in a personal profile as specified in *Chapter 1.2*
    - **NVM**: the command setting is saved in the non-volatile memory as specified in *Chapter 1.2*
    - **No**: the current command setting is volatile and cannot be saved

- o **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
- o **Response time**: estimated maximum time to get the final result code for the AT command execution. More precisely, the command response time measures the time from the complete acquisition of the command line to the issuing of the command result code.

  The response time specified in this manual is generally lower than the time measured by the application on the DTE, because the issuing of the command on the DTE is influenced by the AT interface characteristics (e.g. the synchronous/asynchronous transfer type, the selected baudrate, etc.), by power saving and flow control, which introduces a variable latency in the command acquisition by the DCE.

  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).
- o **Error reference**: reference to the error result codes listed in the *Appendix A*

u-blox Technical Documentation

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

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

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

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

Questions

If you have any questions about u-blox Cellular Hardware Integration, please:
- Read this manual carefully
- Contact our information service on our homepage *www.u-blox.com*
- Read the questions and answers on our FAQ database

Technical Support

Worldwide Web

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

By E-mail

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

Helpful Information when Contacting Technical Support

When contacting Technical Support please have the following information ready:

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

Contents

1 AT command settings

u-blox cellular modules provide at least one physical serial interface, which is compliant to V.24ter [*26*]. At the module power on the module enters the command mode. For more details on command mode see the *Chapter 1.1*.

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

1.1 Definitions

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

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

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

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

The DCE/MT interface can operate in these modes:
- **Command mode**: the DCE waits for AT command instructions. The DCE interprets all the characters received as commands to execute. The DCE may send responses back to the DTE indicating the outcome of the command or further information without having received any commands by the DTE (e.g. unsolicited response code - URC). Any communication in the command mode (in both directions) is terminated by the command line termination character.
- **Data mode**: the DCE transfers data after having sent the "CONNECT" string; all the characters sent to the DCE are intended to be transmitted to the remote party. Any further characters received over the serial link are deemed to be from the remote party, and any characters sent are transmitted to the remote party. The DCE enters data mode immediately after it makes a Circuit Switched Data (CSD) or Packet Switched Data (PSD) connection.
- **Online command mode**: the DCE has a data connection established with a remote party, but treats signals from the DTE as command lines and sends back responses and unsolicited indications to the DTE.

1.1.1 Switch from data mode to online command mode

It is possible to switch from data mode to online command mode (when a data connection is established) in the following ways:
- with the escape sequence: for more details see the *S2* command description
- via a DTR transition: during data mode, the current DTR state is not important, but only its transition. Furthermore, only the DTR transition from ON to OFF is detected; it can be used to control the switch to online command mode, or to command mode (the data connection is released). For more details see the *Table 4* and the *Table 5*

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

1.1.2 Command description

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

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

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

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

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

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

1.1.3 Default values

If the command parameters are optional, they can be left out in the command line. If not otherwise specified, the default values are assumed as follows:
- For parameters of type Number, the default value is 0
- For parameters of type String, the default value is an empty string

1.1.4 Command line

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

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

Where:
- "AT": prefix to be set at the beginning of each command line
- <command_name>: command name string; it can have a "+" character as prefix
- <string>: string consisting of the parameters value following the syntax provided in this manual
  The following rules are used when describing the command syntax:
  o <...>: the name in angle brackets is a parameter. The brackets themselves do not appear in the command line
  o [...]: 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:
  o Number: positive and negative counting numbers, as well as zero {..., -2, -1, 0, 1, 2,...}.
  o String: sequence of characters enclosed within quotation marks (" ").
- SARA-R4 - <S3_character>: command line termination character; it can be set with *ATS3* command; 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).

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

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

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

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

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

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

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

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

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

1.1.6 Information text responses and result codes
The AT command response comprises an optional information text string and a final result code. The V command configures the result code in numeric or verbose format:

- **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; it can be set with S3 command
- <S4_character> is the linefeed character; it can be set with S4 command

Table 1 lists the allowed result codes.

Verbose	Numeric	Result code type	Description
OK	0	Final	Command line successfully processed and the command is correctly executed
CONNECT	1	Intermediate	Data connection established
RING	2	Unsolicited	Incoming call signal from the network
NO CARRIER	3	Final	Connection terminated from the remote part or attempt to establish a connection failed
ERROR	4	Final	General failure. The AT+CMEE command configures the error result format

Verbose	Numeric	Result code type	Description
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). See the *+CBST* AT command for the allowed values of <data rate>. ☞ In case of data/fax call, see *Circuit 108/2, +++ behaviour for the different &D: summarizing table* to return in command mode and disconnect the call.
Command aborted	3000	Final	Command execution aborted issuing a character to the DCE

Table 1: Allowed result codes

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

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

If the command is not accepted by the MT an error result code will be displayed. The *AT+CMEE* command configures the error result code format. In this manual it is assumed that AT+CMEE=2, which results in error result code of the format:
- "+CMS ERROR: <err>" for SMS-related AT commands
- "+CME ERROR: <err>" for any other AT commands

where <err> represents the verbose error result code.

The most typical error result codes are the following:
- If the command is not supported or unknown, either "+CME ERROR: unknown" or "+CME ERROR: operation not supported" is sent
- If the command syntax is wrong, "+CME ERROR: operation not supported" is sent ("+CMS ERROR: operation not supported" for SMS related commands)

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

☞ The proprietary AT commands supporting the following features implement a different error management and provide different error result codes:
- Firmware update Over AT command and over the air: see the *Appendix A.3* and *Appendix A.4*
- TCP and UDP connections, FTP and HTTP: see the *Appendix A.5*, *Appendix A.6*, *Appendix A.6.1*, *Appendix A.6.2*

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

1.2 Profiles

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

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

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

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

1.3 S-parameters

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

ATS<parameter_number>?

ATS<parameter_number>=<value>

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

u-blox cellular modules support the following set of S-parameters (<parameter_number>):
• 0: automatic answer setting (for more details see the *S0*)
• 3: command line termination character setting (for more details see the *S3*)
• 4: response formatting character setting (for more details see the *S4*)
• 5: command line editing character setting (for more details see the *S5*)
• 6: pause before blind dialling setting (for more details see the *S6*)
• 7: connection completion timeout setting (for more details see the *S7*)
• 8: command dial modifier time setting (for more details see the *S8*)
• 10: automatic disconnect delay setting (for more details see the *S10*)
• 12: escape prompt delay setting (for more details see the *S12*)

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

2 General operation

2.1 Start up and initialization

A complete start up can take place only with a SIM card with disabled PIN check.

For a SIM card with enabled PIN check, some commands answers with "+CME ERROR: SIM PIN required". After entering the PIN via the +CPIN command, which allows a start up completion, a lot of SIM files will be read: it is possible that some commands are affected by this preliminary phase, resulting in a temporary error response.

2.1.1 Operational restrictions

Operational restrictions may derive from several settings: PIN required, SIM lock, invalidation of the IMEI or SIM credentials by the Mobile Network Operator (MNO) during the registration procedure, FDN enabled. Restrictions to access the network are applied by the module also in one of these conditions:
- In eCall only state (for all modules supporting the eCall feature)
- In minimum functionality power modes (+CFUN: 0, +CFUN: 4, +CFUN: 19, +CFUN: 127)

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

2.2 AT commands types

2.2.1 Action command

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

2.2.2 Set command

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

2.2.3 Read command

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

2.2.4 Test command

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

2.2.5 Unsolicited Result Code (URC)

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

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

2.2.5.1 URCs presentation deferring

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

The module avoids this collision by delaying the URCs presentation in case the AT command interface is busy. The AT command interface can be busy in the following cases:
- During a data call (data mode)
- During the execution of an AT command in command or online command mode

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

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

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

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

☞ The DTE should wait some time (the recommended value is at least 20 ms) after the reception of an AT command final result code or URC before issuing a new AT command to give the DCE the opportunity to transmit the buffered URCs. Otherwise the collision of the URCs with the subsequent AT command is still possible.

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

2.2.6 Intermediate Result Code (IRC)

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

3 IPC - Inter Processor Communication

3.1 Multiplexing mode +CMUX

+CMUX						
Modules	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 [46]. The command sets the parameters for the control channel. The result code is returned using the old interface speed. The parameters become active only after sending the OK result code.

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

The multiplexer configuration is as follows:

Channel	Control channel	AT commands / data connection	GNSS tunneling	SAP (SIM Access Profile)
SARA-R4	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 See Notes for the parameter applicability.
<port_speed>	Number	Transmission rate. The allowed range is 0-7. This parameter is ignored and the value 0 is always displayed in case of read command.
<N1>	Number	Maximum frame size: • Allowed range is 1-1509. • The default value is 31.
<T1>	Number	Acknowledgement timer in units of ten milliseconds. The allowed range is 1-255.

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

3.1.4 Notes

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

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- <subset> can only assume the value 0.
- <T1>, <T2>, <N2> values are ignored, since the related timers are not implemented.

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>	u-blox
		OK	OK
Test	AT+CGMI=?	OK	

4.1.3 Defined values

Parameter	**Type**	**Description**
<manufacturer>	String	Manufacturer name

4.2 Manufacturer identification +GMI

+GMI						
Modules	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>	u-blox
		OK	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 model identification.

4.3.2 Syntax

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

4.3.3 Defined values

Parameter	Type	Description
<model>	String	Name of model

4.4 Model identification +GMM

+GMM						
Modules	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 model identification.

4.4.2 Syntax

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

4.4.3 Defined values

Parameter	Type	Description
<model>	String	Name of model

4.5 Firmware version identification +CGMR

+CGMR						
Modules	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>	11.40
		OK	OK
Test	AT+CGMR=?	OK	

4.5.3 Defined values

Parameter	Type	Description
<version>	String	Firmware version

4.6 Firmware version identification +GMR

+GMR						
Modules	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>	11.40
		OK	OK

4.6.3 Defined values

Parameter	Type	Description
<version>	String	Firmware version

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

4.7.2 Syntax

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

4.7.3 Defined values

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

4.7.4 Notes

SARA-R4

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

4.8 IMEI identification +GSN

+GSN						
Modules	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>	004999010640000
		OK	OK
Test	AT+GSN=?	OK	

4.8.3 Defined values

See +CGSN AT command.

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 some details about the firmware:
- SARA-R4 - it contains the modem version and the application version of the module

It returns "Undefined" where not applicable.

4.9.2 Syntax

Type	Syntax	Response	Example
Action	**Ordering code request** ATI[0]	<type_number> OK	ATI0 SARA-G350-00S-00 OK
	Modem and application version request ATI9	<modem_version>,<applications_version> OK	ATI9 29.90,A01.00 OK
	Application protocol and security version request ATI9	<applications_version>,<protocol_version>,<security_version> OK	ATI9 A01.00,P01.00,S01.00 OK

4.9.3 Defined values

Parameter	Type	Description
<type_number>	String	Product type number
<modem_version>	String	Module modem version
<applications_version>	String	Module application version. Where not applicable the module provides "Undefined"
<protocol_version>	String	Module protocol version
<security_version>	String	Module security version

4.9.4 Notes

SARA-R4

• The application protocol and security version request is not available.

4.10 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*

4.10.1 Description

Request the IMSI (International Mobile Subscriber Identity).

4.10.2 Syntax

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

4.10.3 Defined values

Parameter	Type	Description
<IMSI>	String	International Mobile Subscriber Identity

4.11 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*

4.11.1 Description

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

4.11.2 Syntax

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

4.11.3 Defined values

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

4.11.4 Notes

• The command needs of the SIM to correctly work.

4.12 Repeat last command A/

A/						
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

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

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

4.12.2 Syntax

Type	Syntax	Response	Example
Action	A/		

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 shut-down current settings are saved in module's non-volatile memory.

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

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

5.1.2 Syntax

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

5.2 Set module functionality +CFUN

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

5.2.1 Description

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

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

☞ SARA-R4
A SW reset via *AT+CFUN=1,1* triggers signalling attempts whose number is internally counted by the SW and limited based on mobile network operators thresholds. The AT&T RPM feature (see also the *+URPM* AT command) limits the number of SW reset per hour, and might cause the AT command to return an error result code.

5.2.2 Syntax

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

5.2.3 Defined values

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

5.2.4 Notes

SARA-R4
- <fun>=16, 19 and 127 are not supported.

SARA-R404M / SARA-R410M-01B
- <fun>=6, 7, 8 and 9 are not supported.
- <fun>=15 will reset the SIM card
- <fun>=1,1 is not recomended. Use <fun>=15 instead

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 [2].

5.3.2 Syntax

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

5.3.3 Defined values

Parameter	Type	Description
<ind>	Number	Range of corresponding <descr> used to identify the service when an unsolicited indication is provided
<descr>	String	Reserved by the norm and their <ind> ranges; it may have the values:

- "battchg": battery charge level (0-5)
- "signal": signal quality. See mapping in the note below
- "service": network service availability
  - o 0: not registered to any network
  - o 1: registered to the network
  - o 65535: indication not available
- "sounder": sounder activity, indicating when the module is generating a sound
  - o 0: no sound
  - o 1: sound is generated
- "message": unread message available in <mem1> storage
  - o 0: no messages
  - o 1: unread message available
- "call": call in progress
  - o 0: no call in progress
  - o 1: call in progress
- "roam": registration on a roaming network
  - o 0: not in roaming or not registered
  - o 1: roaming
  - o 65535: indication not available
- "smsfull": indication that an SMS has been rejected with the cause of SMS storage full
  - o 0: SMS storage not full
  - o 1: SMS storage full
- "gprs": PS indication status:
  - o 0: no PS available in the network
  - o 1: PS available in the network but not registered
  - o 2: registered to PS
  - o 65535: indication not available
- "callsetup": call set-up:
  - o 0: no call set-up
  - o 1: incoming call not accepted or rejected

Parameter	Type	Description
		o 2: outgoing call in dialling state
		o 3: outgoing call in remote party alerting state
		• "callheld": call on hold:
		o 0: no calls on hold
		o 1: at least one call on hold
		• "simind": SIM detection
		o 0: no SIM detected
		o 1: SIM detected
		o 2: not available

5.3.4 Notes

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

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

5.4 Configuration of indicator control +UCIND

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

5.4.1 Description

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

5.4.2 Syntax

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

5.4.3 Defined values

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

5.5 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

5.5.1 Description

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

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

The command +UCIND allows enabling or disabling indicators.

5.5.2 Syntax

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

5.5.3 Defined values

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

<descr>	Number	Indicates the indicator order number. The name in the brackets indicates the corresponding <descr> parameter of +CIND; <value> is the new value of indicator:
		• 1 ("battchg"): <value> provides the battery charge level (0-5)
		• 2 ("signal"): <value> provides the signal quality
		  o 0: < -105 dBm
		  o 1: < -93 dBm
		  o 2: < -81 dBm
		  o 3: < -69 dBm
		  o 4: < - 57 dBm

Parameter	Type	Description
		o 5: >= -57 dBm
		• 3 ("service"): <value> provides the network service availability:
		o 0: not registered to the network
		o 1: registered to the network
		• 4 ("sounder"): <value> provides the sounder activity:
		o 0: no sound
		o 1: sound is generated
		• 5 ("message"): <value> provides the unread message available in <mem1> storage:
		o 0: no messages
		o 1: unread message available
		• 6 ("call"): <value> provides the call in progress:
		o 0: no call in progress
		o 1: call in progress
		• 7 ("roam"): <value> provides the registration on a roaming network:
		o 0: not in roaming
		o 1: roaming
		• 8 ("smsfull"): <value> provides the SMS storage status:
		o 0: SMS storage not full
		o 1: SMS Storage full (an SMS has been rejected with the cause of SMS storage full)
		• 9 ("gprs"): <value> provides the GPRS indication status:
		o 0: no GPRS available in the network
		o 1: GPRS available in the network but not registered
		o 2: registered to GPRS
		o 65535: PS service indication is not available
		• 10 ("callsetup"): <value> provides the call set-up:
		o 0: no call set-up
		o 1: incoming call not accepted or rejected
		o 2: outgoing call in dialing state
		o 3: outgoing call in remote party alerting state
		• 11 ("callheld"): <value> provides the call on hold:
		o 0: no calls on hold
		o 1: at least one call on hold
		• 12 ("simind"): <value> provides the SIM detection:
		o 0: no SIM detected
		o 1: SIM detected
		o 2: not available

5.6 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*

5.6.1 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.

5.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+CMEE=[<n>]	OK	AT+CMEE=2
			OK
Read	AT+CMEE?	+CMEE: <n>	+CMEE: 0

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

5.6.3 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

5.6.4 Notes

- When +CMEE=2 selected, the following convention is valid:
  - o If the error result code is related to a parameter not covered by the GSM/ETSI or u-blox specification, the value <err>="operation not supported" shall be reported.
  - o If the MT is in a state which does not allow performing the entered command, the value <err>= "operation not allowed" shall be reported.

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 [*5*] and initiates the indicated kind of call. No further commands may follow in the command line in case of data or fax calls.

6.1.2 Syntax

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

6.1.3 Defined values

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

6.1.4 Notes

SARA-R4

• Only data calls with ATD are supported.

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.

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

6.2.2 Syntax

Type	Syntax	Response	Example
Action	ATA	RING	
		OK	

6.3 Hook control H

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

6.3.1 Description

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

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

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

6.3.2 Syntax

Type	Syntax	Response	Example
Action	ATH	OK	

6.4 Automatic answer S0

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

6.4.1 Description

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

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

6.4.2 Syntax

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

6.4.3 Defined values

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

6.4.4 Notes

SARA-R404M / SARA-R410M-01B

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

7 Network service

7.1 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*

7.1.1 Description

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

☞ MSISDN is read from the SIM.

7.1.2 Syntax

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

7.1.3 Defined values

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

7.2 Signal quality +CSQ

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

7.2.1 Description

Returns the Received Signal Strength Indication (RSSI) <rssi> and <qual> from the MT.

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

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

7.2.2 Syntax

Type	Syntax	Response	Example
Action	AT+CSQ	+CSQ: <rssi>,<qual>	+CSQ: 2,5

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

7.2.3 Defined values

Parameter	Type	Description
<rssi>	Number	The allowed range is 0-31 and 99. Remapped indication of the following parameters: • the Received Signal Strength Indication (RSSI) in GSM RAT • the Received Signal Code Power (RSCP) in UMTS RAT • the Reference Signal Received Power (RSRP) in LTE RAT When the RF power level of the received signal is the highest possible, the value 31 is reported. When it is not known, not detectable or currently not available, 99 is returned.
<qual>	Number	The allowed range is 0-7 and 99. The information provided depends on the selected RAT: • In 2G RAT CS dedicated and GPRS packet transfer mode indicates the Bit Error Rate (BER) as specified in 3GPP TS 45.008 [147] • In 2G RAT EGPRS packet transfer mode indicates the Mean Bit Error Probability (BEP) of a radio block. 3GPP TS 45.008 [147] 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 [105] 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 [104] specifies the range 0-34 for RSRQ which is mapped to the range 0-7 of <qual> See Notes for the complete parameter mapping

7.2.4 Notes

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

7.3 Extended signal quality +CESQ

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

☞ The Reference Signal Received Power (RSRP) is a LTE specific measure that averages the power received on the subcarriers carrying the reference signal. The RSRP measurement bandwidth is equivalent to a single LTE subcarrier: its value is therefore much lower than the total received power usually referred to as RSSI.

In LTE the RSSI depends on the currently allocated bandwidth, which is not pre-determined. Therefore the RSSI is not useful to describe the signal level in the cell.

7.3.2 Syntax

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

7.3.3 Defined values

Parameter	Type	Description
<rxlev>	Number	Received Signal Strength Indication (RSSI): • 0: less than -110 dBm • 1..62: from -110 to -49 dBm with 1 dBm steps • 63: -48 dBm or greater • 99: not known or not detectable
<ber>	Number	Bit Error Rate (BER): • 0..7: as the RXQUAL values described in GSM TS 05.08 [28] • 99: not known or not detectable
<rscp>	Number	Received Signal Code Power (RSCP): • 0: -121 dBm or less • 1..95: from -120 dBm to -24 dBm with 1 dBm steps • 96: -25 dBm or greater • 255: not known or not detectable
<ecn0>	Number	Ratio of received energy per PN chip to the total received power spectral density: • 0: -24.5 dB or less • 1..48: from -24 dB to -0.5 dBm with 0.5 dB steps • 49: 0 dB or greater • 255: not known or not detectable
<rsrq>	Number	Reference Signal Received Quality (RSRQ): • 0: -19 dB or less • 1..33: from -19.5 dB to -3.5 dB with 0.5 dB steps • 34: -3 dB or greater • 255: not known or not detectable
<rsrp>	Number	Reference Signal Received Power (RSRP): • 0: -141 dBm or less • 1..96: from -140 dBm to -45 dBm with 1 dBm steps • 97: -44 dBm or greater • 255: not known or not detectable

7.4 Operator selection +COPS

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

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. 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).

☞ SARA-R4
In manual PLMN selection mode, if the optional <AcT> parameter is not specified, the modules will select the default access technology with the following priority order: LTE, UMTS and GSM (not supported technologies will be ignored).

☞ u-blox cellular modules are certified according to all the capabilities and options stated in the Protocol Implementation Conformance Statement document (PICS) of the module. The PICS, according to 3GPP TS 51.010-2 [*83*], 3GPP TS 34.121-2 [*84*], 3GPP TS 36.521-2 [*114*] and 3GPP TS 36.523-2 [*115*], is a statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

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

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

- **<mode>=0 and <mode>=1**: the AT command setting is immediately stored in the current activated profile. If the MT is set in automatic selection mode (<mode>= 0), only the mode will be saved. If the MT is set in manual mode (<mode>= 1), also the format (<format>) and operator (<oper>) will be stored in the profile.
- **<mode>=4**: the module starts a manual selection of the specified operator; if this operation is not successful, the module will start an automatic network selection and will remain in automatic mode.
- **<mode>=5 and <mode>=6**: an extended network search is performed
  - o **For GSM networks**: all cells found will be reported, including those belonging to the neighbour list of the serving cell. The command response includes the following data (if supported): AcT, MCC, MNC, LAC, CI, BSIC, Arfcn, RxLev (see the *+CGED* command for the parameter description)
  - o **For UMTS networks**: all cells found will be reported, including those belonging to the neighbour 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 *+CGED* command for the parameter description)
- **<mode>=8**: a network timing advance search is performed
  - o The network timing advance search is performed only on the serving cell and the 6 neighbour cells of BA list with the higher power levels.
  - o The information text response always includes the following data for the serving cell and for the other 6 neighbour cells: MCC, MNC, LAC, CI, BSIC, Arfcn, RxLev (see the *+CGED* command for the parameter description) and TA. When the <CI> value is not valid, no data of the correspondent neighbour cell is inside the information text response.
  - o It can be started only when the module is in idle mode and no reselection is ongoing. The network condition could sometimes increase the estimated response time.
  - o 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 [*70*]), i.e. the module triggers a search for the HPLMN or a higher order PLMN. This is useful when roaming in areas where the HPLMN or a higher order PLMN is available. If no HPLMN or higher order PLMN is found, the module remains in the state it was in prior to the search (e.g. camped and/ or registered on the PLMN before the search).

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

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

☞ SARA-R4
The user should not rely only on the set command "OK" final result code as a confirmation that the network selection has been performed. To determine the current network registration status, *+CEREG* should be also checked.

7.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+COPS=[<mode>[, <format>[,<oper>[, <AcT>]]]]	**If <mode>=0, 1, 2, 3, 4:**	AT+COPS=0,0
		OK	OK
		If <mode>=5 and on GSM networks:	AT+COPS=5
		[MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<Arfcn>, RxLev:<RxLev>	MCC:222, MNC: 88, LAC:55fa, CI:ffff, BSIC:3f, Arfcn:00104, RxLev:037
		[MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<Arfcn>, RxLev:<RxLev>	MCC:222, MNC: 10, LAC:4e54, CI:ffff, BSIC:32, Arfcn:00080, RxLev:032
		[...]]]	...
		OK	...
			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
		[MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, RAC:<RAC>, CI:<CI>, DLF:<dl_frequency>, ULF:<ul_frequency>, SC:<SC>, RSCP LEV:<RSCP LEV>, ECN0 LEV:<ecn0_lev>	MCC:222, MNC:10, LAC:61ef, RAC:14, CI:0 7d2088, DLF:10788, ULF: 9838, SC:81, RSCP LEV:23, ECN0 LEV:41
		[MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, RAC:<RAC>, CI:<CI>, DLF:<dl_frequency>, ULF:<ul_frequency>, SC:<SC>, RSCP LEV:<rscp_lev>, ECN0 LEV:<ecn0_lev>	MCC:222, MNC:10, LAC:61ef, RAC:14, CI:0 7d2085, DLF:10813, ULF: 9863, SC:81, RSCP LEV:26, ECN0 LEV:41
		[...]]]	...
		OK	...
			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>=6 and on GSM networks:	AT+COPS=6
		[<AcT>,<MCC>,<MNC>,<LAC>,<CI>,<BSIC>, <Arfcn>,<RxLev>	0,222,88,55fa,ffff,3f,00104,037
			...
		[<AcT>,<MCC>,<MNC>,<LAC>,<CI>,<BSIC>, <Arfcn>,<RxLev> [...]]]	0,222,10,4e54,ffff,32,00080,032
		OK	...
			OK
		If <mode>=6 and on UMTS networks:	AT+COPS=6
		[<MCC>,<MNC>,<LAC>,<RAC>,<CI>,<dl_frequency>,<ul_frequency>,<SC>,<RSCP LEV>, <ecn0_lev>	222,99,754f,2,03554d7,10713,9763,341,255, 14
			...
		[<MCC>,<MNC>,<LAC>,<RAC>,<CI>,<dl_frequency>,<ul_frequency>,<SC>,<RSCP LEV>, <ecn0_lev>	222,01,ef8d,0,52d2647,10663,9713,453,4,23
		[...]]]	...
		OK	OK

Type	Syntax	Response	Example
		If <mode>=8 and on GSM networks:	AT+COPS=8
		[MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<Arfcn>, RxLev:<RxLev>, TA:<TA>	MCC:222, MNC: 10, LAC:4e54, CI:12f1, BSIC:3f, Arfcn:00104, RxLev:037, TA:3
		[MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<Arfcn>, RxLev:<RxLev>, TA:<TA>	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
			...
		OK	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>]]	+COPS: 0,0,"vodafone IT"
		OK	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)	+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	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
<format>	Number	• 0 (factory-programmed value): long alphanumeric <oper> • 1: short format alphanumeric <oper> • 2: numeric <oper>
<oper>	String	Given in format <format> this field may be up to 24 characters long for long alphanumeric format, up to 10 characters for short alphanumeric format and 5 or 6 characters long for numeric format (MCC/MNC codes). The factory-programmed value is FFFF (undefined).
<stat>	Number	• 0: unknown • 1: available • 2: current • 3: forbidden
<AcT>	Number	Indicates the radio access technology: • 0: GSM • 1: GSM COMPACT • 2: UTRAN • 3: GSM with EDGE availability • 4: UTRAN with HSDPA availability • 5: UTRAN with HSUPA availability • 6: UTRAN with HSDPA and HSUPA availability • 7: LTE • 8: EC-GSM-IoT (A/Gb mode) • 9: E-UTRAN (NB-S1 mode)
<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.

7.4.4 Notes

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

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- <mode>=5, 6 and 8 are not supported.
- <AcT>=8 and 9 are not supported.
- <AcT>=0, 1, 2, 3, 4, 5, 6 are not supported.

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*	No	-	*+CME Error*

7.5.1 Description

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

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

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

☞ u-blox cellular modules are certified according to all the capabilities and options stated in the Protocol Implementation Conformance Statement document (PICS) of the module. The PICS, according to 3GPP TS 51.010-2 [*83*], 3GPP TS 34.121-2 [*84*], 3GPP TS 36.521-2 [*114*] and 3GPP TS 36.523-2 [*115*], is a statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

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

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 (single mode)

Parameter	Type	Description
		• 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)
<PreferredAct>	Number	Indicates the preferred access technology; it is ignored if dual mode or tri mode are not selected.
		• 0: GSM
		• 2: UTRAN
		• 3: LTE
<2ndPreferredAct>	Number	Indicates the second preferred access technology; it is ignored if tri mode is not selected.
		• 0: GSM
		• 2: UTRAN
		• 3: LTE

7.5.4 Notes

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

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

7.6 Edit Verizon wireless APN table +VZWAPNE

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

7.6.1 Description

Reads and writes the APN table stored in the NVM:

- The set command causes the APN table on the DUT to be overwritten. A set command must be issued for each APN edit.
- The read command queries the APN table that is currently on the DUT, starting from the first entry to the last; it returns each APN entry in a new line.

If the command fails, an error result code is returned. See the 3GPP TS 27.007 [*2*] subclause 9.2 for <err> values.

7.6.2 Syntax

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

7.6.3 Defined values

Parameter	Type	Description
<wapn>	Number	APN list entry
<apncl>	Number	APN class
<apnni>	String	Network identifier: • "VZWIMS": Verizon wireless IMS PDN • "VZWADMIN": Verizon wireless administrative PDN • "VZWINTERNET": Verizon Internet PDN • "VZWAPP": Verizon wireless application PDN The previous strings are predefined but others could be accepted.
<apntype>	String	• "IPv6": IPv6 type • "IPv4v6" (factory-programmed value): IPv4 and IPv6 type
<apnb>	String	APN bearer: • "LTE" (factory-programmed value): LTE bearer used
<apned>	String	Enable/disable the APN: • "Enabled" (factory-programmed value): APN enabled • "Disabled": APN disabled
<apntime>	Number	APN inactivity timer value in minutes. The range goes from 0 to 5. Value '0' (factory-programmed value) sets the timer to infinity.

7.6.4 Notes

APN class	APN NI	IP type	APN bearer	Enable flag	WAIT_TIME	Description
1	VZWIMS	Ipv4v6	LTE	Enabled	0	IMS
2	VZWADMIN	Ipv4v6	LTE	Enabled	0	Administrative
3	VZWINTERNET	Ipv4v6	LTE	Enabled	0	Internet
4	VZWAPP	Ipv4v6	LTE	Enabled	0	Application

Table 3: Factory-programmed APN table setting

7.7 Read RSRP values +VZWRSRP

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

7.7.1 Description

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

7.7.2 Syntax

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

7.7.3 Defined values

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

7.8 Read RSRQ values +VZWRSRQ

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

7.8.1 Description

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

7.8.2 Syntax

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

7.8.3 Defined values

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

8 Security

8.1 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*

8.1.1 Description

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

8.1.2 Syntax

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

8.1.3 Defined values

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

8.1.4 Notes

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

  OK

  AT+COPS=0

  +CME ERROR: SIM PIN required

  AT+CMEE=0

  OK

  AT+COPS=0

ERROR

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

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

8.2 Facility lock +CLCK

+CLCK						
Modules	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*

8.2.1 Description

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

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

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

8.2.2 Syntax

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

8.2.3 Defined values

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

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

8.3 Change password +CPWD

+CPWD						
Modules	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*

8.3.1 Description

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

8.3.2 Syntax

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

8.3.3 Defined values

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

8.3.4 Notes

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

9 Short Messages Service

9.1 Introduction

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

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

9.1.1 Class 0 SMS

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

• SARA-R4 - not stored.

9.1.2 <index> parameter range

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

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

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

BM (Broadcast Message):

SR (Status Report)

9.1.3 Limitations

The following limitations apply related to the SMS usage:

Single SMS

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

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

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

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

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

A concatenated SMS can have as many as 255 parts.

9.2 Select message service +CSMS

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

9.2.1 Description

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

9.2.2 Syntax

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

9.2.3 Defined values

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

9.2.4 Notes

SARA-R4

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

9.3 Preferred message storage +CPMS

+CPMS						
Modules	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

9.3.1 Description

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

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

9.3.2 Syntax

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

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

9.3.3 Defined values

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

9.4 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*

9.4.1 Description

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

9.4.2 Syntax

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

9.4.3 Defined values

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

9.5 Save settings +CSAS

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

9.5.1 Description

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

9.5.2 Syntax

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

9.5.3 Defined values

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

9.6 Restore settings +CRES

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

9.6.1 Description

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

9.6.2 Syntax

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

9.6.3 Defined values

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

9.7 New message indication +CNMI

+CNMI

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

9.7.1 Description

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

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

9.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+CNMI=[<mode>[,<mt>[,<bm>[,<ds>[,<bfr>]]]]]	OK	AT+CNMI=1,1 OK
Read	AT+CNMI?	+CNMI: <mode>,<mt>,<bm>,<ds>,<bfr> OK	+CNMI: 0,0,0,0,0 OK
Test	AT+CNMI=?	+CNMI: (list of supported <mode>s),(list of supported <mt>s),(list of supported <bm>s),(list of supported <ds>s),(list of supported <bfr>s) OK	+CNMI: (0-2),(0-3),(0-3),(0-2),(0-1) OK
URC		+CMTI: <mem>,<index>	+CMTI: "SM",5
URC		**Text mode (+CMGF=1):** +CMT: <oa>,[<alpha>],<scts>[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>]<CR><LF><data> **PDU mode (+CMGF=0):** +CMT: ,<length><CR><LF><pdu>	+CMT: "+393475234652",,"14/11/21,11:58:23+01" Hello world
URC		**Text mode (+CMGF=1):** +UCMT: <message_id>,<oa>,<scts>,[<priority>],[<privacy>],[<callback_number>],<encoding>,[<status>],[<num_sms>,<part>,<reference>],<length><CR><LF><text> **PDU mode (+CMGF=0):** +UCMT: <pdu_length><CR><LF><pdu>	+UCMT: 1,+1231241241,"18:02:28+08",,,,2,,,,,6 Hello!
URC		+CBMI: <mem>,<index>	+CBMI: "BM",48
URC		**Text mode (+CMGF=1):** +CBM: <sn>,<mid>,<dcs>,<page>,<pages><CR><LF><data> **PDU mode (+CMGF=0):** +CBM: <length><CR><LF><pdu>	+CBM: 271,1025,1,1,1 The quick brown fox jumps over the lazy dog 0123456789
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

Type	Syntax	Response	Example
		PDU mode (+CMGF=0):	
		+CDS: <length><CR><LF><pdu>	

9.7.3 Defined values

Parameter	Type	Description
<mode>	Number	Controls the processing of URCs specified within this command: • 0 (default value): buffer URCs in the MT; if the MT buffer is full, the oldest indication may be discarded and replaced with the new received indications (ring buffer) • 1 (factory-programmed value): discard indication and reject new received message URCs when MT-DTE link is reserved; otherwise forward them directly to the DTE • 2: buffer URCs in the MT when the serial link is busy (e.g. data-transfer); otherwise forward them directly to the DTE • 3: forward URCs directly to the TE. TA-TE link specific inband technique used to embed result codes and data when MT is in on-line data mode
<mt>	Number	Specifies the rules for managing the received SMS according the message's Data Coding Scheme (DCS): • 0 (default and factory-programmed value): No SMS-DELIVER indications are routed to the TE • 1: if SMS-DELIVER is stored in the MT, indication of the memory location is routed to the DTE using the +CMTI URC • 2: SMS-DELIVER (except class 2 SMS) are routed directly to the DTE (but not saved in the module file system or SIM memory) using the +CMT URC. If MT has its own display device then class 0 SMS and SMS in the message waiting indication group (discard message) may be copied to both MT display and to DTE. In this case MT shall send the acknowledgement to the network. Class 2 SMSs and messages in the message waiting indication group (storage message) result in indication as defined in <mt>=1 • 3: Class 3 SMS-DELIVERs are routed directly to DTE using URCs defined in <mt>=2. Messages of other data coding schemes result in indication as defined in <mt>=1
<bm>	Number	Specifies the rules for managing the received Cell Broadcast messages (CBM): • 0 (default and factory-programmed value): no CBM indications to the DTE • 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: 0 39121430100038166F6000004E374F80D: this is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length>=13.
<pdu>	String	Protocol data unit: each 8-bit octet is presented as two IRA character long hexadecimal numbers, e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)
<oa>	String	Originator address
<scts>	String	Service center time stamp in time-string format, see the <dt>
<data>	String	In the case of SMS: 3GPP TS 23.040 [8] TP-User-Data in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used and <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is not set:

Parameter	Type	Description
		o if TE character set other than "HEX" (see the +CSCS command in 3GPP TS 27.007 [2]): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A
		o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67))
		• if <dcs> indicates that 8-bit or UCS2 data coding scheme is used, or <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is set: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65))
		In the case of CBS: 3GPP TS 23.041 [9] CBM Content of Message in text mode responses; format:
		• if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used:
		o if TE character set other than "HEX" (see the +CSCS in 3GPP TS 27.007 [2]): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A
		o if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number
		• if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<sn>	Number	CBM serial number
<mid>	Number	CBM message identifier
<dcs>	Number	Data Coding Scheme
<page>	Number	CBM Page Parameter bits 4-7 in integer format as described in 3GPP TS 23.041 [9]
<pages>	Number	CBM Page Parameter bits 0-3 in integer format as described in 3GPP TS 23.041 [9]
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [8])
<mr>	Number	Message reference
<ra>	String	Recipient address field
<tora>	Number	Type of address of <ra> - octet
<dt>	String	Discharge time in format "yy/MM/dd,hh:mm:ss+zz"; the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<st>	Number	Status of a SMS STATUS-REPORT
<message_id>	Number	Message-ID of the 3GPP2 SMS
<priority>	Number	3GPP2 priority: • 0: normal • 1: interactive • 2: urgent • 3: emergency
<privacy>	Number	3GPP2 privacy: • 0: not restricted • 1: restrictive • 2: confidential • 3: secret
<callback_number>	String	Callback number
<encoding>	Number	Text encoding: • 2: ASCII7 • 3: IA5 • 4: UCS2 • 8: ISO 8859-1 • 9: GSM7
<num_sms>	Number	Total number of SMS
<part>	Number	Fragment part number
<reference>	Number	3GPP2 reference ID

9.7.4 Notes

- The incoming SMS/CBM URC indications will be displayed only on the AT interface where the last +CNMI command was set. As a general rule, the command should be issued by the DTE:
  - o   After start-up
  - o   After using the Z and &F command (which reset the command configuration)

o Whenever the incoming SMS URCs indications are requested on a different AT interface
- <mode> = 3 is not supported.

9.8 Read message +CMGR

+CMGR						
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*

9.8.1 Description

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

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

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

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

9.8.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGR=<index>	**SMS-DELIVER** +CMGR: <stat>,<oa>,[<alpha>],<scts>[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>] <data> OK	AT+CMGR=303 +CMGR: "REC READ", "+393488535999",,"07/04/05,18:02:28+08",145,4,0,0,"+393492000466", 145,93
		SMS-SUBMIT +CMGR: <stat>,<da>,[<alpha>][,<toda>,<fo>,<pid>,<dcs>,[<vp>],<sca>,<tosca>,<length>] <data> OK	You have a missed called. Free information provided by your operator. OK
		SMS-STATUS-report +CMGR: <stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> OK	
		SMS-COMMAND +CMGR: <stat>,<fo>,<ct>[,<pid>,[<mn>],[<da>],[<toda>],<length> [<cdata>]] OK	
		CBM storage +CMGR: <stat>,<sn>,<mid>,<dcs>,<page>,<pages> <data> OK	
	PDU mode (+CMGF=0): AT+CMGR=<index>	+CMGR: <stat>,[<alpha>],<length> <pdu> OK	AT+CMGR=1 +CMGR: 1,,40 0791934329002000040 C919323098266140000080 70328045218018D4F29CFE0

Type	Syntax	Response	Example
			6B5CBF379F87C4EBF41E4340 82E7FDBC3
			OK
Test	AT+CMGR=?	OK	

9.8.3 Defined values

Parameter	Type	Description
<index>	Number	Storage position
<stat>	Number	• 0: in PDU mode or "REC UNREAD" in text mode: received unread SMS • 1: in PDU mode or "REC READ" in text mode: received read SMS • 2: in PDU mode or "STO UNSENT" in text mode: stored unsent SMS • 3: in PDU mode or "STO SENT" in text mode: stored sent SMS
<oa>	String	Originator address
<alpha>	String	Alphanumeric representation of <da> or <oa> corresponding to the entry found in the phonebook 3GPP TS 24.008 [12]. The parameter is not managed.
<scts>	String	Service center time stamp in time-string format, see <dt>
<tooa>	Number	Type of address of <oa> - octet
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [8])
<pid>	Number	TP-Protocol-Identifier (default 0); see the 3GPP TS 23.040 [8]
<dcs>	Number	Data Coding Scheme
<sca>	String	Service center address field
<tosca>	Number	Type of address of <sca> - octet in Number format (for more details see the 3GPP TS 24.008 [12]); default 145 when string includes '+', otherwise default 129
<length>	Number	Two meanings: • in text mode: number of characters • in PDU mode: PDU's length in octets without the Service Center's address. In example 0 39121430100038166F6000004E374F80D: this is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length> = 13.
<data>	String	In the case of SMS: 3GPP TS 23.040 [8] TP-User-Data in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used and <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is not set: o if TE character set other than "HEX" (see +CSCS command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used, or <fo> indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is set: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [9] CBM Content of Message in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see +CSCS command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<vp>	Number	Format depending of the <fo> setting: • Relative format: validity period starting from when the SMS is received by the SMSC, in range 0-255 (default value 167); for more details see the 3GPP TS 23.040 [8]

<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)

Parameter	Type	Description	
		168 to 196	(TP-VP - 166) x 1 day
		197 to 255	(TP-VP - 192) x 1 week
		• Absolute format: absolute time of the validity period termination in string format ("yy/MM/dd, hh:mm:ss+zz") (see the 3GPP TS 23.040 [8]); the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56	
<mr>	Number	Message reference	
<ra>	String	Recipient address field	
<tora>	Number	Type of address of <ra> - octet	
<dt>	String	Discharge time in format "yy/MM/dd,hh:mm:ss+zz"; the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56	
<st>	Number	Status of an SMS STATUS-REPORT	
<ct>	Number	TP-Command-Type (default 0)	
<mn>	Number	See the 3GPP TS 23.040 [8] TP-Message-Number in integer format	
<cdata>	String	TP-Command-Data in text mode responses	
<sn>	Number	CBM serial number	
<mid>	Number	CBM message identifier	
<page>	Number	3GPP TS 23.041 [9] CBM Page Parameter bits 4-7 in integer format	
<pages>	Number	3GPP TS 23.041 [9] CBM Page Parameter bits 0-3 in integer format	
<pdu>	String	Protocol data unit: each 8-bit octet is presented as two IRA character long hexadecimal numbers, e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)	

9.9 New message acknowledgement to MT +CNMA

+CNMA

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

9.9.1 Description

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

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

9.9.2 Syntax

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

Type	Syntax	Response	Example
		+CNMA: (list of supported <n>s)	OK
		OK	

9.9.3 Defined values

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

9.10 List message +CMGL

+CMGL						
Modules	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

9.10.1 Description

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

9.10.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGL[=<stat>]	**Command successful and SMS-DELIVERs:** +CMGL: <index>,<stat>,<oa>,[<alpha>],[<scts>][,<tooa>,<length>] <data> [+CMGL: <index>,<stat>,<oa>,[<alpha>],[<scts>][,<tooa>,<length>]<data>[...]] OK	AT+CMGL +CMGL: 303,"REC READ","+39340 1234999",,"08/08/06,10:01:38+08" You have a missed called. Free information provided by your operator. OK
		Command successful and SMS-SUBMITs: +CMGL: <index>,<stat>,<da>,[<alpha>],[<toda>, <length>] <data> [+CMGL: <index>,<stat>,<da>,[<alpha>],[<toda>, <length>]<data>[...]] OK	
		Command successful and SMS-STATUS-REPORTs: +CMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> [+CMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> [...]] OK	
		Command successful and SMS-COMMANDs: +CMGL: <index>,<stat>,<fo>,<ct> [+CMGL: <index>,<stat>,<fo>,<ct>[...]] OK	

Type	Syntax	Response	Example
		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 1185440ED0D637396C7EBBCB000090 9092708024802A050003000303DEA0 584CE60205D974791994769BDF3A90 DB759687E9F534FD0DA2C9603419 OK
Test	AT+CMGL=?	+CMGL: (list of supported <stat>s) OK	+CMGL: ("REC UNREAD","REC READ", "STO UNSENT","STO SENT","ALL") OK

9.10.3 Defined values

Parameter	Type	Description
<stat>	Number or String	Number type in PDU mode (default value: 4), or string type in text mode (default value: "ALL"); indicates the status of message in memory: • 0: in PDU mode or "REC UNREAD" in text mode: received unread SMS messages • 1: in PDU mode or "REC READ" in text mode: received read SMS messages • 2: in PDU mode or "STO UNSENT" in text mode: stored unsent SMS messages • 3: in PDU mode or "STO SENT" in text mode: stored sent SMS messages • 4: in PDU mode or "ALL" in text mode: all SMS messages
<index>	Number	Storage position
<oa>	String	Originator address
<alpha>	String	Alphanumeric representation of <da> or <oa> corresponding to the entry found in the phonebook 3GPP TS 24.008 [12]. The parameter is not managed.
<scts>	String	Service center time stamp in time-string format; see the <dt> parameter
<tooa>	Number	Type of address of <oa> - octet
<length>	Number	Two meanings: • in text mode: number of characters • in PDU mode: PDU's length in octets without the Service Center's address. In example 0 39121430100038166F6000004E374F80D: this is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length> = 13.
<data>	String	This is the TP-User-Data in text mode; the decoding depends on the DCS (Data Coding Scheme) and the FO (First Octect) of the SMS header 3GPP TS 23.040 [8]; format: • if DCS indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used and FO indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is not set: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if DCS indicates that 8-bit or UCS2 data coding scheme is used, or FO indicates that 3GPP TS 23.040 [8] TP-User-Data-Header-Indication is set: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [9] CBM Content of Message in text mode responses; format: • if DCS indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number

Parameter	Type	Description
		if DCS indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [8])
<mr>	Number	Message reference
<ra>	String	Recipient address field
<tora>	Number	Type of address of <ra> - octet
<dt>	String	Discharge time in format "yy/MM/dd,hh:mm:ss+zz"; the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<st>	Number	Status of an SMS STATUS-REPORT
<ct>	Number	TP-Command-Type (default 0)
<sn>	Number	CBM serial number
<mid>	Number	CBM message identifier
<page>	Number	3GPP TS 23.041 [9] CBM Page Parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [9] CBM Page Parameter bits 0-3 in integer format
<pdu>	String	Protocol data unit: each 8-bit octet is presented as two IRA character long hexadecimal numbers, e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)
<dcs>	Number	Data Coding Scheme

9.11 Send message +CMGS

+CMGS						
Modules	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

9.11.1 Description

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

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

9.11.2 Syntax

Type	Syntax	Response	Example
Set	Text mode (+CMGF=1):	+CMGS: <mr>	AT+CMGS="0171112233"<CR>
	AT+CMGS=<da>[,<toda>]<CR>	OK	> This is the text<Ctrl-Z>
	text is entered<Ctrl-Z/ESC>		+CMGS:2
			OK
	PDU mode (+CMGF=0):	+CMGS: <mr>	AT+CMGS=13<CR>
	AT+CMGS=<length><CR>	OK	> 039121430100038166F600000 4E374F80D<Ctrl-Z>
	PDU is given<Ctrl-Z/ESC>		+CMGS:2
			OK
Test	AT+CMGS=?	OK	

9.11.3 Defined values

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

Parameter	Type	Description
<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 0 39121430100038166F6000004E374F80D: 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)

9.12 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*

9.12.1 Description

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

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

9.12.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGW[=<oa/da>[,<tooa/toda>[,<stat>]]]<CR> text is entered<Ctrl-Z/ESC>	+CMGW: <index> OK	AT+CMGW="091137880"<CR> > This is the text<Ctrl-Z> +CMGW: 303 OK
	PDU mode (+CMGF=0): AT+CMGW=<length>[,<stat>]<CR> PDU is given<Ctrl-Z/ESC>	+CMGW: <index> OK	AT+CMGW=13<CR> > 039121430100038166F600000 4E374F80D<Ctrl-Z> +CMGW: 303 OK
Test	AT+CMGW=?	OK	

9.12.3 Defined values

Parameter	Type	Description
<da>	String	TP-Destination-Address Address-Value field (see the 3GPP TS 23.040 *[8]*); BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters of the currently selected TE character set (see the *+CSCS* AT command); type of address given by <toda>
<oa>	String	TP-Originating-Address Address-Value field (see the 3GPP TS 23.040 *[8]*); BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters of the currently selected TE character set (see the *+CSCS* AT command); type of address given by <tooa>
<tooa>	Number	TP-Originating-Address Type-of-Address octet (see the 3GPP TS 24.011 *[13]*); see the <toda> parameter for the default value
<toda>	Number	TP-Destination-Address Type-of-Address octet (see the 3GPP TS 24.011 *[13]*); when the first character of <da> is + (IRA 43) the default value is 145, otherwise it is 129
<stat>	Number or String	Number type in PDU mode (default value: 2), or string type in text mode (default value: "STO UNSENT"); it indicates the message status in memory: • 0: in PDU mode or "REC UNREAD" in text mode: received unread SMS messages • 1: in PDU mode or "REC READ" in text mode: received read SMS messages

Parameter	Type	Description
		• 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: 0 39121430100038166F6000004E374F80D is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length>=13.
<PDU>	String	Protocol Data Unit: each 8-bit octet of the PDU must be written as two IRA character long hexadecimal numbers, e.g. an octet with integer value 42 must be written as two characters 2A (IRA 50 and 65)

9.13 Send message from storage +CMSS

+CMSS						
Modules	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*

9.13.1 Description

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

9.13.2 Syntax

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

9.13.3 Defined values

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

9.14 Set text mode parameters +CSMP

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

9.14.1 Description

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

9.14.2 Syntax

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

9.14.3 Defined values

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

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

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

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

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

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

9.15 Delete message +CMGD

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

9.15.1 Description

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

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

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

9.15.2 Syntax

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

9.15.3 Defined values

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

9.16 Service center address +CSCA

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

9.16.1 Description

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

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

9.16.2 Syntax

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

9.16.3 Defined values

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

9.17 More messages to send +CMMS

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

9.17.1 Description

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

9.17.2 Syntax

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

9.17.3 Defined values

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

10 V24 control and V25ter

10.1 Introduction

These commands, unless specifically stated, do not implement set syntax using "=", read ("?"), or test ("=?"). If such commands are used, the "+CME ERROR: unknown" error result code is provided (if +CMEE is set to 2).

10.2 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*

10.2.1 Description

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

10.2.2 Syntax

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

10.2.3 Defined values

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

10.2.4 Notes

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

10.3 Circuit 108/2 behavior &D

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

10.3.1 Description

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

10.3.2 Syntax

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

10.3.3 Defined values

Parameter	Type	Description
<value>	Number	• 0: the DCE ignores circuit 108/2

Parameter	Type	Description
		• 1 (default value and factory-programmed value): upon an ON-to-OFF transition of circuit 10 8/2, the DCE enters online command state and issues an OK result code
		• 2: upon an ON-to-OFF transition of circuit 108/2, the DCE performs an orderly cleardown of the call. The automatic answer is disabled while circuit 108/2 remains OFF

10.3.4 ~+++ behavior in PSD &D

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

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

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

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

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

Table 4: CSD data mode

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

Table 5: PSD data mode

10.3.6 Notes

- The ON/OFF DTR transition in direct link forces the DCE into command mode. In case of AT&D0 the DTR transition is ignored, also in direct link.
- The escape sequence for the PSD data mode with a L2 protocol different from the PPP is not ~+++, and it could be not supported. See the *Table 6* for more information.

10.4 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*

10.4.1 Description

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

10.4.2 Syntax

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

10.4.3 Defined values

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

10.4.4 Notes

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

10.5 Flow control &K

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

10.5.1 Description

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

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

10.5.2 Syntax

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

10.5.3 Defined values

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

10.5.4 Notes

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

active, the DC1/DC3 characters could be used to wake up the module's UART, and therefore lost. In case a DC3 character (XOFF) is correctly received by module's UART and some data is waiting to be transmitted, the module is forced to stay awake until a subsequent DC1 character (XON) is received.

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

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

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

PPP Octet-stuffed framing and transparency

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

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

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

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

ACCM negotiation for XON/XOFF chars during PPP LCP negotiation

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

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

| 02 | 06 | Async Control Character Map |

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

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

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

Application to XON/XOFF flow control implementation in the module

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

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

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

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

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

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

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

10.6 DTE-DCE character framing +ICF

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

10.6.1 Description

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

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

10.6.2 Syntax

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

10.6.3 Defined values

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

Parameter	Type	Description
<parity>	Number	• 0: odd • 1: even

10.6.4 Notes

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

10.7 DTE-DCE local flow control +IFC

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

10.7.1 Description

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

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

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

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

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

10.7.2 Syntax

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

10.7.3 Defined values

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

10.7.4 Notes

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

10.8 Set flow control \Q

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

10.8.1 Description

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

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

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

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

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

☞ On the UART interface, in case of *+UPSV=2*, only \Q0 (no flow control) is allowed.

10.8.2 Syntax

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

10.8.3 Defined values

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

10.9 UART data rate configuration +IPR

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

10.9.1 Description

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

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

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

10.9.2 Syntax

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

10.9.3 Defined values

Parameter	Type	Description
<rate>	Number	Baud rate • 0 (factory-programmed value): autobauding • 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 (default value), 230400, 460800, 921600, 3000000, 3250000, 6000000, 6500000

10.9.4 Notes

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

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- Automatic baud rate detection is not implemented (<rate>=0 is not supported).
- The factory-programmed value for <rate> is 115200.
- Valid baud rates <rate>= 300,600,1200,2400,4800,9600,19200,38400,57600,115200,230400,921600, 2000000,2900000,3000000,3200000,3686400,4000000.

10.10 Escape character S2

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

10.10.1 Description

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

10.10.2 Syntax

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

10.10.3 Defined values

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

10.10.4 Notes

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

Data call command	L2 protocol	Description	ATS2 behavior
AT+CGDATA="M-HEX",1	HEX	u-blox specific	Escape sequence detection is only done for +++ (plus carriage return). ATS2 is not effective. No timing constraints.
AT+CGDATA="M-RAW_IP",1	RAW-IP	PSD call: Transfer IP packet directly	Break detection is not supported
AT+CGDATA="PPP",1	PPP	PSD call: Same of ATD*99***1# (e.g. dial up)	Escape sequence detection is only done for ~+++. ATS2 is not effective. There is not a timing constraint (see S12 command, *Chapter 10.18*) for ~+++ (+++ is incapsulated in a PPP frame)
ATD1234		CSD call	The command is effective if issued in both command and online command mode
AT+USODL=0		PSD call: Direct Link mode	The command is effective
AT+USOWR=0,32		PSD call:AT socket (not transparent)	Break detection is not supported

Table 6: ATS2 handling for different data call scenarios

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- The command has no effect.

10.11 Command line termination character S3

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

10.11.1 Description

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

10.11.2 Syntax

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

10.11.3 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 13 (ASCII carriage return (CR, IRA5 0/13)).

10.12 Response formatting character S4

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

10.12.1 Description

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

10.12.2 Syntax

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

10.12.3 Defined values

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

10.13 Command line editing character S5

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

10.13.1 Description

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

10.13.2 Syntax

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

10.13.3 Defined values

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

10.14 Pause before blind dialling S6

S6						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	*+CME Error*

10.14.1 Description

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

10.14.2 Syntax

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

10.14.3 Defined values

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

10.15 Connection completion timeout S7

S7						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	*Profile*	No	-	*+CME Error*

10.15.1 Description

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

10.15.2 Syntax

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

10.15.3 Defined values

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

10.16 Command dial modifier time S8

S8						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	*+CME Error*

10.16.1 Description

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

☞ The command has no effect.

10.16.2 Syntax

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

10.16.3 Defined values

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

10.17 Automatic disconnect delay S10

S10						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	partial	No	No	No	-	*+CME Error*

10.17.1 Description

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

10.17.2 Syntax

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

10.17.3 Defined values

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

10.17.4 Notes

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- The command has no effect.

10.18 Escape prompt delay (EPD) S12

S12						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	partial	No	No	No	-	*+CME Error*

10.18.1 Description

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

Furthermore, the timeout is:

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

10.18.2 Syntax

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

10.18.3 Defined values

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

10.19 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*

10.19.1 Description

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

10.19.2 Syntax

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

10.19.3 Defined values

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

10.20 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*

10.20.1 Description

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

10.20.2 Syntax

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

10.20.3 Defined values

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

10.21 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*

10.21.1 Description

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

10.21.2 Syntax

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

10.21.3 Defined values

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

10.22 Result code selection and call progress monitoring control X

X	
Modules	All products

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

10.22.1 Description

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

10.22.2 Syntax

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

10.22.3 Defined values

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

10.23 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*

10.23.1 Description

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

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

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

10.23.2 Syntax

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

10.23.3 Defined values

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

10.24 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*

10.24.1 Description

Resets the current profile to factory-defined defaults. 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 and S4 AT commands) loaded from the factory default profile. The other DCE settings are applied after the response has been sent.

For more details on the settings stored in the profiles, refer to *Appendix B.1*.

10.24.2 Syntax

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

10.24.3 Defined values

Parameter	Type	Description
<value>	Number	Only 0 allowed

10.25 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*

10.25.1 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 (more details on the command in the *Chapter 5.1*).

10.25.2 Syntax

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

10.25.3 Defined values

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

10.26 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*

10.26.1 Description

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

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

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

10.26.2 Syntax

Type	Syntax	Response	Example
Action	AT&V	ACTIVE PROFILE: List of commands stored in the active profile with the related values STORED PROFILE 0: List of commands stored in the profile 0 with the related values STORED PROFILE 1: List of commands stored in the profile 1 with the related values OK	ACTIVE PROFILE: &C1, &D1, &S1, &K3, E1, Q0, V1, X4, S00:000, S02:043, S03:0 13, S04:010, S05:008, S07:060, +CBST:0 07, 000, 001, +CRLP:061, 061, 048, 00 6, +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, S03:0 13, S04:010, S05:008, S07:060, +CBST:0 07, 000, 001, +CRLP:061, 061, 048, 00 6, +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

Type	Syntax	Response	Example
			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

10.26.3 Notes

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• Only the ACTIVE PROFILE is available. The device does not support STORED PROFILE 0 or STORED PROFILE 1

10.27 Designate a default reset profile &Y

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

10.27.1 Description

Selects which profile will be loaded at the next power on. The AT commands configuration from the loaded profile will be separately applied to each attached interface. At run time each interface will own the configuration as described in *Appendix B.1*. An error is returned if <value> is greater then 2, or NVM is not installed or is not operational.

For more details on the commands stored in the profiles, refer to *Appendix B.1*.

10.27.2 Syntax

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

10.27.3 Defined values

Parameter	Type	Description
<value>	Number	• 0 (default value and factory-programmed value): selects profile 0 • 1: selects profile 1 • 2: selects the factory-programmed settings

11 Packet switched data services

11.1 Introduction and common parameters definition

11.1.1 <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.

An optional special code placed at the beginning of <APN> indicates the type of authentication handling between the module and the network and may be:
- CHAP: challenge handshake authentication protocol
- PAP: personal authentication protocol
- NOAUTH: authentication protocol not used
- code omitted: authentication protocol not used

An example for the usage of <APN> is:

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

☞ +CGDCONT?'s response does not include the PAP: and CHAP: prefixes in the APN string.

The maximum length of the parameter is 99 characters (the maximum length of coded APN is 100 octets, see 3GPP TS 23.003 [*116*], subclause 9.1).

11.1.2 <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:

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

11.1.3 <L2P>

String parameter indicating the layer 2 protocol to be used between the DTE and MT; these values are supported:
- "PPP" (default value)
- "M-HEX"
- "M-RAW_IP"
- "M-OPT-PPP"

☞ The application on the remote side must support the selected protocol as well.

11.1.4 <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"

11.1.5 <PDP_type>

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

- "IP" (default value): Internet Protocol (IETF STD 5)
- "IPV4V6": virtual <PDP_type> introduced to handle dual IP stack UE capability (see the 3GPP TS 24.301 [*87*])
- "IPV6": Internet Protocol, version 6 (see RFC 2460)

11.2 PPP LCP handshake behaviour

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

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

11.3 PDP context definition +CGDCONT

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

11.3.1 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.

11.3.2 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: 1,"IP","web.omnitel.it", "91.80.140.199",0,0 OK

Type	Syntax	Response	Example
		OK	
Test	AT+CGDCONT=?	+CGDCONT: (list of supported <cid>s), <PDP_type>,,,(list of supported <d_comp>s),(list of supported <h_comp>s)[, (list of supported <IPv4AllocAddr>s),(list of supported <emergency_indication>s), (list of supported <P-CSCF_discovery>s), (list of supported <IM_CN_Signalling_Flag_Ind>s)[,(list of supported <NSLPI>s)]]	+CGDCONT: (1-3),"IP",,,(0-2),(0-4) OK
		OK	

11.3.3 Defined values

Parameter	Type	Description
<cid>	Number	See *<cid>*
<PDP_type>	String	See *<PDP_type>*
<APN>	String	See *<APN>*
<PDP_addr>	Number	See *<PDP_addr>*
<d_comp>	Number	PDP data compression; it can have the values: • 0 (default value): off • 1: on (predefined compression type i.e. V.42bis data compression) • 2: V.42bis data compression
<h_comp>	Number	PDP header compression; it can have the values: • 0 (default value): off • 1: on (predefined compression type, i.e. RFC1144) • 2: RFC1144 • 3: RFC2507 • 4: RFC3095 ☞ <h_comp>: the available head-compressions is depending on configuration of the stack (configured via features in the stack)
<IPv4AddrAlloc>	Number	Controls how the MT/TA requests to get the IPv4 address information: • 0 (default value): IPv4 Address Allocation through NAS Signalling • 1: IPv4 Address Allocated through DHCP
<emergency_indication>	Number	Indicates whether the PDP context is for emergency bearer services or not: • 0 (default value): PDP context is not for emergency bearer services • 1: PDP context is for emergency bearer services
<P-CSCF_discovery>	Number	Influences how the MT/TA requests to get the P-CSCF address, see 3GPP TS 24.229 [*102*] annex B and annex L: • 0 (default value): preference of P-CSCF address discovery not influenced by *+CGDCONT* • 1: preference of P-CSCF address discovery through NAS Signalling • 2: preference of P-CSCF address discovery through DHCP
<IM_CN_Signalling_Flag_Ind>	Number	Shows whether the PDP context is for IM CN subsystem-related signalling only or not: • 0: PDP context is not for IM CN subsystem-related signalling only • 1: PDP context is for IM CN subsystem-related signalling only
<NSLPI>	Number	Indicates the NAS signalling priority requested for the corresponding PDP context: • 0 (default value): indicates that the PDP context has to be activated with the value for the low priority indicator configured in the MT. • 1: indicates that the PDP context has to be activated with the value for the low priority indicator set to "MS is not configured for NAS signalling low priority". The MT utilises the provide NSLPI information as specified in 3GPP TS 24.301 [*87*] and 3GPP TS 24.008 [*12*].

11.3.4 Notes

Additional examples:

Command	Response	Description
AT+CMEE=2	OK	Use verbose <err> values
AT+CGDCONT=?	+CGDCONT: (1-3),"IP",,,(0),(0-1)	Test command

Command	Response	Description
	OK	
AT+CGDCONT=4,"IP","internet"	+CME ERROR: operation not allowed	Define out of range PDP contexts
AT+CGDCONT=2,"IP","internet"	OK	Define allowed PDP contexts
AT+CGDCONT=1,"IP","STATREAL"	OK	Define allowed PDP contexts
AT+CGDCONT=3,"IP","PAP: tim.ibox.it"	OK	Define allowed PDP contexts
AT+CGDCONT=253,"IP","internet"	+CME ERROR: operation not allowed	Define out of range PDP contexts
AT+CGDCONT?	+CGDCONT: 2,"IP","internet","0.0.0.0",0,0	Read command
	+CGDCONT: 1,"IP","STATREAL","0.0.0.0",0,0	
	+CGDCONT: 3,"IP","tim.ibox.it","0.0.0.0",0,0	
	OK	

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- When registering in LTE, the initial default EPS bearer is mapped to <cid>= 1.
- If not specified by the set command, the following values are assumed:
    - o <cid>: 1
    - o <PDP_addr>: "0.0.0.0"
- <d_comp>=1, 2 are not supported.
- The command setting are stored in the NVM at the module switch off.
- The module automatically accepts Mobile Terminated PDP contexts/EPS bearers.
- The <NSLPI> parameter is not supported.
- <P-CSCF_discovery>=2 is not supported.

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- <h_comp>= 1, 2, 3 and 4 are not supported.
- <d_comp>=1, 2 are not supported.
- The <NSLPI> parameter is not supported.

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- The settings of the initial default EPS bearer mapped to <cid>= 1 must have a blank APN.

11.4 GPRS 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	*Up to 3 min*	*+CME Error*

11.4.1 Description

Register (attach) the MT to, or deregister (detach) the MT from the GPRS service. After this command the MT remains in AT command mode. If the MT is already in the requested state (attached or detached), the command is ignored and OK result code is returned. If the requested state cannot be reached, an error result code is returned. The command can be aborted if a character is sent to the DCE during the command execution. Any active PDP context will be automatically deactivated when the GPRS registration state changes to detached.

☞ If MT is configured in class "B" (see command *+CGCLASS*) and the GSM registration has not yet been performed, AT+CGATT=1 triggers both GSM and GPRS registration.

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

☞ Unless the MS is detached from GPRS service due to a previously performed GPRS detach, the set command with <state>=1 triggers a user reselection. In this case a search for the HPLMN or a higher order PLMN is triggered (for more details see *+COPS* and 3GPP TS 23.122 [70]).

11.4.2 Syntax

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

11.4.3 Defined values

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

11.5 PDP context activate or deactivate +CGACT

+CGACT						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	*Up to 40-150 s (see below)*	*+CME Error*

11.5.1 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 in case the activation or the deactivation of a PDP context is performed (150 s and 40 s respectively).

The command can be aborted if a character is sent to the DCE during the command execution: in case a PDP context activation on a specific <cid> was requested, the PDP context deactivation is performed; if a multiple PDP context activation was requested, it is aborted after the pending PDP context activation has finished.

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

11.5.2 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)	+CGACT: (0-1)
		OK	OK

11.5.3 Defined values

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

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

11.5.4 Notes

- If <cid> is not defined, the command activates or deactivates all the defined PDP contexts.

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

Command sent by DTE	DCE response	Description
AT+CMEE=2	OK	Set the verbose error result codes
AT+COPS=0	OK	
AT+COPS?	+COPS: 0,0,"vodafone IT" OK	
AT+CGDCONT=1,"IP","web.omnitel.it"	OK	Define several PDP contexts
AT+CGDCONT=3,"IP","internet"	OK	
AT+CGDCONT=2,"IP","mms.vodafone.it"	OK	
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0 +CGDCONT: 3,"IP","internet","0.0.0.0",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","0.0.0.0",0,0 OK	Read PDP contexts
AT+CGACT=1,1	OK	Activate PDP context 1
AT+CGPADDR=1	+CGPADDR: 1, "91.80.104.82" OK	Show address of PDP context 1
AT+CGPADDR=2	+CGPADDR: 2, "0.0.0.0" OK	Show address of PDP context 2
AT+CGPADDR=3	+CGPADDR: 3, "0.0.0.0" OK	Show address of PDP context 3
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","91.80.104.82",0,0 +CGDCONT: 3,"IP","internet","0.0.0.0",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","0.0.0.0",0,0 OK	
AT+CGACT=0,1	OK	Deactivate PDP context 1
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0 +CGDCONT: 3,"IP","internet","0.0.0.0",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","0.0.0.0",0,0 OK	
AT+CGACT=1	OK	Activate all of defined PDP contexts
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","91.80.101.207",0,0 +CGDCONT: 3,"IP","internet","83.225.114.136",0,0 +CGDCONT: 2,"IP","mms.vodafone.it","10.159.135.60",0,0 OK	
AT+CGPADDR=1	+CGPADDR: 1, "91.80.101.207" OK	Show address of PDP context 1
AT+CGPADDR=2	+CGPADDR: 2, "10.159.135.60" OK	Show address of PDP context 2
AT+CGACT=0	OK	Deactivate all of defined PDP contexts
AT+CGPADDR=2	+CGPADDR: 2, "0.0.0.0" OK	Show address of PDP context 2
AT+CGPADDR=3	+CGPADDR: 3, "0.0.0.0"	Show address of PDP context 3

Command sent by DTE	DCE response	Description
	OK	
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0	
	+CGDCONT: 3,"IP","internet","0.0.0.0",0,0	
	+CGDCONT: 2,"IP","mms.vodafone.it","0.0.0.0",0,0	
	OK	
AT+CGACT=1,2	OK	Activate PDP context 2
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0	
	+CGDCONT: 3,"IP","internet","0.0.0.0",0,0	
	+CGDCONT: 2,"IP","mms.vodafone.it","10.153.123.229",0,0	
	OK	
AT+CGACT=1,3	OK	Activate PDP context 3
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0	
	+CGDCONT: 3,"IP","internet","83.225.171.77",0,0	
	+CGDCONT: 2,"IP","mms.vodafone.it","10.153.123.229",0,0	
	OK	
AT+CGACT=1,1	OK	Activate PDP context 1
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","91.80.175.163",0,0	
	+CGDCONT: 3,"IP","internet","83.225.171.77",0,0	
	+CGDCONT: 2,"IP","mms.vodafone.it","10.153.123.229",0,0	
	OK	
AT+CGACT=0	OK	Deactivate all of defined PDP contexts
AT+CGDCONT?	+CGDCONT: 1,"IP","web.omnitel.it","0.0.0.0",0,0	
	+CGDCONT: 3,"IP","internet","0.0.0.0",0,0	
	+CGDCONT: 2,"IP","mms.vodafone.it","0.0.0.0",0,0	
	OK	

11.6 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*

11.6.1 Description

The V.24ter dial command "D", similar to the command with the syntax *AT+CGDATA="PPP",<cid>*, causes the MT to perform the necessary actions to establish the communication between the DTE and the external PDP network through the PPP protocol. This can include performing a PS attach and, if the PPP server on the DTE side starts communication, PDP context activation on the specified PDP context identifier (if not already requested by means of *+CGATT* and *+CGACT* commands).

If the command is accepted and the preliminary PS procedures have succeeded, the "CONNECT" intermediate result code is returned, the MT enters the V.25ter online data state and the PPP L2 protocol between the MT and the DTE is started.

☞ The data session is terminated by one of the following events:
- sending **~+++**.
- via a DTR transition from ON to OFF.
- sending an LCP Terminate Request.

If used with <cid>= 100, this command can enable the *local dial-up*, that establishes a PPP communication between the DTE and the module through a serial interface (UART, MUX, or CDC-ACM). In this case an active PDP context is not needed since the DTE is assigned a private IP address.

11.6.2 Local dial-up

☞ SARA-R4

The section does not apply to this module series.

The local dial-up feature is enabled by performing a dial-up on <cid>= 100. It establishes a PPP communication between the DTE and the module through a serial interface (UART, MUX, or CDC-ACM). An IP link is created by assigning private IP addresses to the endpoints. An active PDP context is not needed. The IP traffic is automatically routed by the module, thus allowing the DTE to communicate with:

- the internet through an active PDP context (at least one PDP context/EPS bearer is needed for the IP connectivity). By default, the first PDP context activated is used to convey the data;
- a device connected to the Virtual Ethernet over USB (RNDIS/CDC-ECM);
- devices (STA) connected to the Wi-Fi access point (AP) of the cellular module (see *Wi-Fi section*).

The feature has been studied to work in router mode.

In general no defined / no active context is required to use local dial-up. The local dial-up is in any case able to communicate with the interfaces connected to the module IP stack, as for example RNDIS and Wi-Fi interfaces.

The local dial-up feature does not support the OnLine Command Mode (OLCM). Furthermore the DTR ON to OFF transition and the ~+++ cannot be used to terminate the local dial-up (the procedure described in *~+++ behavior in PSD &D* is not applicable).

The PIN insertion is not mandatory for the local dial-up feature.

11.6.3 Syntax

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

11.6.4 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	See *<L2P>*
<cid>	Number	See *<cid>*

11.6.5 Notes

- Dial up with PAP/CHAP authentication is not supported on an already active PDP context that was activated without authentication.
- The context identifier <cid> is mapped to 1 if not specified.
- The GPRS dial-up command maps to AT+CGDATA="PPP",<cid>.
- If FDN is enabled and FDN check for PS data call is supported by the module, to perform a GPRS dial-up one of the following entries must be stored in the FDN phonebook: *99#, *99*#, *99**# or *99***#.

SARA-R4
- The local dial-up feature is not supported.

11.7 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*

11.7.1 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.

11.7.2 Syntax

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

11.7.3 Defined values

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

11.8 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*	-

11.8.1 Description

This command H (On-hook) deactivates a pending PDP context with PPP L2 protocol in online command mode. The MT responds with OK. See *Chapter 6.3* for a detailed description.

☞ In GPRS online command mode, entered by typing the escape sequence "+++" or "~+++" (see *Chapter 10.3.4*), the ATH command is needed to terminate the connection. Alternatively, in data transfer mode, DTE originated DTR toggling or PPP disconnection may be used.

11.8.2 Syntax

Type	Syntax	Response	Example
Action	ATH	OK	

11.9 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*

11.9.1 Description

Controls the presentation of the network registration URC. 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

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

The read command returns the status of result code presentation and an integer <stat> which shows whether the network has currently indicated the registration of the MT. The location information elements <tac>, <ci> and <AcT>, if available, are returned only when <n>=2 and the MT is registered with the network. The parameters <cause_type>, <reject_cause>, if available, are returned when <n>=3.

☞ 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.

11.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+CEREG=[<n>]	OK	AT+CEREG=1 OK
Read	AT+CEREG?	+CEREG: <n>,<stat>[,[<tac>],[<ci>],[<AcT>[,<cause_type>,<reject_cause>]]] OK	+CEREG: 2,1,"3a9b","0000c33d",7 OK
Test	AT+CEREG=?	+CEREG: (list of supported <n>s) OK	+CEREG: (0-3) OK
URC		+CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,<cause_type>,<reject_cause>]]	+CEREG: 1,"3a9b","0000c33d",7

11.9.3 Defined values

Parameter	Type	Description
<n>	Number	Mode configuration: • 0 (default value): network registration URC disabled • 1: network registration URC +CEREG: <stat> enabled • 2: network registration and location information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>]] enabled • 3: network registration, location information and EMM cause value information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,<cause_type>,<reject_cause>]] enabled
<stat>	Number	EPS registration status: • 0: not registered, the MT is not currently searching an operator to register to • 1: registered, home network • 2: not registered, but the MT is currently trying to attach or searching an operator to register to • 3: registration denied • 4: unknown (e.g. out of E-UTRAN coverage) • 5: registered, roaming

Parameter	Type	Description
		• 8: attached for emergency bearer services only (see 3GPP TS 24.008 [12] and 3GPP TS 24.30 1 [87] that specify the condition when the MS is considered as attached for emergency bearer services)
<tac>	String	Two bytes tracking area code coded in hexadecimal format
<ci>	String	Four bytes E-UTRAN cell-id in hexadecimal format
<Act>	Number	Access technology of the service cell: • 7: E-UTRAN (see 3GPP TS 44.060 [88] that specifies the System Information messages which give the information about whether the serving cell supports EGPRS)
<cause_type>	Number	<reject_cause> type: • 0: indicates that <reject_cause> contains an EMM cause value, see 3GPP TS 24.301 [87] Annex A • 1: indicates that <reject_cause> contains a manufacture-specific cause
<reject_cause>	Number	Cause of the failed registration. The value is of type as defined by <cause_type>

11.10 Delete non-active PDP contexts +CGDEL

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

11.10.1 Description

Removes the indicated PDP context and removes all the associated data related to the indicated PDP contexts that are not activated. The AT command does not delete or remove the information for activated PDP contexts. The removed PDP context is listed by the +CGDEL: <cid> IRC.

If the <cid> parameter points to a primary PDP context, the PDP context will be deleted together with all the linked secondary PDP contexts if none of the PDP contexts are activated.

If the <cid> parameter points to a secondary PDP context, the PDP context will be deleted if it is not activated.

☞ If the parameter <cid> is omitted, all the primary PDP contexts that are not activated or that have any activated secondary PDP contexts will be removed and all secondary PDP contexts that are not activated will be removed. The associated data of all the deleted PDP contexts will be removed, and the removed PDP context are listed by the +CGDEL: <cid>[,<cid>,...]] IRC.

☞ The command removes the associated PDP context data that can be set by the AT commands +CGDCONT, +CGDSCONT, +CGTFT, +CGEQREQ, +CGEQMIN and +CGEQOS. For an attempt to delete PDP context(s) which would violate these rules, an error result code is returned.

11.10.2 Syntax

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

11.10.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>

11.11 Multiple PDP contexts

Two PDP context types are defined:

• "external" PDP context: IP packets are built by the DTE, the MT's IP instance runs the IP relay function only;

- "internal" PDP context: the PDP context (relying on the MT's embedded TCP/IP stack) is configured, established and handled via the data connection management AT commands.

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

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

☞ SARA-R4

Multiple PDP contexts and internal PDP contexts are not supported.

11.12 Primary and secondary PDP contexts

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

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

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

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

☞ On all other modules, at most 2 secondary PDP contexts may be associated to a primary PDP context and at most 2 secondary PDP contexts can be activated, since the maximum number of PDP contexts, both normal and secondary, is always 3.

☞ SARA-R4

The secondary PDP contexts are not supported.

12 System features

12.1 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*

12.1.1 Description

Triggers the FW installation procedure, starting from the file (update binary file) stored in the module file system. It could be used as a part of implementation of the FOTA procedure. The command causes a SW system reset with network deregistration.

During the update process, the device cannot be used to make calls, even emergency calls. The update process is fault tolerant, even if the battery is suddenly removed.

At the end of a successful installation, the main firmware software boots up, NVM and profiles data are set to the factory-programmed values of the new firmware version and the SIM is reset (the PIN will be required if enabled).

☞ SARA-R4
Refer to the specific firmware update release notes for information concerning NVM after installing the firmware

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

☞ In case of power loss during the install phase, at the next module wake-up a fault is detected and the module remains in Firmware Install Mode until the end of the procedure (install terminated).

The command syntax differs depending on the module: see the corresponding subsection for the correct command handling.

12.1.2 SARA-R4 syntax

Type	Syntax	Response	Example
Set	AT+UFWINSTALL	OK	AT+UFWINSTALL
			OK
Test	AT+UFWINSTALL=?	OK	OK

12.1.3 Notes

- After the command is issued, the module reboots and starts the install process which will take about 1 minute long. No result codes are issued on the terminal during this phase. At the end of the update process the module reboots again with the new firmware installed.
- The update file must be stored on the device via one of the following methods; *+UFTPC*, *+UFWUPD* or *+UDWNFILE*.

12.2 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	*NVM*	No	-	*FOAT Error*

12.2.1 Description

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

The command syntax differs depending on the module series: see the corresponding subsection for the correct command handling.

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

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

☞ For more details see u-blox Firmware Update Application Note [*85*].

12.2.2 Notes

- If <filetype>=2 make sure the file contains both the firmware and file system images.

12.2.3 SARA-R4 description

Making use of the file triggers the firmware download using the Xmodem or Xmodem-1k protocols.

☞ In case of power loss during the download, at the next module wake-up the module remains in Firmware Download Mode expecting that the download restarts from the beginning.

12.2.4 SARA-R4 syntax

Type	Syntax	Response	Example
Set	AT+UFWUPD=<filetype>	+UFWUPD: ONGOING	AT+UFWUPD=3
		CCC<NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK>	+UFWUPD: ONGOING
		OK	CCC<NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK>
			OK
Test	AT+UFWUPD=?	+UFWUPD: (list of supported <filetype>s)	+UFWUPD: (3)
		OK	OK

12.2.5 SARA-R4 defined values

Parameter	Type	Description
<filetype>	Number	Download type: • 3: firmware image update

12.2.6 Notes

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- Status updates on the file transfer via CCC or <NACK><NACK><NACK> are not sent to the terminal.

12.3 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*

12.3.1 Description

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

12.3.2 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

12.3.3 Defined values

Parameter	Type	Description
<antenna_id>	Number	Antenna identifier (optional parameter) • 0 (default value): cellular antenna • 1: GPS antenna (RFU)
<antenna_load>	Number	Measured value in kOhm of the antenna load with a resolution of 1 kOhm. The range goes from -1 to 53 (only integer values can be assumed), where: • -1: open circuit • 0: short circuit • 1: 1 kOhm (minimum limit of the measurement range) … • 53: 53 kOhm (maximum limit of the measurement range)

12.3.4 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.

12.4 End user test +UTEST

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

12.4.1 Description

Enables the module testing about RF parts and all the digital pins.

⚠ The usage of this command shall be restricted to controlled (shielded chamber/box) environments and for test purpose only.

⚠ u blox assumes no responsibilities for the inappropriate use of this command.

12.4.2 RF test description

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

In test/non-signalling mode the module switches off the 2G/3G/4G protocol stack for performing single tests which could not be performed during signalling mode.

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

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

- 2G transmission of GSM burst sequence on the desired channel and power level (only one time slot configuration is available)
- 2G transmission of 8-PSK modulation burst sequence on the desired channel and power level (only one time slot configuration is available)
- 3G transmission of WCDMA signal on the desired channel and power level
- 4G transmission of LTE SC-FDMA OFDM signal (5 MHz bandwidth) in the desired channel in FDD band and power level
- Receiving signal detection and RF level measurement on the desired 2G, 3G or 4G (LTE) channel
- Receiving signal detection at diversity or secondary antenna input and RF level measurement on the desired 2G, 3G or 4G (LTE) channel

☞ The command only accepts the parameters set supported by the specific module version. When an unsupported parameter is issued an error result code will be provided ("+CME ERROR: operation not supported" if +CMEE is set to 2).

The execution of these actions is performed in non-signalling mode. In non-signalling mode:
- The module only accepts +UTEST commands

In normal mode:
- The only allowed +UTEST command is the AT+UTEST=1 used to enable testing interface
- All other +UTEST commands return an error result code ("+CME ERROR: operation not allowed" if +CMEE is set to 2)

☞ The module must not be registered with the network before entering the non-signalling mode, otherwise an error result code ("+CME ERROR: operation not allowed" if +CMEE is set to 2) is provided.

☞ The +CMEE command can only be set in normal mode.

To return to the normal mode perform one of these actions:
- A module reset
- Power off the module
- Send AT+UTEST=0

When the module returns the normal mode, the network registration status stored in the profile will be restored.

☞ See the End User Test Application Note [132] for further test command examples.

12.4.3 Syntax

Type	Syntax	Response	Example
Set	AT+UTEST=<mode>,[<par1>],[<par2>], [<par3>],[<par4>],[<par5>]	If <mode>=0 or 1	AT+UTEST=0
		OK	OK
		If <mode>=2 or 3	AT+UTEST=2,124,250
		+UTEST: [<par1>,<par2>][,<par3>, <par4>,<par5>][,<min>,<avg>,<max>]	+UTEST: 124,250,-80,-80,-80
			OK
		OK	
Read	AT+UTEST?	+UTEST: <mode>	+UTEST: 1
		OK	OK
Test	AT+UTEST=?	+UTEST: (list of supported <mode>s)	+UTEST: (0-3)
		OK	OK

12.4.4 Defined values

Parameter	Type	Description
<mode>	Number	Test mode setting: • 0: the module returns to the module normal mode • 1: the module enters non-signalling mode

Parameter	Type	Description
		• 2: RX test mode (measuring the antenna level estimation of the received RF signal)
		• 3: TX test mode (GSMK/8-PSK burst or transmission in 3G bands)
<par1>..<par5>	Number	Parameters needed for RX and TX test mode as reported in the table below.

12.4.5 Notes

- **RX mode setting (<mode>=2)**

Parameter	Description	Range	Default	Notes
<par1>	Channel	0 ÷ 165535	32	RX channel 2G RAT: for 850, 900, 1800 bands the value corresponds to ARFCN while for 1900 band an offset of 32768 is added.

    o [0-124]: GSM 900 MHz
    o [128-251]: GSM 850 MHz
    o [512-885]: DCS 1800 MHz
    o [975-1023]: EGSM 900 MHz
    o [33280-33578]: PCS 1900 MHz (corresponding to ARFCN 512-810 range in band 1900)

RX channel 3G RAT: the value corresponds to UARFCN except for band 19 where an offset of 20000 is added, additional channels available in some 3G bands are not supported.

    o [1537-1738]: band 4 (1700 MHz)
    o [2937-3088]: band 8 (900 MHz)
    o [4357-4458]: band 5 (850 MHz)
    o [4387-4413]: band 6 (800 MHz)
    o [20712-20763]: band 19 (800 MHz)
    o [9662-9938]: band 2 (1900 MHz)
    o [10562-10838]: band 1 (2100 MHz)

RX channel 4G RAT: the value corresponds to EARFCN with an offset of 100000.

    o [101950-102399]: FDD band 4 (EARFCN range 1950 - 2399)
    o [105010-105179]: FDD band 12 (EARFCN range 5010 - 5179)
    o [105180-105279]: FDD band 13 (EARFCN range 5180 - 5279)
    o [101200-101949]: FDD band 3 (EARFCN range 1200 - 1949)
    o [102750-103449]: FDD band 7 (EARFCN range 2750 - 3449)
    o [106000-106149]: FDD band 19 (EARFCN range 6000 - 6149)
    o [106150-106449]: FDD band 20 (EARFCN range 6150 - 6449)
    o [109210-109659]: FDD band 28 (EARFCN range 9210 - 9659)
    o [100000-100599]: FDD band 1 (EARFCN range 0 - 599)
    o [100600-101199]: FDD band 2 (EARFCN range 600 - 1199)
    o [102400-102649]: FDD band 5 (EARFCN range 2400 - 2649)
    o [102650-102749]: FDD band 6 (EARFCN range 2650 - 2749)
    o [103450-103799]: FDD band 8 (EARFCN range 3450 - 3799)
    o [105730-105849]: FDD band 17 (EARFCN range 5730 - 5849)

☞ The "+CME ERROR: operation not supported" error result code will be provided in these cases (if +CMEE is set to 2):
    o A value not belonging to the above ranges is set
    o The RX channel parameter value belongs to a not supported RAT (2G or 3G or 4G RAT) or band

Parameter	Description	Range	Default	Notes
<par2>	Time	1 ÷ 600000	1000	Time interval for RX test expressed in ms
<par3>	Antenna diversity	0 ÷ 1	0	Receiver path: o 0: main / primary antenna o 1: diversity / secondary antenna The parameter is available only if supported, otherwise an error result code will be provided ("+CME ERROR: operation not supported" if +CMEE is set to 2)
<min>	Minimum antenna RF level estimation	-100 ÷ -20		Expressed in dBm, for 2G RAT ☞ In 3G / 4G RAT the range goes from -90 to -20.
<avg>	Average antenna RF level estimation	-100 ÷ -20		Expressed in dBm, for 2G RAT ☞ In 3G / 4G RAT the range goes from -90 to -20.
<max>	Maximum antenna RF level estimation	-100 ÷ -20		Expressed in dBm, for 2G RAT ☞ In 3G / 4G RAT the range goes from -90 to -20.

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

Parameter	Description	Range	Default	Notes
<par1>	Tx channel	0 ÷ 165535	32	TX channel 2G RAT: for 850, 900, 1800 bands the value corresponds to ARFCN while for 1900 band an offset of 32768 is added. o [0-124]: GSM 900 MHz o [128-251]: GSM 850 MHz o [512-885]: DCS 1800 MHz o [975-1023]: EGSM 900 MHz o [33280-33578]: PCS 1900 MHz (corresponding to ARFCN 512-810 range in band 1900) TX channel 3G RAT: the value corresponds to UARFCN except for the band 19 where an offset of 20000 is added, additional channels available in some 3G bands are not supported. o [1312-1513]: band 4 (1700 MHz) o [2712-2863]: band 8 (900 MHz) o [4132-4233]: band 5 (850 MHz) o [4162-4188]: band 6 (800 MHz) o [20312-20363]: band 19 (800 MHz) o [9262-9538]: band 2 (1900 MHz) o [9612-9888]: band 1 (2100 MHz) TX channel 4G RAT: the value corresponds to EARFCN with an offset of 100000. o [118000-118599]: FDD band 1 (EARFCN range 18000 - 18599) o [118600-119199]: FDD band 2 (EARFCN range 18600 - 19199) o [119950-120399]: FDD band 4 (EARFCN range 19950 - 20399) o [119200-119949]: FDD band 3 (EARFCN range 19200 - 19949) o [120400-120649]: FDD band 5 (EARFCN range 20400 - 20649) o [120650-120749]: FDD band 6 (EARFCN range 20650 - 20749) o [120750-121449]: FDD band 7 (EARFCN range 20750 - 21449) o [121450-121799]: FDD band 8 (EARFCN range 21450 - 21799) o [123010-123179]: FDD band 12 (EARFCN range 23010 - 23179) o [123180-123279]: FDD band 13 (EARFCN range 23180 - 23279)

Parameter	Description	Range	Default	Notes
				o [123730-123849]: FDD band 17 (EARFCN range 23730 - 23849)
				o [124000-124149]: FDD band 19 (EARFCN range 24000 - 24149)
				o [124150-124449]: FDD band 20 (EARFCN range 24150 - 24449)
				o [127210-127659]: FDD band 28 (EARFCN range 27210 - 27659)
				☞ The "+CME ERROR: operation not supported" error result code will be provided in these cases (if +CMEE is set to 2): o A value not belonging to the above ranges is set o The TX channel parameter value belongs to a not supported RAT (2G or 3G or 4G RAT) or band
<par2>	Power control level	-56 ÷ 24	5	For 2G RAT: PCL (power control level). The allowed values depend on the related <par1> value: lower numbers means higher power level. o [0-19]: GSM 850 and 900, if <par2> is less than 5 the handling is the same for <par2>=5 o [0-15]: DCS 1800 and PCS 1900 In case <par4> is set to 2 (8-PSK modulation) the range is as below. Other values are valid but behave as the indicated level: o [0-19]: GSM 850 and 900 if <par2> is less than 8 the handling is the same for <par2>=8 o [0-15]: DCS 1800 and PCS 1900; if <par2> is less than 2 the handling is the same for <par2>=2 For 3G RAT: absolute output power [dBm] o [-56 ÷ 24] for all the bands For 4G RAT: absolute output power [dBm] o [-40 ÷ 24] for all the bands ☞ Only the values indicated in the above ranges are valid, otherwise an error result code will be provided ("+CME ERROR: operation not supported" if +CMEE is set to 2).
<par3>	Training sequence	0 ÷ 7	5	Training sequence to be used (to be changed only in case of link with network simulator, else use default) ☞ In 3G / 4G RAT the values is unused.
<par4>	Modulation mode	1 ÷ 2	1	Modulation mode o 1: GMSK normal modulation including the training sequence o 2: 8-PSK normal modulation including the training sequence ☞ In 3G / 4G RAT the parameter is ignored. ☞ LTE SC-FDMA OFDM modulation (5 MHz bandwidth), FDD, is automatically set using for <par1> an EARFCN value.
<par5>	Time	0 ÷ 600000	1000	Time interval for TX test expressed in ms o 0: burst sequence is continuously transmitted. In this case the command will immediately return the information text response. The command line will be immediately available for any +UTEST command. Provide AT+UTEST= 1 command to stop the burst sequence transmission, any other +UTEST commands can be set and the current sequence transmission is stopped.

12.4.6 Examples

☞ In *RX mode test command examples* the module provides the information text response after the timeout issued in the set command.

Command	Response	Description
AT+UTEST=2	+UTEST: 32,1000,-89,-88,-87 OK	The module measures the antenna RX level at RX channel 32 band GSM 900 for 1 s interval. ☞ In the example -89,-88,-87 are the antenna RF level estimation: the numbers are just an example.
AT+UTEST=2,885,5000	+UTEST: 885,5000,-66,-65,-65 OK	The module measures the antenna RX level at RX channel 885 band DCS 1800 for 5 s interval.
AT+UTEST=2,10562,2000	+UTEST: 10562,2000,-60,-60,-59 OK	The module measures the antenna RX level at RX channel 10562 band B1 for 2 s interval on the main antenna path.
AT+UTEST=2,10562	+UTEST: 10562,1000,0,-85,-85,-85 OK	The module measures the antenna RX level at RX channel 10562 band B1 for 1 s interval on the main antenna path.
AT+UTEST=2,65,3000,0	+UTEST: 65,3000,0,-63,-62,-62 OK	The module measures the antenna RX level at RX channel 65 band GSM 900 for 3 s interval on the main antenna path.
AT+UTEST=2,4357,,1	+UTEST: 4357,1000,1,-51,-51,-51 OK	The module measures the antenna RX level at RX channel 4357 band B5 for 1 s interval on the diversity antenna path.
AT+UTEST=2,102174,500,0	+UTEST: 102174,500,0,-71,-70,-70 OK	The module measures the antenna RX level at RX channel 2174 band FDD 4 for 0.5 s interval on the primary antenna path.
AT+UTEST=2,105230,,1	+UTEST: 105230,1000,1,-72,-71,-70 OK	The module measures the antenna RX level at RX channel 5230 band FDD 13 for 1 s interval on the secondary antenna path.

Table 7: RX mode test command examples

Command	Response	Description
AT+UTEST=3,32,7,5	+UTEST: 32,7,5,1,1000 OK	The module will transmit for 1 s interval 1 slot burst sequence at TX channel 32 GSM 900 at PCL 5 using training sequence 5 and normal GMSK modulation.
AT+UTEST=3,65,8,,2,5000	+UTEST: 65,8,5,2,5000 OK	The module will transmit for 5 s interval 1 slot burst sequence at TX channel 65 GSM 900 at PCL 8 (gamma 6, 27 dBm) using training sequence 5 and normal 8-PSK modulation.
AT+UTEST=3,660,,,,0	+UTEST: 660,5,5,1,0 OK	The module will transmit continuously 1 slot burst sequence at TX channel 660 DCS 1800 at PCL 5 using training sequence 5 and normal GMSK modulation.
AT+UTEST=3,9612,22,,,2000	+UTEST: 9612,22,5,1,2000 OK	The module will transmit for 2 s interval at TX channel 9612 band B1 at 22 dBm power level using WCDMA modulation.
AT+UTEST=3,120399,15,,,3000	+UTEST: 120399,15,5,1,3000 OK	The module transmits for 3 s interval at TX channel 20399 band FDD 4 at 15 dBm power level using SC-FDMA OFDM modulation 5 MHz bandwidth.
AT+UTEST=3,123230,-10,,,0	+UTEST: 123230,-10,5,1,0 OK	The module continuously transmits at TX channel 23230 band FDD 13 at -10 dBm power level using SC-FDMA OFDM modulation 5 MHz bandwidth.

Table 8: TX mode test command examples

12.4.7 Digital pins testing description

Defines the commands to perform some verifications on all the digital pins of the u-blox cellular modules.

These pins can be considered as generic digital input / output pins; it is possible to configure one pin as a digital output with "high" logic level and then verify the voltage level present. Conversely, it is possible set a pin as a digital input, externally apply a "high" or "low" logic level and then check if the module is able to correctly measure the voltage level applied.

After the execution of the AT+UTEST=10,5 command, it is possible to externally apply a voltage level to the enabled input pins and / or measure the voltage level on the pins configured as digital input.

☞ These commands are intended for production to check the correct digital pins behavior, detect possible soldering or functional problems and can be executed only in non-signalling mode (otherwise the "+CME

ERROR: operation not allowed" (if +CMEE is set to 2) error result code is issued without performing any operations).

⚠ Do not exceed the values reported in the Generic Digital Interface section of the module data sheet when testing a pin as a digital input pin, since stressing the device above the listed ratings may cause a permanent damage of the module.

☞ See the End User Test Application Note [132] and the corresponding module data sheet for the list of pins available for testing and their levels characteristics.

12.4.8 Syntax

Type	Syntax	Response	Example
Digital pins testing generic syntax			
Set	AT+UTEST=10,<op_code>[,[<bit_padding>]<pin_seq>]	OK	AT+UTEST=10,3,"0000001000000300" OK
Original configuration restoring			
Set	AT+UTEST=10,0	OK	AT+UTEST=10,0 OK
Pins set definition			
Set	AT+UTEST=10,2,[<bit_padding>]<pin_seq>	OK	AT+UTEST=10,2,"0000000C300000003000" OK
Pins configuration			
Set	AT+UTEST=10,3,[<bit_padding>]<pin_seq>	OK	AT+UTEST=10,3,"00000004200000001000" OK
Output pins definition			
Set	AT+UTEST=10,4,[<bit_padding>]<pin_seq>	OK	AT+UTEST=10,4,"00000000100000002000" OK
Digital testing execution			
Set	AT+UTEST=10,5	OK	AT+UTEST=10,5 OK
Digital value measurement			
Set	AT+UTEST=10,6	<bit_padding>]<pin_seq> OK	AT+UTEST=10,6 00000004100000003000 OK
Read	AT+UTEST?	+UTEST: <mode> OK	+UTEST: 1 OK
Test	AT+UTEST=?	+UTEST: (list of supported <mode>s) OK	+UTEST: (0-3) OK

12.4.9 Defined values

Parameter	Type	Description
<op_code>	Number	Test mode setting: • 0: exits the test interface and restore the pins to the original configuration • 2: defines a set of pins that will be tested and initialize these pins to be ready for testing. The original pins configuration is kept for final restore. See the End User Test Application Note [132] for the list of pins available for testing. In the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: o 0: the pin will not be tested o 1: the pin will be tested (as digital input or output) • 3: configures the logical pins previously enabled for testing as output or input; the command has effect only if AT+UTEST=10,2 has been previously issued.

Parameter	Type	Description
		In case a not enabled pin is set as digital input or output, the command does not return an error and the setting is not applied. In the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: ○ 0: the pin will be set as an output ○ 1: the pin will be set as an input • 4: configures the value of the output pins under testing; the command has effect only if AT+UTEST=10,3 has been previously issued; The command is not mandatory if there are not output pins to configure. In the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: ○ 0: the pin will output a "low" logic level ○ 1: the pin will output a "high" logic level • 5: apply the setting change defined with <op_code>= 2 / 3 / 4 and triggers the execution of the digital testing. Digital testing of the pins is possible only after the execution of the AT+UTEST=10,5 command. • 6: returns the logic value of pins under testing (both input and output); in the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: ○ 0: "low" logic digital level measured at the module pin ○ 1: "high" logic digital level measured at the module pin
[<bit_padding>]<pin_seq>	Number	Sequence of hexadecimal digits containing the pins information and the action to execute See the *Notes* and End User Test Application Note [*132*] for detailed number description

12.4.10 Notes

• Consider these steps to construct the [<bit_padding>]<pin_seq> sequence
  ○ Consider the total number of module's pins available (76 pins for LISA-U2 series, 64 pins for SARA-U2 series, 92 pins, for TOBY-L2 series)
  ○ See the End User Test Application Note [*132*] for the list of pins available for testing
  ○ In case a non-testable pin is selected, the command does not return an error result code but the value is not considered and not applied.
  ○ The status of the n-th pin will be represented by the corresponding n-th bit; see the <op_code> description for the notation of each mode setting
  ○ Convert each group of four binary digits into its hexadecimal representation
  ○ Add one 0 digit at the beginning of the sequence for TOBY-L2 and LISA-U2 series to complete the resulting sequence of hexadecimal values with 0 padding

• An example of AT commands sequence to test the digital pins is reported in *Table 9*.

Command	Response	Description
AT+CMEE=2	OK	Enable the verbose error result code
AT+COPS=2	OK	Deregister the module from the network
AT+UTEST=1	OK	The module enters the test mode
AT+UTEST=10,2,"000007F400C00 0D83F00"	OK	The command puts the module in Interface initialised state; the command saves the pins status to restore it at the end of the test. Pins enabled for testing: DSR, RI, DCD, DTR, RTS, CTS, GPIO1, GPIO2, GPIO3, GPIO4, I2S1_RXD/GPIO6, I2S1_TXD/GPIO7, GPIO5, I2S1_CLK/GPIO8, I2S1_WA/GPIO9, SPI_SCLK/GPIO10, SPI_MOSI/GPIO11, SPI_MISO/GPIO12, SPI_SRDY/GPIO13, SPI_MRDY/GPIO14
AT+UTEST=10,3,"0000049400400 0C01800"	OK	Pins configuration: ○ DTR, RTS, GPIO3, GPIO4, I2S1_RXD/GPIO6, GPIO5, I2S1_CLK/GPIO8, SPI_MOSI/GPIO11, SPI_MRDY/GPIO14 as input ○ DSR, RI, DCD, CTS, GPIO1, GPIO2, I2S1_TXD/GPIO7, I2S1_WA/GPIO9, SPI_SCLK/GPIO10, SPI_MISO/GPIO12, SPI_SRDY/GPIO13 as output
AT+UTEST=10,4,"0000036000800 0182700"	OK	Digital logic value of the output pins:

Command	Response	Description
		o DSR, RI, DCD, CTS, GPIO1, GPIO2, I2S1_TXD/GPIO7, I2S1_ WA/GPIO9, SPI_SCLK/GPIO10, SPI_MISO/GPIO12, SPI_SRDY/ GPIO13 set to "high".
AT+UTEST=10,5	OK	Configurations made by AT+UTEST=10,2; AT+UTEST=10,3 and AT+UTEST=10,4 are executed.
AT+UTEST=10,6	000007F400C000D83F00 OK	Logic digital value measured at modules pins: o DSR, RI, DCD, DTR, RTS, CTS, GPIO1, GPIO2, GPIO3, GPIO4, I2S1_RXD/GPIO6, I2S1_TXD/GPIO7, GPIO5, I2S1_ CLK/GPIO8, I2S1_WA/GPIO9, SPI_SCLK/GPIO10, SPI_MOSI/ GPIO11, SPI_MISO/GPIO12, SPI_SRDY/GPIO13, SPI_MRDY/ GPIO14: "high" level detected
AT+UTEST=0	OK	Module exits from the test mode and normal pins configurations is restored.

Table 9: Digital pins test command examples

- The digital pins can be configured as many times as needed by the testing process; AT+UTEST=10,2 command is not needed any more as the DUT is already in Interface initialised state:
- See the End User Test Application Note [*132*] for further test command examples.

12.5 Power Saving Mode Setting +CPSMS

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

12.5.1 Description

Sets the device power saving mode parameters. The command controls whether the device wants to apply PSM or not, as well as the requested extended periodic TAU value in E-UTRAN and the requested Active Time value. Use the read command to get the asigned values from the network:

- If the power saving mode is enabled (+CPSMS=1), Everything on the device will power down except the real-time clock (RTC) after the expiry of T3324 (Active Time). It will stay powered down until the expiry of T3412 (Extended TAU Timer) or if the Power On line is toggled.
- If the power saving mode is disabled (+CPSMS=0), the device will not enter Power Save Mode (PSM)

12.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPSMS=[<mode>[,<Requested_ Periodic-RAU>[,<Requested_GPRS- READY-timer>[,<Requested_Periodic- TAU>[,<Requested_Active-Time>]]]]]	OK	AT+CPSMS=1,,,"01100000","0000000 0" OK
Read	AT+CPSMS?	+CPSMS: <mode>,[<Requested_Periodic- RAU>],[<Requested_GPRS-READY- timer>],[<Requested_Periodic-TAU>], [<Requested_Active-Time>] OK	+CPSMS: 1,,,"01100000","00000000" OK
Test	AT+CPSMS=?	+CPSMS: (list of supported <mode>s), (list of supported <Requested_Periodic- RAU>s),(list of supported <Requested_ GPRS-READY-timer>s),(list of supported <Requested_Periodic-TAU>s),(list of supported <Requested_Active-Time>s) OK	+CPSMS: (0-1),,,(<Units(0- 6)><TimerValue(0-31)> in bits),(<Units(0- 2)><TimerValue(0-31)> in bits) OK

12.5.3 Defined values

Parameter	Type	Description
<mode>	Number	Power saving configuration. Allowed values: • 0 (default and factory-programmed value): disabled • 1: enabled
<Requested_Periodic-RAU>	String	Not Supported
<Requested_GPRS-READY-timer>	String	Not Supported
<Requested_Periodic-TAU>	String	One byte in an 8 bit format. Requested extended periodic TAU value (T3412) to be allocated to the device in E-UTRAN. The requested extended periodic TAU value is coded as one byte (octet 3) of the GPRS Timer 3 information element coded as bit format (e.g. "01000111" equals 70 hours). For the coding and the value range, see the GPRS Timer 3 IE in 3GPP TS 24.008 Table 10.5.163a/3GPP TS 24.008 [12]. See also 3GPP TS 23.682 [152] and 3GPP TS 23.401 [153]. The default value is "01100000".
<Requested_Active-Time>	String	One byte in an 8 bit format. Requested Active Time value (T3324) to be allocated to the UE. The requested Active Time value is coded as one byte (octet 3) of the GPRS Timer 2 information element coded as bit format (e.g. "00100100" equals 4 minutes). For the coding and the value range, see the GPRS Timer 2 IE in 3GPP TS 24.008 Table 10.5.163/3GPP TS 24.008 [12]. See also 3GPP TS 23.682 [152], 3GPP TS 23.060 [10] and 3GPP TS 23.401 [153]. The default value is "00 000000".

12.6 Cancel LWM2M FOTA Download +ULWM2M=0

+ULWM2M=0						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	Yes	No	No	-	-

12.6.1 Description

Cancels a LWM2M FOTA firmware file download session. When a LWM2M session is in progress and the firmware is being download to the device, the download can be canceled by issuing this command. To make use of this command, URCs for LWM2M FOTA sessions must be enabled. See *+ULWM2MSTAT* for details on enabling LWM2M URCs.

12.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2M=0	OK	AT+ULWM2M=0 OK

12.7 Set LWM2M FOTA URCs +ULWM2MSTAT

+ULWM2MSTAT						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	Yes	NVM	No	-	-

12.7.1 Description

Allows enabling or disabling of LWM2M FOTA status URCs.

12.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MSTAT=<n>	OK	AT+ULWM2MSTAT=1 OK
Read	AT+ULWM2MSTAT?	+ULWM2MSTAT: <n> OK	+ULWM2MSTAT: 1 OK

Type	Syntax	Response	Example
Test	AT+ULWM2MSTAT=?	+ULWM2MSTAT: (list of supported <n>s)	+ULWM2MSTAT: (0,1)
		OK	OK
URC		+ULWM2MSTAT: <stat>,<percent>	+ULWM2MSTAT: 1,99

12.7.3 Defined values

Parameter	Type	Description
<n>	Number	Mode configuration: • 0: LWM2M FOTA status URC disabled • 1 (default value): LWM2M FOTA status +ULWM2MSTAT URC enabled
<stat>	Number	LWM2M FOTA status: • 1: FOTA download in progress • 2: FOTA download complete
<percent>	Number	Percentage of FOTA download completed

13 GPIO

13.1 Introduction

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

13.1.1 GPIO functions

On u-blox cellular modules, GPIO pins can be opportunely configured as general purpose input or output. Moreover GPIO pins of u-blox cellular modules can be configured to provide custom functions via *+UGPIOC* AT command. The custom functions availability can vary depending on the u-blox cellular modules series and version: see the following tables for an overview of the custom functions supported by u-blox cellular modules.

<gpio_mode>	Output	Input	Network status indication	GNSS supply enable	GNSS data ready	GNSS RTC sharing	Jamming detection	SIM card detection	Headset detection	GSM Tx burst indication	Module operating status indication	Module functionality status indication	I²S digital audio interface	SPI serial interface	Master clock generation	UART (DSR, DTR, DCD and RI) interface	Wi-Fi enable	Pad disabled
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	255
SARA-R4	*	*	*					*			*							*

Table 10: GPIO custom functions overview

The configuration of the GPIO pins (i.e. the setting of the parameters of the *+UGPIOC* AT command) is saved in the NVM and used at the next power-on.

13.1.2 GPIO mapping

The number of available GPIO pins and their mapping can vary depending on the u-blox cellular modules series and version. The GPIOs mapping for different u-blox cellular modules is reported in the following tables.

☞ See the corresponding module system integration manual for the functions supported by each GPIO.

<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	-
25	GPIO4	25	General purpose output (low)	-
42	SIM_DET	42	SIM card detection	Only pin 42 can be configured for SIM card detection functionality
19	GPIO5	19	Pin disabled	-

Table 11: SARA-R4 series GPIO mapping

☞ The "GNSS supply enable", "GNSS data ready" and "GNSS RTC sharing" custom functions can be handled by the *+UGPS* and the *+UGPRF* custom AT commands to manage the u-blox GNSS receiver connected to the cellular module and the embedded GPS aiding.

☞ The AT+UGPIOC=xx,255 or AT+UGPIOC=xx,0 or AT+UGPIOC=xx,1 commands (where xx= 55, 56, 57, 58, 59) cannot be sent over SPI interface (the "+CME ERROR: GPIO busy" error result code is reported). This is because these commands disable the SPI interface.

☞ When the GPIOs 10-14 need to be switched from tristate (<gpio_mode>=255) or GPIO output (<gpio_mode>=0) or GPIO input (<gpio_mode>=1) to SPI functionality (<gpio_mode>=13), a power cycle (reset) is required for the changes to take effect.

☞ When SIM card detection functionality is enabled, the status is reported by +CIND AT command.

☞ Both the SIM hot insertion detection feature (configurable through the +UDCONF=50 AT command where supported) and the SIM card detection feature must be enabled to allow a correct implementation of these features.

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

13.1.3 Network status indication

When a GPIO pin is configured to provide network status indication, its progress depends on the CS network registration state (see +CREG) and on the module transmission state:

- No service: indicates no network coverage or not registered state
- Registered home network 2G: indicates registered state on home network in 2G RAT
- Registered home network 3G: indicates registered state on home network in 3G RAT
- Registered 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)
- Data transmission: indicates voice or data call active either in 2G, 3G or 4G RAT
- Data transmission roaming: indicates voice or data call active either in 2G, 3G or 4G RAT with visitor network

☞ SARA-R4
When registered on 4G (LTE) network, the GPIO pin progress is the same as for data transmission (Figure 6) because a PDP context/EPS bearer is available.

The following figures report the allowed progresses for GPIO pin set as network indication: V_H and V_L values are provided in the corresponding module data sheet in the "Generic Digital Interfaces pins" section.

13.1.3.1 No service (no network coverage or not registered)

- Continuous Output / Low

Figure 1: GPIO pin progress for no service

13.1.3.2 Registered home network 2G

- Cyclic Output / High for 100 ms, Output / Low for 2 s
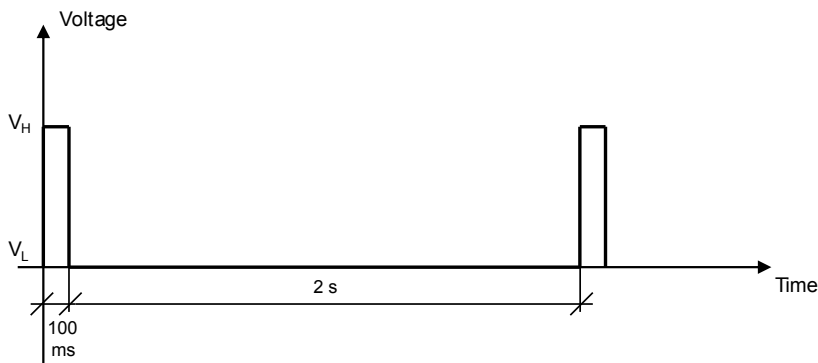
Figure 2: GPIO pin progress for registered home network 2G

13.1.3.3 Registered home network 3G

• Cyclic Output / High for 50 ms, Output / Low for 50 ms, Output / High for 50 ms, Output / Low for 2 s
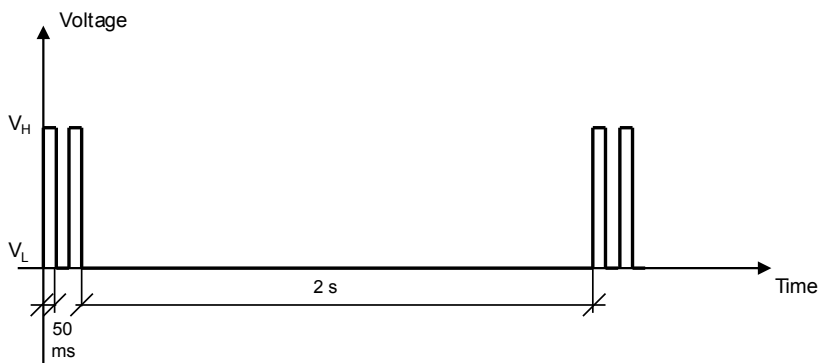
Figure 3: GPIO pin progress for registered home network 3G

13.1.3.4 Registered roaming 2G

• Cyclic Output / High for 100 ms, Output / Low for 100 ms, Output / High for 100 ms, Output / Low for 2 s
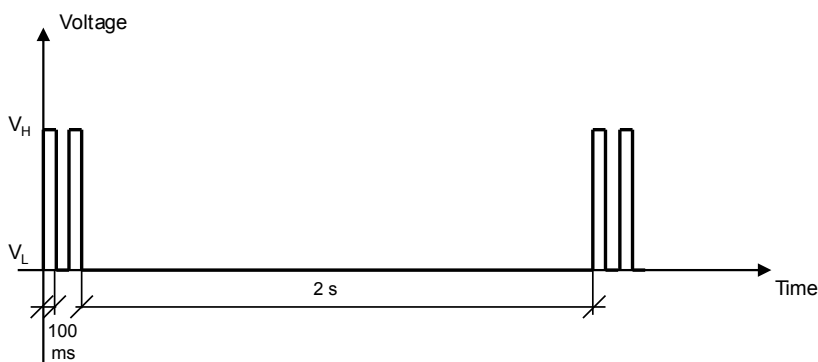
Figure 4: GPIO pin progress for registered roaming 2G

13.1.3.5 Registered roaming 3G

• Cyclic Output / High for 50 ms, Output / Low for 50 ms, Output / High for 50 ms, Output / Low for 100 ms
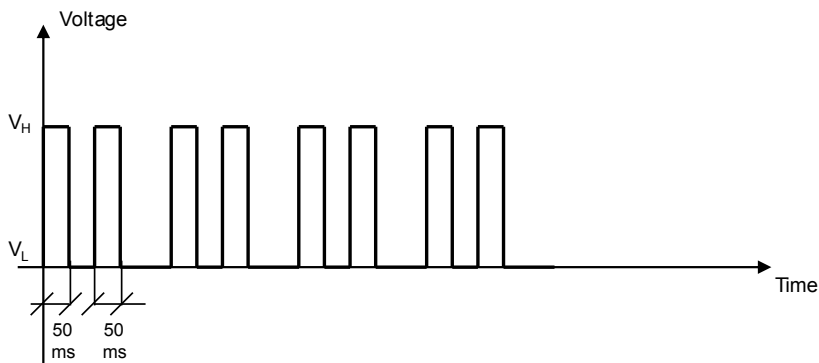
Figure 5: GPIO pin progress for registered roaming 3G

13.1.3.6 Data transmission

• Continuous Output / High
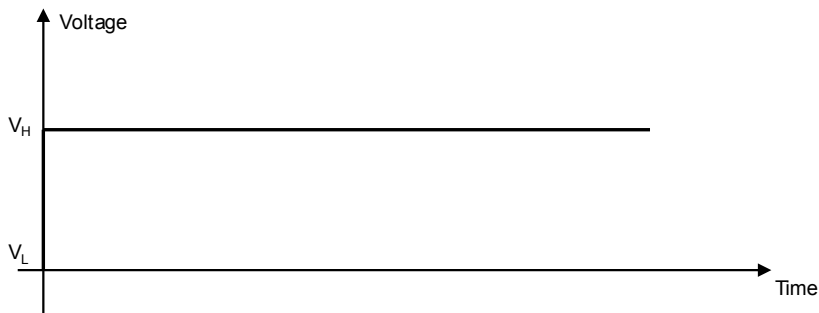
Figure 6: GPIO pin progress for data transmission

13.1.3.7 Data transmission roaming

• Cyclic Output / High for 800 ms, Output / Low for 200 ms
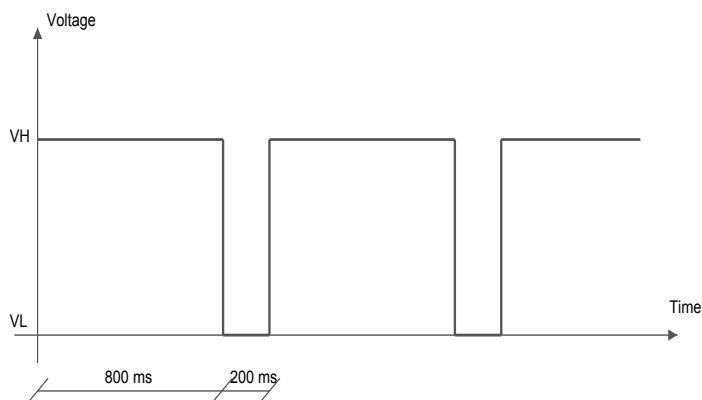
Figure 7: GPIO pin progress for data transmission roaming

13.2 GPIO select configuration command +UGPIOC

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

13.2.1 Description

Configures the GPIOs pins as input, output or to handle a custom function. When the GPIOs pins are configured as output pin, it is possible to set the value.

The test command provides the list of the supported GPIOs, the supported functions and the status of all the GPIOs.

☞ Not all the GPIO functions can be assigned to each GPIO pin. If the configuration is not allowed, an error result code will be returned (error result code 1502 - "+CME ERROR: Select GPIO mode error").
   The following custom functions cannot be simultaneously configured on 2 GPIOs:
   • Network status indication
   • GNSS supply enable
   • GNSS data ready
   • GNSS RTC sharing
   • SIM card detection
   • Headset detection
   • GSM Tx burst indication
   • Module operating status indication
   • Module functionality status indication

☞ The AT+UGPIOC=xx,255 or AT+UGPIOC=xx,0 or AT+UGPIOC=xx,1 commands (where xx= 55, 56, 57, 58, 59) cannot be sent over the SPI interface (the error result code "+CME ERROR: GPIO busy" is reported). This is because these commands disable the SPI interface.

☞ 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*.

13.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPIOC=<gpio_id>,<gpio_mode>[, <gpio_out_val>\<gpio_in_pull>]	OK	AT+UGPIOC=20,0,1 OK
Read	AT+UGPIOC?	+UGPIOC: <gpio_id>,<gpio_mode> [<gpio_id>,<gpio_mode> [....]] OK	+UGPIOC: 20,0 21,3 23,255 24,255 51,7 OK
Test	AT+UGPIOC=?	+UGPIOC: (list of supported <gpio_id>), (list of supported <gpio_mode>),(list of supported <gpio_out_val>\<gpio_in_pull>) [<gpio_id1>,<gpio_mode> ... <gpio_idN>,<gpio_mode>] OK	+UGPIOC: (20,21,23,24,51),(0-5,7,9, 255),(0-2) OK

13.2.3 Defined values

Parameter	Type	Description
<gpio_id>	Number	GPIO pin identifier: pin number
		See the *GPIO mapping* for the available GPIO pins, their mapping and factory-programmed values on different u-blox cellular modules series and product version.
<gpio_mode>	Number	Mode identifier: configured function
		See the *GPIO functions* for custom functions supported by different u-blox cellular modules series and product version.
		Allowed values:
		• 0: output
		• 1: input
		• 2: network status indication
		• 3: GNSS supply enable
		• 4: GNSS data ready
		• 5: GNSS RTC sharing
		• 7: SIM card detection
		• 8: headset detection
		• 9: GSM Tx burst indication
		• 10: module operating status indication
		• 11: module functionality status indication
		• 12: I^{2}S digital audio interface
		• 13: SPI serial interface
		• 14: master clock generation
		• 15: UART (DSR, DTR, DCD e RI) interface
		• 16: Wi-Fi enable
		• 255: pad disabled
<gpio_out_val>	Number	GPIO output value (for output function <gpio_mode>=0 only):
		• 0 (default value): low
		• 1: high
<gpio_in_pull>	Number	GPIO input value (for input function <gpio_mode>=1 only):
		• 0 (default value): no resistor activated
		• 1: pull up resistor active
		• 2: pull down resistor active

13.3 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*

13.3.1 Description

Reads the current value of the specified GPIO pin, no matter whether it is configured as input or output (see the *+UGPIOC* AT command to define the GPIO function). The parameters range is shown in the information text response to the test command.

13.3.2 Syntax

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

13.3.3 Defined values

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

13.3.4 Notes

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

13.4 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*

13.4.1 Description

Sets ("writes") the output of the specified GPIO pin, but only if it is configured in output function (see the *+UGPIOC* AT command to set the pin as output).

13.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPIOW=<gpio_id>,<gpio_out_val>	OK	AT+UGPIOW=20,1
			OK
Test	AT+UGPIOW=?	+UGPIOW: (list of supported <gpio_id>s), (list of supported <gpio_out_val>s)	+UGPIOW: (20, 21),(0-1)
			OK
		OK	

13.4.3 Defined values

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

13.4.4 Notes

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

14 File System

14.1 File tags

14.1.1 Description

File system commands have the optional <tag> parameter that allows to specify a file type when an AT command is issued, to inform the system what to do with it. Application specific files must be saved with the correct type tag, otherwise they are treated as common user files.

Table 12 defines the tags and their specific meaning:

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.

Table 12: Tags meaning

☞ SARA-R4
The AUDIO tag is not supported.

14.2 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*

14.2.1 Description

Stores (writes) a file into the file system:

• The stream of bytes can be entered after the '>' prompt has been provided to the user. The file transfer is terminated exactly when <size> bytes have been sent entered and either "OK" final result code or an error result code is returned. The feed process cannot be interrupted i.e. the command mode is re-entered once the user has provided the declared the number of bytes.

• If the file already exists, the data will be appended to the file already stored in the file system.

• If the data transfer stops, after 20 s the command is stopped and the "+CME ERROR: FFS TIMEOUT" error result code (if *+CMEE=2*) is returned.

• If the module shuts down during the file storing, all bytes of the file will be deleted.

• If an error occurs during the file writing, the transfer is aborted and it is up to the user to delete the file.

☞ The available free memory space is checked before starting the file transfer. If the file size exceeds the available space, the "+CME ERROR: NOT ENOUGH FREE SPACE" error result code will be provided (if *+CMEE=2*).

☞ SARA-R4
If the HW flow control is disabled (*AT+IFC*), a data loss could be experienced. So the HW flow control usage is strongly recommended.

14.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDWNFILE=<filename>,<size>[, <tag>]	OK	AT+UDWNFILE="filename",36,"USER"

Type	Syntax	Response	Example
	>		>
	<text>		The 36 downloaded bytes of the file!
			OK

14.2.3 Defined values

Parameter	Type	Description
<filename>	String	File name. For file system file name and data size limits see *File system limits*.
<size>	Number	File size expressed in bytes. For file system file name and data size limits see *File system limits*.
<tag>	String	Optional parameter that specifies the application file type. *FILE TAGS* table lists the allowed <tag> strings.
<text>	String	Stream of bytes.

14.2.4 Notes

- Issue the *AT+ULSTFILE=1* to retrieve the available user space in the file system.
- Two files with different types can have the same name, i.e. AT+UDWNFILE="testfile",20,"USER" and AT+UDWNFILE="testfile",43,"AUDIO".

14.3 List files information +ULSTFILE

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

14.3.1 Description

Retrieves some information about the FS. Depending on the specified <op_code>, it can print:

- List of files stored into the FS
- Remaining free FS space expressed in bytes
- Size of the specified file expressed in bytes

☞ The available free space on FS in bytes reported by the command AT+ULSTFILE=1 is the theoretical free space including the space occupied by the hidden and temporary files which are not displayed by the AT+ULSTFILE=0.

14.3.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+ULSTFILE[=<op_code>[,<param1>[,<param2>]]]	+ULSTFILE: [<param3>,...[,<paramN>]] OK	AT+ULSTFILE=1 +ULSTFILE: 236800 OK
List of files stored into the FS			
Set	AT+ULSTFILE[=0[,<tag>]]	+ULSTFILE: [<filename1>[,<filename2>[,...[,<filenameN>]]]] OK	AT+ULSTFILE= +ULSTFILE: "filename" OK
Remaining free FS space expressed in bytes			
Set	AT+ULSTFILE=1[,<tag>]	+ULSTFILE: <free_fs_space> OK	AT+ULSTFILE=1 +ULSTFILE: 236800 OK
Size of the specified file			
Set	AT+ULSTFILE=2,<filename>[,<tag>]	+ULSTFILE: <file_size> OK	AT+ULSTFILE=2,"filename" +ULSTFILE: 784

Type	Syntax	Response	Example
			OK

14.3.3 Defined values

Parameter	Type	Description
<op_code>	Number	Allowed values are:
		• 0 (default value): lists the files belonging to <tag> file type
		• 1: gets the free space for the specific <tag> file type
		• 2: gets the file size expressed in bytes, belonging to <tag> type (if specified)
<tag>	String	Specifies the application file type. *FILE TAGS* table lists the allowed <tag> strings.
<filename1>,.., <filenameN>	String	File name. For file system file name and data size limits see *File system limits*.
<free_fs_space>	Number	Available free space on FS in bytes.
<file_size>	Number	Size of the file specified with the <filename> parameter.
<param1>	Number / String	Type and supported content depend on related <op_code> (details are given above).
<param2>	Number / String	Type and supported content depend on related <op_code> (details are given above).

14.4 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*

14.4.1 Description

Retrieves a file from the file system.

14.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+URDFILE=<filename>[,<tag>]	+URDFILE: <filename>,<size>,<data>	AT+URDFILE="filename"
		OK	+URDFILE: "filename",36,"these bytes are the data of the file"
			OK

14.4.3 Defined values

Parameter	Type	Description
<filename>	String	File name. For file system file name and data size limits see *File system limits*.
<tag>	String	The optional parameter <tag> specifies a different application file type. *FILE TAGS* table lists the allowed <tag> strings.
<size>	Number	File size, in bytes.
<data>	String	File content.

14.4.4 Notes

• The returned file data is displayed as an ASCII string of <size> characters in the range [0x00,0xFF]. At the end of the string, <CR><LF> are provided for user convenience and visualization purposes.

14.5 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*

14.5.1 Description

Deletes a stored file from the file system.

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

14.5.2 Syntax

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

14.5.3 Defined values

Parameter	Type	Description
<filename>	String	File name. For file system file name and data size limits see *File system limits*.
<tag>	String	The optional parameter <tag> specifies a different application file type. *FILE TAGS* table lists the allowed <tag> strings.

14.6 File system limits

14.6.1 Limits

Here below are listed the maximum file name length, the maximum data size of the file system and the maximum number of files for the u-blox cellular modules.

Maximum file name length:
- SARA-R4 - 248 characters

Maximum file size:
- SARA-R4 - File size limited by the available file system space retrieved by *+ULSTFILE=1* command

Maximum number of files:
- SARA-R4 - The theoretical maximum number of files that can be stored is 1100.

☞ The theoretical maximum file size and the maximum number of files also includes system, hidden and temporary files whose number is not statically predictable, so the actual numbers can be less than stated.

15 Internet protocol transport layer

15.1 Introduction

Before using TCP/IP services, a connection profile (either PSD or CSD) must be defined and activated. See the *+UCSD*, *+UCSDA* and *+UCSND* AT commands for establishing a CSD connection and *+UPSD*, *+UPSDA* and *+UPSND* AT commands for establishing a PSD connection. 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.

When these commands report an error result code which is not a +CME ERROR, the error code can be queried using the *+USOER* or *+USOCTL* (specifying the socket ID and with <param_id>=1) AT commands.

The maximum number of sockets that can be managed are 7.

☞ SARA-R4
No need to establish a PSD connection explicitly. This device automatically establishes a PSD connection as part of the network registration and attach procedure.

⚠ The UDP protocol has not any flow control mechanism and packets might be lost in the following scenarios:
- No network signal is available
- Unreliable radio interface (e.g. mobility in GPRS, where cell reselections can lead to data loss, that can be contrasted with the usage of LLC ack reliability QoS parameter

⚠ Some network operators close dynamic NATs after few minutes if there is no activity on the connection (no data transfer in the period). To solve this problem enable the TCP keep alive options with 1 minute delay (see the *+USOSO* AT command).

⚠ When both TCP and UDP socket are used at the same time at the maximum throughput (downlink and uplink at the maximum allowed baud rate) it is possible to lose some incoming UDP packets due to internal buffer limitation. A possible workaround is provided as follows:
- If it is possible, adopt an application layer UDP acknowledge system

15.2 IPv4/IPv6 addressing

15.2.1 Introduction

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

15.2.2 IPv4

Format:

- 32 bits long in dot-decimal notation (without leading 0 notation).
- All the decimal numbers must be in range 0-255.
- The dot-octal notation is not supported.
- The dot-hexadecimal notation is not supported.

Examples:

IPv4 address	Remarks
254.254.254.254	Valid address
010.228.76.34	Invalid address; first decimal number prefixed with a leading zero
257.228.76.34	Invalid address; first decimal number greater than 255
0010.0344.0114.0042	Invalid address; dot-octal notation; decimals given as octal numbers

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

Table 13: IPv4 address format examples

15.2.3 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 14: 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*

15.3 Create Socket +USOCR

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

15.3.1 Description

Creates a socket and associates it with the specified protocol (TCP or UDP), returns a number identifying the socket. Such command corresponds to the BSD socket routine. Up to 7 sockets can be created. It is possible to specify the local port to bind within the socket in order to send data from a specific port. The bind functionality is supported only for UDP sockets.

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

15.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCR=<protocol>[,<local_port>]	+USOCR: <socket> OK	AT+USOCR=17 +USOCR: 2 OK
Test	AT+USOCR=?	+USOCR: (list of supported <protocol>s), (list of supported <local_port>s) OK	+USOCR: (6,17),(1-65535) OK

15.3.3 Defined values

Parameter	Type	Description
<protocol>	Number	• 6: TCP • 17: UDP
<local_port>	Number	Local port to be used while sending data. The range goes from 1 to 65535. If the parameter is omitted it will be set to 0; in this case a random port will be used while sending data.
<socket>	Number	Socket identifier to be used for any future operation on that socket. The range goes from 0 to 6.

15.4 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	-	*TCP/UDP/IP Error* *+CME Error*

15.4.1 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.

15.4.2 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

15.4.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6
<level>	Number	• 0: IP protocol 　<opt_name> for IP protocol level may be: 　o 1: type of service (TOS) 　　<opt_val>: 8 bitmask that represents the flags of IP TOS. The range is 0-255 (the default value is 0). For more information see the RFC 791 [*27*] 　o 2: time-to-live (TTL) 　　<opt_val>: unsigned 8 bit value representing the TTL. The range is 0-255 (the default value is 255) • 6: TCP protocol 　<opt_name> for TCP protocol level may be: 　o 1: no delay option; do not delay send to coalesce packets; 　　<opt_val>: numeric parameter, it enables/disables the "no delay" option 　　- 0 (default value): disabled

Parameter	Type	Description
		- 1: enabled
		o 2: keepidle option: send keepidle probes when it is idle for <opt_val> milliseconds <opt_val>: signed 32 bit numeric parameter representing the milliseconds for "keepidle" option. The range is 0-2147483647. The default value is 7200000 (2 hours)
		• 65535: socket <opt_name> for socket level options may be:
		o 4: local address re-use. <opt_val>: numeric parameter, it configures the "local address re-use" option.
		- 0 (default value): disabled
		- 1: enabled
		o 8: keep connections alive. <opt_val>: numeric parameter, it configures "keep connections alive" option.
		- 0 (default value): disabled
		- 1: enabled
		o 32: sending of broadcast messages. <opt_val>: numeric parameter, it configures "sending of broadcast messages".
		- 0 (default value): disabled
		- 1: enabled
		o 128: linger on close if data present. <opt_val>: numeric parameter, it configures the "linger" option.
		- 0 (default value): disabled
		- 1: enabled
		<opt_val2>: signed 16 bit numeric parameter, it sets the linger time, the range goes from 0 to 32767 in milliseconds. The default value is 0.
		o 512: local address and port re-use. <opt_val>: numeric parameter, it configures the "local address and port re-use".
		- 0 (default value): disabled
		- 1: enabled
<opt_name>	Number	Type and supported content depend on related <level> (details are given above).
<opt_val>	Number	Type and supported content depend on related <level> (details are given above).
<opt_val2>	Number	Type and supported content depend on related <level> (details are given above).

15.4.4 Notes

SARA-R4

• <level> 6: TCP protocol, <opt_name> 2: keepidle option, is not supported.

15.5 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	-	*TCP/UDP/IP Error* *+CME Error*

15.5.1 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.

15.5.2 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)	+USOGO: (0-6),(0,6,65535)

Type	Syntax	Response	Example
		OK	OK

15.5.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6

<level>	Number	• 0: IP Protocol
		<opt_name> for IP protocol level may be:
		  o 1: type of service
		    <opt_val>: 8 bit mask that represents the flags of IP TOS. For more information see the RFC 791 [27]. The range is 0-255. The default value is 0
		  o 2: time-to-live
		    <opt_val>: unsigned 8 bit value representing the TTL. The range is 0-255. The default value is 0.
		• 6: TCP Protocol
		<opt_name> for TCP protocol level may be:
		  o 1: no delay option: do not delay send to coalesce packets
		    <opt_val>: numeric parameter, it enables/disables the "no delay" option
		    - 0 (default value): disabled
		    - 1: enabled
		  o 2: keepidle option: send keepidle probes when idle for <opt_val> milliseconds
		    <opt_val>: signed 32 bit number value representing the milliseconds for "keepidle" option. The range 0-2147483647. The default value is 7200000 (2 hours)
		• 65535: socket
		<opt_name> for the socket level options may be:
		  o 4: local address re-use
		    <opt_val>: numeric parameter, it configures the "local address re-use" option:
		    - 0 (default value): disabled
		    - 1: enabled
		  o 8: keep connections alive
		    <opt_val>: numeric parameter, it configures the "keep connections alive" option:
		    - 0 (default value): disabled
		    - 1: enabled
		  o 32: sending of broadcast messages
		    <opt_val>: numeric parameter, it configures the "sending of broadcast messages":
		    - 1: enabled
		    - 0 (default value): disabled
		  o 128: linger on close if data present
		    <opt_val>: numeric parameter, it sets on/off the "linger" option.
		    - 0 (default value): disabled
		    - 1: enabled
		    <opt_val2>: signed 16 bit numeric value, linger time, the range goes from 0 to 32767 in milliseconds. The default value is 0.
		  o 512: local address and port re-use
		    <opt_val>: numeric parameter, it enables/disables "local address and port re-use":
		    - 0 (default value): disabled
		    - 1: enabled

15.6 Close Socket +USOCL

+USOCL						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	partial	No	No	No	< 10s (except URC)	+CME Error

15.6.1 Description

Closes the specified socket, like the BSD close routine. In case of remote socket closure the user is notified via the URC.

15.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCL=<socket>	OK	AT+USOCL=2
			OK
Test	AT+USOCL=?	+USOCL: (list of supported <socket>s)	+USOCL: (0-6)
		OK	OK
URC		+UUSOCL: <socket>	+UUSOCL: 2

15.6.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6

15.7 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*

15.7.1 Description

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

15.7.2 Syntax

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

15.7.3 Defined values

Parameter	Type	Description
<socket_error>	Number	Code of the last error occurred in a socket operation. The allowed values are listed in *Appendix A.5* • 0: no error

15.8 Connect Socket +USOCO

+USOCO						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	partial	No	No	No	*< 20 s*	*TCP/UDP/IP Error* *+CME Error*

15.8.1 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.

15.8.2 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
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

15.8.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6
<remote_addr>	String	Remote host IP address or domain name of the remote host. For IP address format reference see the *IP addressing*.
<remote_port>	Number	Remote host port, in range 1-65535
<async_connect>	Number	Asynchronous connect flag. The flag has effect for TCP connections only. Allowed values: • 0 (default value): the final result code will be returned only once the TCP connection is established, this locks the AT interface until the connection status is received • 1: the final result code will be returned immediately (intermediate response), this unlocks the AT interface and makes it available for the execution of other AT commands. Once the result of TCP connection will be available, the connection status will be notified to the AT interface through the +UUSOCO URC. If <remote_addr> is an hostname and <async_connect>= 1, the intermediate result will be returned just after DNS resolution.
<socket_error>	Number	Code of the last error occurred in a socket operation. The allowed values are listed in *Appendix A.5* • 0: no error, connection successful

15.8.4 Notes

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• <async_connect> parameter and +UUSOCO URC are not available.

15.9 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	*< 10 s*	*TCP/UDP/IP Error* *+CME Error*

15.9.1 Description

Writes the specified amount of data to the specified socket, like the BSD write routine, and returns the number of bytes of data actually written. The command applies to UDP sockets too, after a *+USOCO* command.

There are three kinds of syntax:

• Base syntax normal: writing simple strings to the socket, some characters are forbidden
• Base syntax HEX: writing hexadecimal strings to the socket, the string will be converted in binary data and sent to the socket; see the *AT+UDCONF=1* command description to enable it
• Binary extended syntax: mandatory for writing any character in the ASCII range [0x00, 0xFF]

☞ Some notes about the **TCP socket**:
- If no network signal is available, the TCP packets are enqueued until the network will become available again. If the TCP queue is full the +USOWR command will return an error result code. To get the last socket error use the *+USOCTL=1* command. If the error code returned is 11, it means that the queue is full.
- If the connection is closed by the remote host, the *+UUSOCL* URC is not sent until all received data is read using the *AT+USORD* command. If AT+USOWR command is used in this situation, an error result code is returned. See also the *Notes* section about the specific product behaviour
- If the connection is closed by the remote host and binary interface started with AT+USOWR command is still waiting for data, an error result code is returned indicating that the binary interface was closed. After the error result code a *+UUSOCL* URC is reported indicating that the socket was closed.

☞ Some notes about the **UDP socket**:
- Due to the UDP specific AT commands, it is preferred to use the *+USOST* command to send data via UDP socket. This command does not require the usage of *+USOCO* before sending data.
- If no network signal is available, out going UDP packet may be lost.

☞ The information text response indicates that data has been sent to lower level of protocol stack. This is not an indication of an acknowledgement received by the remote server the socket is connected to.

15.9.2 Syntax

Type	Syntax	Response	Example
Base syntax			
Set	AT+USOWR=<socket>,<length>,<data>	+USOWR: <socket>,<length>	AT+USOWR=3,12,"Hello world!"
		OK	+USOWR: 3,12
			OK
Binary syntax			
Set	AT+USOWR=<socket>,<length>	@<data>	AT+USOWR=3,16
		+USOWR: <socket>,<length>	@16 bytes of data
		OK	+USOWR: 3,16
			OK
Test	AT+USOWR=?	+USOWR: (list of supported <socket>s), (list of supported <length>s),"HEX data"	+USOWR: (0-6),(0-512),"HEX data"
		+USOWR: (list of supported <socket>s), (list of supported <length>s),"data"	+USOWR: (0-6),(0-1024),"data"
		+USOWR: (list of supported <socket>s), (list of supported <length>s)	+USOWR: (0-6),(0-1024)
		OK	OK

15.9.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6.
<length>	Number	Number of data bytes to write: • Base syntax normal mode: range 1-1024 • Base syntax HEX mode: range 1-512 • Binary extended syntax: range 1-1024
<data>	String	Data bytes to be written. Not all of the ASCII charset can be used.

15.9.4 Notes

- For base syntax:
  - o The value of <length> and the actual length of <data> must match
- For base syntax HEX mode:
  - o Only the ASCII characters 0-9, A-F and a-f are allowed.

o The length of the <data> parameter must be two times the <length> parameter.
• For binary syntax:
  o 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.
  o After the @ prompt reception, wait for a minimum of 50 ms before sending data.
  o The binary extended syntax is the only way for the system to accept control characters as data; for the AT command specifications 3GPP TS 27.005 [16], characters like <CR>, <CTRL-Z>, quotation marks, etc. have a specific meaning and they cannot be used like data in the command itself. The command is so extended with a specific acceptance state identified by the @ prompt.
  o 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].
  o In binary mode the module does not display the echo of data bytes.
  o Binary syntax is not affected by HEX mode option.
• For <data> parameter not all of the ASCII charset can be used.

15.10 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	< 10 s	TCP/UDP/IP Error +CME Error

15.10.1 Description

Writes the specified amount of data to the remote address, like the BSD sendto routine, and returns the number of bytes of data actually written. It can be applied to UDP sockets only. This command allows the reuse of the same socket to send data to many different remote hosts.

There are three kinds of syntax:
• Base syntax normal: writing simple strings to the socket, there are characters which are forbidden
• Base syntax HEX: writing hexadecimal strings to the socket, the string will be converted in binary data and sent to the socket
• Binary extended syntax: mandatory for writing any character in the ASCII range [0x00, 0xFF]

☞ It is strongly recommended using this command to send data while using UDP sockets. It is also recommended avoiding +USOCO usage with UDP socket.

☞ (about UDP socket): if no network signal is available, outcoming UDP packet may be lost.

☞ To enable the base syntax HEX mode, see the AT+UDCONF=1 command description.

15.10.2 Syntax

Type	Syntax	Response	Example
Set (Base)	AT+USOST=<socket>,<remote_addr>, <remote_port>,<length>,<data>	+USOST: <socket>,<length> OK	AT+USOST=3,"151.9.34.66",449,16,"16 bytes of data" +USOST: 3,16 OK
Set (Binary)	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=?	+USOWR: (list of supported <socket>s), "remote_host",(list of supported <remote_port>s),(list of supported <length>s),"HEX data"	+USOST: (0-6),"remote_host",(1-65535), (0-512),"HEX data"
			+USOST: (0-6),"remote_host",(1-65535), (0-1024),"data"
		+USOWR: (list of supported <socket>s), "remote_host",(list of supported <remote_port>s),(list of supported <length>s),"data"	+USOST: (0-6),"remote_host",(1-65535), (0-1024)
			OK
		+USOWR: (list of supported <socket>s), "remote_host",(list of supported <remote_port>s),(list of supported <length>s)	
		OK	

15.10.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6
<remote_addr>	String	Remote host IP address or domain name of the remote host. For IP address format reference see the *IP addressing*.
<remote_port>	Number	Remote host port, in range 1-65535
<length>	Number	Number of data bytes to write • Base syntax normal mode: range 1-1024 • Base syntax HEX mode: range 1-512 • Binary syntax mode: range 1-1024
<data>	String	Data bytes to be written (not all of the ASCII charset can be used)

15.10.4 Notes

- For base syntax:
  - The value of <length> and the actual length of <data> must match
  - For base syntax HEX mode, only ASCII characters 0-9, A-F and a-f are allowed. The length of the <data> parameter must be two times the <length> parameter
- For binary syntax:
  - After the command is sent, the user waits for the @ prompt. When it appears the stream of bytes can be provided. After the specified amount of bytes has been sent, the system returns with final result code. The feed process cannot be interrupted i.e. the return in the command mode can be effective only when the number of bytes provided is the declared one
  - That binary extended syntax is the only way for the system to accept control characters as data; for the AT command specifications [16], characters like <CR>, <CTRL-Z>, quotation marks, etc. have a specific meaning and they cannot be used like data in the command itself. The command is so extended with a specific acceptance state identified by the @ prompt
  - This feature can be successfully used when there is need to send a byte stream which belongs to a protocol that has any kind of characters in the ASCII range [0x00,0xFF]
  - In binary mode the module does not display the echo of data bytes
  - Binary syntax is not affected by HEX mode option

15.11 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	*< 10s (except URC)*	*TCP/UDP/IP Error* *+CME Error*

15.11.1 Description

Reads the specified amount of data from the specified socket, like the BSD read routine. This command can be used to know the total amount of unread data.

For the TCP socket type the URC **+UUSORD: <socket>,<length>** notifies the data bytes available for reading, either when buffer is empty and new data arrives or after a partial read by the user.

For the UDP socket type the URC **+UUSORD: <socket>,<length>** notifies that a UDP packet has been received, either when buffer is empty or after a UDP packet has been read and one or more packets are stored in the buffer.

In case of a partial read of a UDP packet **+UUSORD: <socket>,<length>** will show the remaining number of data bytes of the packet the user is reading.

☞ (about UDP socket) Due to the UDP specific AT command, it is preferred to use the *+USORF* command to read data from UDP socket. *+USORF* command does not require the usage of *+USOCO* before reading data.

☞ When applied to UDP active sockets if the UDP socket is not set in listening mode (see *+USOLI*) it will not be possible to receive any packet if a previous write operation is not performed.

☞ If the HEX mode is enabled (refer to *AT+UDCONF=1* command) the received data will be displayed using an hexadecimal string.

15.11.2 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
URC		+UUSORD: <socket>,<length>	+UUSORD: 3,16
Test	AT+USORD=?	+USORD: (list of supported <socket>s), (list of supported <length>s) OK	+USORD: (0-6),(0-1024) OK

15.11.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6
<length>	Number	Number of data bytes • to read stored in buffer, in range 0-1024 in the set command • read from buffer, in range 0-1024 • stored in buffer for the URC
<data>	String	Data bytes to be read

15.11.4 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>.

15.12 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	*< 10s (except URC)*	*TCP/UDP/IP Error +CME Error*

15.12.1 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.

15.12.2 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

15.12.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6
<remote_ip_addr>	String	Remote host IP address. For IP address format reference see the *IP addressing*.
<remote_port>	Number	Remote host port, in range 1-65535
<length>	Number	Number of data bytes to read, in range 0-1024
<data>	String	Data bytes to be read

15.12.4 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>.

15.13 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	*< 10s (except URC)*	*TCP/UDP/IP Error +CME Error*

15.13.1 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.

15.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOLI=<socket>,<port>	OK	**TCP sockets**
			AT+USOLI=2,1200
			OK
			+UUSOLI: 3,"151.63.16.7",1403,2, "82.89.67.164",1200
			UDP sockets
			AT+USOLI=0,1182
			OK
			+UUSORF: 0,1024
Test	AT+USOLI=?	+USOLI: (list of supported <socket>s),(list of supported <port>s)	+USOLI: (0-6),(1-65535)

Type	Syntax	Response	Example
		OK	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

15.13.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6
<port>	Number	Port of service, range 1-65535. Port numbers below 1024 are not recommended since they are usually reserved
<ip_address>	String	Remote host IP address (only in URC +UUSOLI). For IP address format reference see the *IP addressing*.
<listening_socket>	Number	Socket identifier specified within the AT+USOLI command, indicates on which listening socket the connection has been accepted (only in +UUSOLI URC)
<local_ip_address>	String	TE IP address (only in +UUSOLI URC). For IP address format reference see the *IP addressing*.
<listening_port>	Number	Listening port that has accepted the connection. This port is specified within the AT+USOLI command (only in +UUSOLI URC)
<length>	Number	Data length received on the UDP listening socket (only in +UUSORF unsolicited indication). In order to know the sender IP address and port, use the *AT+USORF* command.

15.13.4 Notes

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

15.14 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*

15.14.1 Description

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

15.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=1,<hex_mode_disable>	OK	AT+UDCONF=1,0 OK
Read	AT+UDCONF=1	+UDCONF: 1,<hex_mode_disable> OK	AT+UDCONF=1 +UDCONF: 1,1 OK

15.14.3 Defined values

Parameter	Type	Description
<hex_mode_disable>	Number	Enables/disables the HEX mode for *+USOWR*, *+USOST*, *+USORD* and *+USORF* AT commands. Allowed values: • 0 (factory-programmed value): HEX mode disabled • 1: HEX mode enabled

15.15 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	*< 10 s*	*+CME Error*

15.15.1 Description

Establishes a transparent end to end communication with an already connected TCP or UDP socket via the serial interface. The data can be sent to the socket and can be received via the serial interface: the HW flow control usage is strongly recommended to avoid data loss.

The transparent TCP/UDP connection mode can be exited via the +++ sequence, entered after at least 2 s of suspension of transmission to the port. The socket will remain connected and communication can be re-established any time.

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

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

15.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+USODL=<socket>	CONNECT	AT+USODL=0
			CONNECT
Test	AT+USODL=?	+USODL: (list of supported <socket>s)	+USODL: (0-6)
		OK	OK

15.15.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6.

15.15.4 Enhanced Direct Link

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

- Timer Trigger
- Data Length Trigger
- Character Trigger

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

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

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

By default no triggers are enabled for TCP sockets.

See the *+UDCONF=5*, *+UDCONF=6*, *+UDCONF=7*, *+UDCONF=8* commands description for the transmission triggers configuration.

15.15.4.1 Timer Trigger (TT)

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

The timer range is between 100 and 120000 ms; the special value 0 (zero) means that the timer is disabled.

By default the timer trigger is disabled for TCP sockets and enabled with a value of 500 ms for UDP sockets.

The *+UDCONF=5* command can configure the timer trigger.

15.15.4.2 Data Length Trigger (DLT)

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

The minimum data length is 3, the maximum data length is 2048 bytes for TCP and 1472 bytes for UDP. If the data length is set to 0 (zero) the trigger is disabled (every data chunk received from the serial port is immediately sent to the network).

By default the data length trigger is disabled for TCP sockets and set to 1024 for UDP sockets.

The *+UDCONF=6* command can configure the data length trigger.

15.15.4.3 Character Trigger (CT)

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

If the specified character is -1, the character trigger is disabled.

By default it is disabled for both TCP and UDP sockets.

The *+UDCONF=7* command can configure the character trigger.

15.15.4.4 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.

15.15.4.5 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.

15.15.4.6 Data from the network

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

15.15.4.7 Congestion timer

Is it also possible to set a congestion timer after which, in case of network congestion, the module exits from direct link.

The timer range is between 1000 and 720000 ms, the special value 0 (zero) means that the timer is disabled.

By default the congestion timer is set to 60000 (60 s) for both TCP and UDP sockets.

The *+UDCONF=8* command can configure the congestion timer.

15.16 UDP Direct Link Packet Size configuration +UDCONF=2

+UDCONF=2						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	*+CME Error*

15.16.1 Description

Set the packet size for the UDP direct link packet.

15.16.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=2,<socket_id>,<packet_size>	OK	AT+UDCONF=2,1,1024 OK
Read	AT+UDCONF=2,<socket_id>	+UDCONF: 2,<socket_id>,<packet_size> OK	AT+UDCONF=2,1 +UDCONF: 2,1,1024 OK

15.16.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings. Valid range is 0-6
<packet_size>	Number	Packet size (in bytes) for UDP direct link; valid range is 100-1472; the factory-programmed value is 1024 bytes

15.17 UDP Direct Link Sending timer configuration +UDCONF=3

+UDCONF=3						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	+CME Error

15.17.1 Description

Configures the UDP direct link set sending timer.

15.17.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=3,<socket_id>,<sending_timer_timeout>	OK	AT+UDCONF=3,1,1000 OK
Read	AT+UDCONF=3,<socket_id>	+UDCONF: 3,<socket_id>,<sending_timer_timeout> OK	AT+UDCONF=3,1 +UDCONF: 3,1,1000 OK

15.17.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings. Allowed range is 0-6
<sending_timer_timeout>	Number	Sending timer (in milliseconds) for UDP direct link; valid range is 100-120000; the default value is 1000 ms

15.18 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

15.18.1 Description

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

15.18.2 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>	AT+UDCONF=5,0
			+UDCONF: 5,0,500
		OK	
			OK

15.18.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings.
		Valid range is 0-6
<timer_trigger>	Number	Enhanced Direct Link sending timer trigger (in milliseconds); valid range is 0, 100 120000; the factory-programmed value is 500 ms for UDP, 0 for TCP, 0 means trigger disabled

15.19 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

15.19.1 Description

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

15.19.2 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>	AT+UDCONF=6,0
			+UDCONF: 6,0,1024
		OK	
			OK

15.19.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings.
		Valid range is 0-6
<data_length_trigger>	Number	Enhanced Direct Link data length trigger in bytes, valid range is 0, 3 1472 for UDP and 0, 3-2048 for TCP, the factory-programmed value is 1024 for UDP, 0 for TCP, 0 means trigger disabled

15.20 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

15.20.1 Description

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

15.20.2 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

15.20.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the Direct Link settings. The allowed range is 0-6
<character_trigger>	Number	Enhanced Direct Link character trigger, the value represents the ASCII code (in base 10) of the character to be used as character trigger. The allowed range is -1, 0-255, the factory-programmed value is -1; -1 means trigger disabled

15.21 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

15.21.1 Description

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

15.21.2 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

15.21.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the Direct Link settings. Valid range is 0-6
<congestion_timer>	Number	Enhanced Direct Link congestion timer (in milliseconds); valid range is 0, 1000-720000; the factory-programmed value is 60000, 0 means trigger disabled

15.22 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

15.22.1 Description

Allows interaction with the low level socket layer.

15.22.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCTL=<socket>,<param_id>	+USOCTL: <socket>,<param_id>, <param_val>[,<param_val2>] OK	AT+USOCTL=0,2 +USOCTL: 0,2,38 OK
Test	AT+USOCTL=?	+USOCTL: (list of supported <socket>s), (list of supported <param_id>s) OK	+USOCTL: (0-6),(0-4,10-11) OK

15.22.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. The range goes from 0 to 6
<param_id>	Number	Control request identifier. Possible values are: • 0: query for socket type • 1: query for last socket error • 2: get the total amount of bytes sent from the socket • 3: get the total amount of bytes received by the socket • 4: query for remote peer IP address and port • 10: query for TCP socket status (only TCP sockets) • 11: query for TCP outgoing unacknowledged data (only TCP sockets) • 5-9, 12-99: RFU
<param_val>	Number / String	This value may assume different means depending on the <param_id> parameter. If <param_id>= 0, <param_val> can assume these values: • 6 TCP socket • 17: UDP socket If <param_id>= 1, <param_val> can assume these values: • N: last socket error If <param_id>= 2, <param_val> can assume these values: • N: the total amount (in bytes) of sent (acknowledged + unacknowledged) data If <param_id>= 3, <param_val> can assume these values: • N: the total amount (in bytes) of received (read) data If <param_id>= 4, <param_val> can assume these values: • A string representing the remote peer IP address expressed in dotted decimal form If <param_id>= 10, <param_val> can assume these values: • 0: the socket is in INACTIVE status (it corresponds to CLOSED status defined in RFC793 "TCP Protocol Specification" [111]) • 1: the socket is in LISTEN status • 2: the socket is in SYN_SENT status • 3: the socket is in SYN_RCVD status • 4: the socket is in ESTABILISHED status • 5: the socket is in FIN_WAIT_1 status • 6: the socket is in FIN_WAIT_2 status • 7: the sokcet is in CLOSE_WAIT status • 8: the socket is in CLOSING status • 9: the socket is in LAST_ACK status • 10: the socket is in TIME_WAIT status If <param_id>= 11, <param_val> can assume these values: • N: the total amount of outgoing unacknowledged data
<param_val2>	Number	This value is present only when <param_id> is 4. It represents the remote peer IP port. For IP address format reference see the *IP addressing*.

16 FTP

Proprietary u-blox AT commands. FTP AT commands set can be used for sending and receiving files over the available bearer, transparently retrieving and storing them in the file system. Standard file and directory management operations on the remote FTP server are as well possible. PSD or CSD connection must be activated before using FTP client services.

Basically, two AT commands are necessary for an FTP client service: one AT command (+*UFTP*) to configure the FTP profile, a second AT command to execute a specific FTP command (+*UFTPC*). The final result of an FTP command will be notified through the +UUFTPCR URC whereas data will be provided through +UUFTPCD URC.

When these commands report an error which is not a +CME ERROR, the error code can be queried using the +*UFTPER* AT command.

☞ SARA-R4
  No need to establish a PSD connection explicitly. This device automatically establishes a PSD connection as part of the network registration and attach procedure.

16.1 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	-	*Appendix A.6.1*

16.1.1 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.

16.1.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UFTP=<op_code>[,<param1>[, <param2>]]	OK	AT+UFTP=7,21 OK
FTP server IP address			
Set	AT+UFTP=0[,<IP_address>]	OK	AT+UFTP=0,"192.168.1.0" OK
FTP server name			
Set	AT+UFTP=1[,<server_name>]	OK	AT+UFTP=1,"ftp.server.com" OK
Username			
Set	AT+UFTP=2[,<username>]	OK	AT+UFTP=2,"user_test" OK
Password			
Set	AT+UFTP=3[,<password>]	OK	AT+UFTP=3,"PWD" OK
Account			
Set	AT+UFTP=4[,<account>]	OK	AT+UFTP=4,"test" OK

Type	Syntax	Response	Example
Inactivity timeout			
Set	AT+UFTP=5[,<timeout>]	OK	AT+UFTP=5,21
			OK
FTP mode			
Set	AT+UFTP=6[,<FTP_mode>]	OK	AT+UFTP=6,1
			OK
FTP server port			
Set	AT+UFTP=7[,<FTP_server_port>]	OK	AT+UFTP=7,30
			OK
FTP Secure option in explicit mode			
Set	AT+UFTP=8[,<FTP_secure>[,<USECMNG_ profile>]]	OK	AT+UFTP=8,1,2
			OK
Read	AT+UFTP?	+UFTP: 0,<IP_address>	+UFTP: 0,"216.239.59.147"
		+UFTP: 1,<server_name>	+UFTP: 1,""
		+UFTP: 2,<username>	+UFTP: 2,"username"
		+UFTP: 4,<account>	+UFTP: 4,"account"
		+UFTP: 5,<timeout>	+UFTP: 5,0
		+UFTP: 6,<FTP_mode>	+UFTP: 6,0
		+UFTP: 7,<FTP_server_port>	+UFTP: 7,21
		[+UFTP: 8,<FTP_secure>[,<USECMNG_ profile>]]	+UFTP: 8,0
			OK
		OK	
Test	AT+UFTP=?	+UFTP: (list of supported <param_tag>s)	+UFTP: (0-8)
		OK	OK

16.1.3 Defined values

Parameter	Type	Description
<op_code>	String	FTP parameter: • 0: FTP server IP address • 1: FTP server name • 2: FTP username • 3: FTP password • 4: FTP additional user account • 5: FTP inactivity timeout period • 6: FTP mode • 7: Remote FTP server listening port • 8: FTP secure
<IP_address>	String	FTP server IP address. The default value is an empty string. For IP address format reference see the *IP addressing*.
<server_name>	String	FTP server name (e.g. "ftp.server.com"). The maximum length is 128 characters. The default value is an empty string.
<username>	String	User name (the maximum length is 30 characters) for the FTP login procedure. The default value is an empty string.
<password>	String	Password (the maximum length is 30 characters) for the FTP login procedure. The default value is an empty string.
<account>	String	Additional user account (if required) for the FTP login procedure. The maximum length is 30 characters. The default value is an empty string.
<timeout>	Number	Inactivity timeout period in seconds. The range goes from 0 to 86400 s; 0 means no timeout (the FTP session will not be terminated in the absence of incoming traffic). The default value is 30 s.
<FTP_mode>	Number	FTP mode: • 0 (default value): active • 1: passive

Parameter	Type	Description
<FTP_server_port>	Number	Remote FTP server listening port; it must be a valid TCP port value. The range goes from 1 to 65535; the default value is 21.
<FTP_secure>	Number	Enables / disables the Secure option (explicit mode) of FTP client service. FTP Secure option in explicit mode (SSL encryption of FTP control channel; FTP data channel is not encrypted): • 0 (default value): no SSL encryption • 1: enable SSL encryption of FTP control connection
<USECMNG_profile>	Number	USECMNG profile (number). Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see *USECMNG* section).
<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.

16.1.4 Notes

- The information text response to the read command does not display the password.
- The FTP server IP address and the FTP server name are mutually exclusive. If value for <op_code>=0 is specified by user, then value for <op_code>=1 is reset or vice versa.
- Some network operators do not allow incoming connections. Due to these limitations introduced by network operators it is possible to encounter problems using FTP active mode. If the FTP active mode fails to exchange files, try the passive mode to solve the problem.
- Some network operators do not allow FTPS. In this case the *+UFTPC=1* command (FTP login) will return a failure response via *+UUFTPCR* URC after an SSL timeout of 30 s.

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- <op_code>=8 is not supported.

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- During connection to FTP remote server (via FTP login command) the FTP profile parameters cannot be changed or reset to factory-programmed values until disconnection takes place (FTP logout). Only <op_code>=5 (inactivity timeout), and <op_code>=6 (FTP mode), can be updated while the FTP connection is on the go.

16.2 FTP command +UFTPC

+UFTPC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	*Appendix A.6.1*

16.2.1 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.

16.2.2 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

Type	Syntax	Response	Example
			OK
FTP login			
Set	AT+UFTPC=1	OK	AT+UFTPC=1
			OK
Delete the file from the FTP server			
Set	AT+UFTPC=2,<file_name>	OK	AT+UFTPC=2,"mytest"
			OK
Rename a file of FTP server			
Set	AT+UFTPC=3,<file_name>,<new_file_name>	OK	AT+UFTPC=3,"old_name","final_name"
			OK
Retrieve the file from the FTP server			
Set	AT+UFTPC=4,<remote_file_name>,<local_file_name>[,<retrieving_mode>]	OK	AT+UFTPC=4,"data.zip","data.zip"
			OK
Store the file on the FTP server			
Set	AT+UFTPC=5,<local_file_name>,<remote_file_name>[,<number_of_byte>]	OK	AT+UFTPC=5,"data.zip","data.zip",30
			OK
Retrieve a file from the FTP server using direct link mode			
Set	AT+UFTPC=6,<remote_file_name>[,<number_of_byte>]	OK	AT+UFTPC=6,"data.zip",30
			OK
Send a file to the FTP server using the direct link mode			
Set	AT+UFTPC=7,<remote_file_name>[,<number_of_byte>]	OK	AT+UFTPC=7,"data.zip",30
			OK
Change the working directory to the specified one			
Set	AT+UFTPC=8,<directory_name>	OK	AT+UFTPC=8,"data_folder"
			OK
Create a directory on the FTP host			
Set	AT+UFTPC=10,<directory_name>	OK	AT+UFTPC=10,"new_data_folder"
			OK
Remove the directory from the remote FTP server			
Set	AT+UFTPC=11,<directory_name>	OK	AT+UFTPC=11,"data_folder"
			OK
Information of a file or a directory			
Set	AT+UFTPC=13[,<file_directory_name>]	OK	AT+UFTPC=13,"data_folder"
			OK
List the file names in a specified directory			
Set	AT+UFTPC=14[,<file_directory_name>]	OK	AT+UFTPC=14,"data.zip"
			OK
Retrieve the FOTA update file			
Set	AT+UFTPC=100,<remote_file_name>	OK	AT+UFTPC=100,"data.zip"
			OK
Test	AT+UFTPC=?	+UFTPC: (list of supported <op_code>s)	+UFTPC: (0-5,8,10,11,13,14,100)
		OK	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

16.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	FTP command request. Allowed values:
		• 0: FTP logout; terminates the FTP session by performing a logout.

Parameter	Type	Description
		• 1: FTP login; connects to the FTP server using the parameters of the current FTP profile (set via *AT+UFTP* command).
		• 2: deletes the file from the FTP server.
		• 3: renames the file. This AT command just sends requests to the FTP process.
		• 4: retrieves the file from the FTP server.
		• 5: stores the file on the FTP server.
		• 6: retrieves a file from the FTP server using direct link mode. This command handles the initial steps of the FTP protocol for retrieving a file; after that it will establish a transparent end to end communication with the data connection TCP socket via the serial interface. After the CONNECT result code, the file content will be directly sent to the serial interface. When the data transfer is completed, the module will automatically exit from direct link mode (no need to send +++ sequence).
		• 7: sends a file to the FTP server using the direct link mode. This command handles the initial steps of the FTP protocol for sending a file; after that it will establish a transparent end to end communication with the data connection TCP socket via the serial interface. After the CONNECT result code, the user can send the file content via the serial interface. Once finished, the user must wait at least 2 s before sending the +++ sequence to switch off the direct link mode. This operation may take a few seconds because the command also handles the final steps of the FTP protocol
		• 8: changes the working directory to the specified one.
		• 9: RFU.
		• 10: creates a directory on the FTP host.
		• 11: removes the directory from the remote FTP server.
		• 12: RFU.
		• 13: information of a file or a directory. The URC +UUFTPCD returns the information of the specified file or directory from the FTP server.
		• 14: lists the file names in a specified directory. The URC +UUFTPCD returns the list of the file names received from FTP server. If the directory name is omitted, the list of the files names of current working directory is requested.
		• 100: retrieves the FOTA update file. The downloaded file will not be accessible to the user. The +UUFTPCR URC will display the MD5 checksum of the downloaded file.
<file_name>	String	File name to be deleted/renamed from the FTP host. For the limit of the length of the string, see *Command line*.
<new_file_name>	String	New file name. For the limit of the length of the string, see *Command line*.
<remote_file_name>	String	Remote file name to be retrieved from the FTP host or stored in it. The maximum parameter length is 256 characters.
<local_file_name>	String	Local file name (module file system) text string to be stored/sent on the file system. For the limit of the length of the string, see the *File system limits*.
<retrieving_mode>	Number	Allowed values: • 0 (default value): the file is retrieved from beginning. • 1: restart the data retrieving from the last data received during the previous download interrupted due to error.
<number_of_byte>	Number	Represents the number of bytes already sent to the FTP server or received from it. • During a file retrieval the server writes the file from the offset indicated with this parameter. • During a file storing the server sends the data from the value indicated with this parameter.
<directory_name>	String	Directory name on the FTP server. For the limit of the length of the string, see *Command line*.
<file_directory_name>	String	Path file/directory name to be listed. If not specified, the current directory list is requested. For the limit of the length of the string, see *Command line*. • <param1> optional parameter; the text string of the path (file or directory) to be name listed. If not specified, the list of the files names of current working directory is requested.
<ftp_data_len>	Number	Amount of data in bytes
<ftp_data>	String	Data available from the FTP server in the ASCII [0x00,0xFF] range. The starting quotation mark shall not be taken into account like data, the first byte of data starts after the first quotation mark. The total number of bytes is <ftp_data_len>. At the end of the byte stream, another quotation mark is provided for user convenience and visualization purposes.
<ftp_result>	Number	• 0: fail • 1: success
<md5_sum>	String	MD5 checksum of the FOTA update file downloaded via *+UFTPC=100* AT command. This parameter is issued only for *+UFTPC=100* AT command.
<param1>	String	Content depend on related <op_code> (details are given above)
<param2>	String	Content depend on related <op_code> (details are given above)

Parameter	Type	Description
<param3>	String	Content depend on related <op_code> (details are given above)

16.2.4 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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- <md5_sum> is not supported.

16.3 FTP error +UFTPER

+UFTPER						
Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	full	No	No	No	-	*Appendix A.6.1*

16.3.1 Description

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

16.3.2 Syntax

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

16.3.3 Defined values

Parameter	Type	Description
<error_class>	Number	Value of error class. Values are listed in *Appendix A.6*
<error_code>	Number	Value of class-specific error code (reply code if <error_class> is 0). The values are listed in *Appendix A.6.1*

17 HTTP

The section describes the u-blox proprietary AT commands that can be used for sending requests to a remote HTTP server, receiving the server response and transparently storing it in the file system. The supported methods are: HEAD, GET, DELETE, PUT, POST file and POST data. A PSD or CSD connection must be activated before using HTTP AT commands.

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

☞ SARA-R4
No need to establish a PSD connection explicitly. This device automatically establishes a PSD connection as part of the network registration and attach procedure.

17.1 HTTP control +UHTTP

+UHTTP

Modules	All products					
Attributes	Syntax	PIN required	Settings saved	Can be aborted	Response time	Error reference
	partial	No	No	No	-	*Appendix A.6*

17.1.1 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>

17.1.2 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>	AT+UHTTP=2,1

Type	Syntax	Response	Example
		OK	+UHTTP: 2,1,"www.u-blox.com"
			OK
Username			
Set	AT+UHTTP=<profile_id>,2,<username>	OK	AT+UHTTP=2,0,"my_user"
			OK
Read	AT+UHTTP=<profile_id>,2	+UHTTP: <profile_id>,2,<username>	AT+UHTTP=2,2
		OK	+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>	AT+UHTTP=2,3
		OK	+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>	AT+UHTTP=2,4
		OK	+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>	AT+UHTTP=2,5
		OK	+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>]	AT+UHTTP=2,6
		OK	+UHTTP: 2,6,1
			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)
		OK	OK

17.1.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<op_code>	Number	• 0: HTTP server IP address; • 1: HTTP server name; • 2: username • 3: password • 4: authentication type • 5: HTTP server port • 6: HTTP Secure option (SSL encryption) • 7: reserved for internal use only • 8: reserved for internal use only • 9: reserved for internal use only

Parameter	Type	Description
<HTTP_server_IP_address>	String	HTTP server IP address; The factory-programmed value is an empty text string. For IP address format reference see the *IP addressing*.
<HTTP_server_name>	String	HTTP server name; the maximum length is 128 characters (e.g. "http.server.com"). The factory-programmed value is an empty text string.
<username>	String	User name; the maximum length is 30 characters; it is used for the HTTP login procedure if the authentication is used. The factory-programmed value is an empty text string.
<password>	String	Password; the maximum length is 30 characters; it is used for the HTTP login procedure if the authentication is used. The factory-programmed value is an empty text string.
<HTTP_authentication>	Number	HTTP authentication method; the allowed values are: • 0 (factory-programmed value): no authentication • 1: basic authentication (the password and username must be set)
<HTTP_port>	Number	HTTP server port; range 1-65535. It means the HTTP server port to be used in a HTTP request; the factory-programmed value is 80.
<HTTP_secure>	Number	HTTP Secure option (SSL encryption). It enables or disables the HTTPS (SSL secured connection for HTTP application) usage: • 0 (factory-programmed value): HTTPS (SSL encryption) disabled and the HTTP server port set to 80 • 1: HTTPS (SSL encryption) enabled and the HTTP server port set to 443; an USECMNG profile can be specified with an additional parameter.
<USECMNG_profile>	Number	Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used
<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.

17.1.4 Notes

• HTTP server IP address and HTTP server name are mutually exclusive. If the HTTP server IP address is specified by the user, then the value for the HTTP server name is reset, or vice versa.

SARA-R4

• <op_code>=6 is not supported.

17.2 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	-	*Appendix A.6*

17.2.1 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.

17.2.2 Syntax

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

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

17.2.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3

<param_tag>	Number	• 0: HTTP request COOKIES; manage request COOKIES sent to the HTTP server.
		
		o <key>: index of the cookie (number); range 0-3. Identifies the cookie to be read if <value> is omitted or configured if <value> is a valid string.
		o <value>: value of the cookie (string); the maximum length is 256 characters. The cookie values respect the following rules:
		  - Empty string (""): the cookie will be cleared and will not be present in the request;
		  - Simple one-value cookie: the cookie will be set and sent in the request;
		  - Complex multi-value cookie: the cookies will be set and sent in the request. The multiple cookies must be separated by a left-attached semicolon(";") and a space(" ");

<key>	Number/String	Content depends on the related <param_tag> (see above).
<value>	Number/String	Content depends on the related <param_tag> (see above).

17.2.4 Examples and use cases

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

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

17.3 HTTP command +UHTTPC

+UHTTPC

Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	*Appendix A.6*

17.3.1 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.

17.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UHTTPC=<profile_id>,<http_command>,<path>,<filename>[,<param1>[,<param2>[,<param3>]]]	OK	AT+UHTTPC=0,1,"/path/file.html","responseFilename" OK
Test	AT+UHTTPC=?	+UHTTPC: (list of supported <profile_id>s),(list of supported <http_command>s) OK	+UHTTPC: (0-3),(0-5) OK

Type	Syntax	Response	Example
URC		+UUHTTPCR: <profile_id>,<http_command>,<http_result>	+UUHTTPCR: 0,1,1

17.3.3 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. o <param1>: not allowed o <param2>: not allowed o <param3>: not allowed • 1: GET command; perform a GET request to the HTTP server. o <param1>: not allowed o <param2>: not allowed o <param3>: not allowed • 2: DELETE command; send a DELETE request to the HTTP server. o <param1>: not allowed o <param2>: not allowed o <param3>: not allowed • 3: PUT command; perform a PUT request to the HTTP server. o <param1>: filesystem filename (string). It is a mandatory string representing the file system filename to be sent to the HTTP server within the PUT request. For file system file name and data size limits see *File system limits*. o <param2>: HTTP Content-Type identifier (number); the range is 0-6. It is an optional numeric parameter representing the HTTP Content-Type identifier - 0: application/x-www-form-urlencoded - 1: text/plain - 2: application/octet-stream - 3: multipart/form-data - 4: application/json - 5: application/xml - 6: user defined with <param3> o <param3>: used only when <param2>=6 (user defined Content-Type). The maximum length is 64 characters • 4: POST a file command; issue a POST request for sending a file to the HTTP server. o <param1>: filesystem filename (string). It is a mandatory string representing the file system filename to be sent to the HTTP server within the POST request. For file system file name and data size limits see *File system limits*. o <param2>: HTTP Content-Type identifier (number); the range is 0-6. It is a mandatory numeric parameter representing the HTTP Content-Type identifier - 0: application/x-www-form-urlencoded - 1: text/plain - 2: application/octet-stream - 3: multipart/form-data - 4: application/json - 5: application/xml - 6: user defined with <param3> o <param3>: used only when <param2>=6 (user defined Content-Type). The maximum length is 64 characters • 5: POST data command; send a POST request to the HTTP server using the data specified in <param1> parameter o <param1>: data (string); the maximum length is 128 bytes. It is a mandatory string representing the data to be sent to the HTTP server with the POST request. The data must be formatted according to the Content-Type specified in <param2> parameter. o <param2>: HTTP Content-Type identifier (number); the range is 0-6. It is a mandatory numeric parameter representing the HTTP Content-Type identifier - 0: application/x-www-form-urlencoded

Parameter	Type	Description
		- 1: text/plain
		- 2: application/octet-stream
		- 3: multipart/form-data
		- 5: application/xml
		- 6: user defined with <param3>
		o <param3>: used when <param2> is set to 6 (user defined Content-Type). The maximum length of the user defined content type is 64 characters.
<path>	String	Path of HTTP server resource; the maximum length is 128 characters.
<filename>	String	Filename where the HTTP server response will be stored. If the file already exists, it will be overwritten. If <filename> 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*.
<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

17.3.4 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 <param2>=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="<param3>"\r\n

Content-Length: <length of file specified with param3>\r\n

Content-Type: application/octet-stream\r\n

\r\n

<content of file specified with param3>\r\n

--U1Blox2Http3Unique4Boundary5--\r\n

\r\n
```

17.4 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	-	*Appendix A.6*

17.4.1 Description

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

17.4.2 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

17.4.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<error_class>	Number	List of the allowed values is available in *Appendix A.6*
<error_code>	Number	Value of class-specific error codes (reply code if class is 0). When <error_class>=10 (wrong HTTP API usage), the allowed <error_code>; values are listed in *Appendix A.6.2*

A Appendix: Error result codes

A.1 Mobile termination error result codes +CME ERROR

Numeric error code	Description
0	Phone failure
1	No connection to phone
2	Phone-adaptor link reserved
3	Operation not allowed
4	Operation not supported
5	PH-SIM PIN required
10	SIM not inserted
11	SIM PIN required
12	SIM PUK required
13	SIM failure
14	SIM busy
15	SIM wrong
16	Incorrect password
17	SIM PIN2 required
18	SIM PUK2 required
20	Memory full
21	Invalid index
22	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
100	Unknown
103	Illegal MS
106	Illegal ME
107	GPRS services not allowed
108	GPRS and non GPRS services not allowed
111	PLMN not allowed
112	Location area not allowed
113	Roaming not allowed in this location area
126	Insufficient resources
132	Service option not supported
133	Requested service option not subscribed
134	Service option temporarily out of order

Numeric error code	Description
135	NS-api already used
140	Feature not supported
141	Semantic error in the TFT operation
142	Syntactical error in the TFT operation
143	Unknown PDP context
144	Semantic errors in packet filter(s)
145	Syntactical errors in packet filter(s)
146	PDP context without TFT already activated
148	Unspecified GPRS error
149	PDP authentication failure
150	Invalid mobile class
156	User Busy
159	Uplink Busy/ Flow Control
254	Invalid error mapping
255	Internal error
300	ME failure
301	SMS service of ME reserved
302	Operation not allowed
303	Operation not supported
304	Invalid PDU mode parameter
305	Invalid text mode parameter
310	(U)SIM not inserted
311	(U)SIM PIN required
312	PH-(U)SIM PIN required
313	(U)SIM failure
314	(U)SIM busy
315	(U)SIM wrong
316	(U)SIM PUK required
317	(U)SIM PIN2 required
318	(U)SIM PUK2 required
320	Memory failure
321	Invalid memory index
322	Memory full
330	SMSC address unknown
331	No network service
332	Network timeout
340	No +CNMA acknowledgement expected
500	Unknown error
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

Numeric error code	Description
1031	Normal, unspecified
1034	No circuit/channel available
1038	Network out of order
1041	Temporary failure
1042	Switching equipment congestion
1043	Access information discarded
1044	requested circuit/channel not available
1047	Resources unavailable, unspecified
1049	Quality of service unavailable
1050	Requested facility not subscribed
1055	Incoming calls barred within the CUG
1057	Bearer capability not authorized
1058	Bearer capability not presently available
1063	Service or option not available, unspecified
1065	Bearer service not implemented
1068	ACM equal to or greater than ACMmax
1069	Requested facility not implemented
1070	Only restricted digital information bearer capability is available
1079	Service or option not implemented, unspecified
1081	Invalid transaction identifier value
1087	User not member of CUG
1088	Incompatible destination
1091	Invalid transit network selection
1095	Semantically incorrect message
1096	Invalid mandatory information
1097	Message type non-existent or not implemented
1098	Message type not compatible with protocol state
1099	Information element non-existent or not implemented
1100	Conditional IE error
1101	Message not compatible with protocol state
1102	Recovery on timer expiry
1111	Protocol error, unspecified
1127	Interworking, unspecified
1279	Number not allowed
1283	CCBS possible
1500	Wrong GPIO identifier
1501	Set GPIO default error
1502	Select GPIO mode error
1503	Read GPIO error
1504	Write GPIO error
1505	GPIO busy
1520	Wrong ADC identifier
1521	Read ADC error
1530	IPv4 only allowed
1531	IPv6 only allowed
1540	Wrong ringer identifier
1542	LLC or SNDCP failure
1543	Regular deactivation
1544	Reactivation requested
1545	Single address bearers only allowed
1546	Invalid transaction identifier value
1547	APN restriction val incompatible with PDP context
1548	PDP activation rejected
1549	unknown PDP address or PDP type
1550	GPRS generic operation error

Numeric error code	Description
1551	GPRS invalid APN
1552	GPRS authentication failure
1553	GPRS QoS parameters inconsistent
1554	GPRS network failure
1555	GPRS context busy
1556	CSD generic operation error
1557	CSD undefined profile
1558	CSD context busy
1559	PLMN scan not allowed
1600	FFS error
1560	PDP type IPv4 only allowed
1561	PDP type IPv6 only allowed
1612	FILE NOT FOUND
1613	Cannot open file
1620	Buffer full
1621	FFS initializing
1622	FFS already open file
1623	FFS not open file
1624	FFS file not found
1625	FFS file already created
1626	FFS illegal id
1627	FFS illegal file handle
1628	FFS illegal type
1629	FFS illegal mode
1630	FFS file range
1631	FFS operation not possible
1632	FFS write error
1633	FFS user id error
1634	FFS internal fatal error
1635	FFS memory resource error
1636	FFS maximum number of files exceeded
1637	FFS memory not available
1638	FFS invalid filename
1639	FFS streaming not enabled
1640	FFS operation not allowed on static file
1641	FFS memory table inconsistency
1642	FFS not a factory default file
1643	FFS requested memory temporary not available
1644	FFS operation not allowed for a directory
1645	FFS directory space not available
1646	FFS too many streaming files open
1647	FFS requested dynamic memory temporary not available
1648	FFS user provided a NULL parameter instead of a suitable buffer
1649	FFS timeout
1650	Command line too long
1660	Call barred - Fixed dialing numbers only
1700	GPS GPIO not configured
1701	GPS GPIO ownership error
1702	Invalid operation with GPS ON
1703	Invalid operation with GPS OFF
1704	Invalid GPS aiding mode
1705	Reserved GPS aiding mode
1706	GPS aiding mode already set
1707	Invalid GPS trace mode
1708	Parameter valid only in case of GPS OTA

Numeric error code	Description
1709	GPS trace invalid server
1710	Invalid TimeZone
1711	Invalid value
1712	Invalid parameter
1713	Invalid operation with LOC running / GPS Busy
1801	IBM busy / eCall already armed/active
1802	IBM feature off / eCall feature off
1803	Wrong IBM requested
1804	Audio resource not available
1805	ECALL restriction
1806	eCall invalid dial number
1900	No SAP Server Connection
1901	SAP Protocol Error
1902	SAP Connection failure
1903	SAP Server Disconnection
1904	SAP Other terminal using service
1910	USECMNG import timeout expired (no input for > 20 s)
1911	USECMNG import file size exceeds limit
1912	USECMNG no memory available
1913	USECMNG invalid certificate/key format
1914	USECMNG database full
1950	CDC-ECM is not available
1951	CDC-ECM is busy
1952	No DHCP Packets received from the DTE
2000	Command timeout
3000	Command aborted
4000	APN configuration mismatch
4001	IP type configuration mismatch

A.2 Message service error result codes +CMS ERROR

Numeric error code	Description
1	Unassigned (unallocated) number
5	Delta firmware unavailable on FOTA server
8	Operator determined barring
10	Call barred
17	Network failure
21	Short message transfer rejected
22	Memory capacity exceeded
27	Destination out of service
28	Unidentified subscriber
29	Facility rejected
30	Unknown Subscriber
38	Network out of order
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

Numeric error code	Description
111	Protocol error, unspecified
127	Interworking, unspecified
128	Telematic interworking not supported
129	Short message type 0 not supported
130	Cannot replace short message
143	Unspecified TP-PID error
144	Data coding scheme (alphabet) not supported
145	Message class not supported
159	Unspecified TP-DCS error
160	Command cannot be actioned
161	Command unsupported
175	Unspecified TP-Command error
176	TPDU not supported
192	SC busy
193	No SC subscription
194	SC system failure
195	Invalid SME address
196	Destination SME barred
197	SM Rejected-Duplicate SM
198	TP-VPF not supported
199	TP-VP not supported
208	SIM SMS storage full
209	No SMS storage capability in SIM
210	Error in MS
211	Memory Capacity Exceeded
212	SIM Application Toolkit Busy
213	SIM data download error
287	Network failure unspecified
290	Network no resource
296	Radio Resources not Aailable due to DUAL SIM operation
297	Out of service due to DUAL SIM operation
300	ME failure
301	SMS service of ME reserved
302	Operation not allowed
303	operation not supported
305	Invalid Text mode parameter
310	SIM not inserted
311	SIM PIN required
312	PH-SIM PIN required
313	SIM failure
314	SIM busy
315	SIM wrong
320	memory failure
321	invalid memory index
322	memory full
330	SMSC address unknown
331	no network service
332	network timeout
340	no +CNMA acknowledgement expected
500	unknown error
512	Relay Protocol Acknowledgement
513	SMS timer expired
514	SMS forwarding availability failed
515	SMS forwarding availability aborted
516	MS invalid TP-Message-Type-Indicator

Numeric error code	Description
517	MS no TP-Status-Report in Phase 1
518	MS no TP-Reject-Duplicate in phase 1
519	MS no TP-Replay-Path in Phase 1
520	MS no TP-User-Data-Header in Phase 1
521	MS missing TP-Validity-Period
522	MS invalid TP-Service-Centre-Time-Stamp
523	MS missing TP-Destination-Address
524	MS invalid TP-Destination-Address
525	MS missing Service-Centre-Address
526	MS invalid Service-Centre-Address
527	MS invalid alphabet
528	MS invalid TP-User-Data-length
529	MS missing TP-User-Data
530	MS TP-User-Data to long
531	MS no Command-Request in Phase 1
532	MS Cmd-Req invalid TP-Destination-Address
533	MS Cmd-Req invalid TP-User-Data-Length
534	MS Cmd-Req invalid TP-User-Data
535	MS Cmd-Req invalid TP-Command-Type
536	MN MNR creation failed
537	MS CMM creation failed
538	MS network connection lost
539	MS pending MO SM transfer
540	RP-Error OK
541	RP-Error OK no icon display
542	SMS-PP Unspecified
543	SMS rejected By SMS CONTROL
544	Service Centre Address(SCA) FDN failed
545	Destination Address(DA) FDN failed
546	BDN check failed
547	Unspecified SMS PP error
548	Undefined Result
548	No Route To Destination
549	Channel Unacceptable
555	No Circuit/Channel Available
556	Access Information Discarded
557	Requested Circuit/Channel Not Available By Other Side
558	Quality Of Service Unavailable
560	Bearer Capability Not Authorized
561	Bearer Capability Not Presently Available
562	Service or Option Not Available, Unspecified
563	Bearer Service Not Implemented
564	ACM Equal to or Greater Than ACMmax
565	Only Restricted Digital Information Bearer Capability Is Available
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
659	Signalling Connection Release

Numeric error code	Description
660	CS Connection Release Triggered By MM
661	RRC Connection Establishment Failure
662	RRC Connection Establsihment Reject With Redirection
663	Resource Conflict
664	Layer Layer Failure in Layer 2
665	L2 Cause T200 Expiry N200 Plus 1 Times
669	RR Connection Release Due to BAND Change (2G)
670	Release of the RRC Connection Due to Out of Service in Cell_Fach (3G)
671	Release of the RRC Connection Due to Not Matching PLMN in Shared Networks(3G)
672	Error Happens While Call Is Already Disconnected / Late Error
674	SIM Toolkit Cannot Initiate A Call, Because MMI Is Not Registered
675	SIM Toolkit Call Setup Request Is Rejected Due User Did Not Accept
676	Proactive SIM Appl Terminated By User
677	SIM Toolkit Originated SIM Reset (Refresh Request)
680	Dial String/Number Incorrect

A.3 Firmware install final result codes

The +UFWINSTALL command issues a final result code providing the result of the FW install procedure. In case the FW install procedure fails, the error result code provides some indication about the error cause (syntax error or issue during the installation procedure).

A.3.1 SARA-R4 final result codes

No error codes are generated.

A.3.1.1 SARA-R4 final result codes

No final result codes are generated.

A.4 FOAT error result codes

See +UFWUPD command description.

A.4.1 SARA-R4 error result codes

No error codes are generated.

A.5 Internal TCP/UDP/IP stack class error codes

The following table lists all allowed error classes that can be provided by the internal TCP/UDP/IP stack through +USOER and +USOCTL (with <param_id>=1) AT commands.

Numeric error code	Description	Resulting from the following commands
0	No error	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
1	EPERM - Operation not permitted (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
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

Numeric error code	Description	Resulting from the following commands
11	EWOULDBLOCK / EAGAIN - Current operation would block, try again	+USOWR
12	ENOMEM - Out of memory (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
14	EFAULT - Bad address (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
22	EINVAL - Invalid argument	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
32	EPIPE - Broken pipe (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
38	ENOSYS - Function not implemented	+USOSO, +USOGO
64	ENONET - Machine is not on the internet	+USOCR, +USOWR, +USOST, +USORD, +USORF, +USOLI
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
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

Numeric error code	Description	Resulting from the following commands
168	ENSRBADFAMILY - Unsupported address family	+UDNSRN
169	ENSRBADRESP - Misformatted DNS reply	+UDNSRN
170	ENSRCONNREFUSED - Could not contact DNS servers	+UDNSRN
171	ENSRTIMEOUT - Timeout while contacting DNS servers	+UDNSRN
172	ENSROF - End of file	+UDNSRN
173	ENSRFILE - Error reading file	+UDNSRN
174	ENSRNOMEM - Out of memory	+UDNSRN
175	ENSRDESTRUCTION - Application terminated lookup	+UDNSRN
176	ENSRQUERYDOMAINTOOLONG - Domain name is too long	+UDNSRN
177	ENSRCNAMELOOP - Domain name is too long	+UDNSRN

A.6 Internet suite error classes

The following table lists all allowed error classes that can be provided by the <error_class> parameter for each AT error command (+UFTPER, +UHTTPER) for FTP and HTTP.

<error_class>	Description	<error_codes>	Resulting from the following commands
0	OK, no error occurred		All
1	FTP Protocol error class	See the Appendix A.6.1	+UFTPC, +UFTP, +UFTPER
3	HTTP Protocol error class	See the Appendix A.6.2	+UHTTP, +UHTTPC, +UHTTPER
4	Flash File System error class	See the Appendix A.6.3	+UFTPC, +UFTPER, +UHTTPC, +UHTTPER
5	DNS error class		+UFTPC, +UFTPER, +UHTTPC, +UHTTPER, +USMTPC, +USMTPER
6	Socket error class	BSD error codes standard	All
7	Dynamic Memory error	0	All
8	Wrong FTP API usage (e.g. missing/null parameters)	See the Appendix A.6.1	+UFTPC, +UFTP, +UFTPER
10	Wrong HTTP API usage (e.g. missing/null parameters)	See the Appendix A.6.2	+UHTTP, +UHTTPC, +UHTTPER
11	Syntax error in high layer Protocol (wrong/missing/corrupted data)		+UFTPC, +UFTPER, +UHTTPC, +UHTTPER, +USMTPC, +USMTPER
12	Unspecified error	0	All

A.6.1 FTP class error codes

The following table lists the available values of <error_code> parameter of the last FTP operation provided through +UFTPER AT command if <error_class>=1 or 8 (for more details see the AT+UFTP, AT+UFTC commands description).

Numeric error code	Description
0	No error
1	User missing
2	Password missing
3	Account missing
4	Server missing
5	Directory name missing
6	File name missing
7	Null parameter
8	Unknown FTP command
9	Unknown file action
10	Wrong FTP state
11	Wrong parameter
12	PSD or CSD connection not established
13	No memory available for allocation
14	Reserved internal code

Numeric error code	Description
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
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

Numeric error code	Description
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

☞ For all the errors not listed in the table see the RFC 959 [75].

A.6.2 HTTP class error codes

The following table lists the available values of <error_code> parameter of the last HTTP operation provided through +UHTTPER AT command if <error_class>=3 or 10 (for more details see the AT+UHTTP and AT+UHTTPC commands description).

Numeric error code	Description
0	No error
1	Invalid profile ID
2	Invalid input
3	Server hostname too long
4	Invalid server hostname
5	Invalid server IP address
6	Invalid authorization method
7	Server missing
8	Username length exceeded
9	Password length exceeded
10	Internal error
11	Server connection error
12	Error occurred in HTTP request
13	Internal error

Numeric error code	Description
14	Internal error
15	Invalid POST data size
16	Empty FFS file name
17	Invalid FFS file length
18	Invalid content-type specified
19	Internal error
20	Internal error
21	Internal error
22	PSD or CSD connection not established
23	Server or proxy hostname lookup failed
24	User authentication failed on server
25	User authentication failed on proxy
26	Connection timed out
27	Request prepare timeout expired
28	Response receive timeout expired
29	Request send timeout expired
30	HTTP operation in progress
31	Invalid HTTP parameter TCP port not in range (1-65535)
32	Invalid HTTP parameter secure
33	Invalid HTTP parameter authentication username
34	Invalid HTTP parameter authentication password
35	Invalid HTTP parameter output filename
36	Invalid HTTP parameter output filename length
37	Invalid HTTP parameter server path
38	Invalid HTTP parameter server path length
39	Invalid HTTP parameter content filename length
40	Invalid custom content type string
41	Output file open error
42	Output file close error
43	Output file write error
44	Connection lost
45	Operation not allowed in current state
46 - 72	Internal error
73	Secure socket connect error

A.6.3 File system class error codes

☞ SARA-R4
The following table lists the available values of <error_code> parameter of the last FTP or HTTP operation provided through +UFTPER and +UHTTPER.

Numeric error code	Description
2	Operation performed with success
3	Initialization in progress
4	File already opened
5	File not opened
6	File not found
7	File already created
8	Illegal id
9	Illegal file handle
10	Illegal type
11	Illegal mode
12	File range error
13	The operation is not possible
14	Write error
15	User id error

Numeric error code	Description
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

B Appendix: AT Commands List

AT command	Call control			
	A	D	S0	
SARA R404M-00B	•	•	•	
R410M-01B	•	•	•	
R410M-02B	•	•	•	

AT command	File System				
	+UDELFILE	+UDWNFILE	+ULSTFILE	+URDFILE	
SARA R404M-00B	•	•	•	•	
R410M-01B	•	•	•	•	
R410M-02B	•	•	•	•	

AT command	General commands												
	+CCID	+CGMI	+CGMM	+CGMR	+CGSN	+CIMI	+GMI	+GMM	+GMR	+GSN	A/	I	
SARA R404M-00B	•	•	•	•	•	•	•	•	•	•	•	•	
R410M-01B	•	•	•	•	•	•	•	•	•	•	•	•	
R410M-02B	•	•	•	•	•	•	•	•	•	•	•	•	

AT command	GPIO interface			
	+UGPIOC	+UGPIOR	+UGPIOW	
SARA R404M-00B	•	•	•	
R410M-01B	•	•	•	
R410M-02B	•	•	•	

AT command	Internet suite							
	+UFTP	+UFTPC	+UFTPER	+UHTTP	+UHTTPAC	+UHTTPC	+UHTTPER	
SARA R404M-00B	•	•	•	•	•	•	•	
R410M-01B	•	•	•	•	•	•	•	
R410M-02B	•	•	•	•	•	•	•	

	AT command	Mobile equipment control and status						
		+CFUN	+CIND	+CMEE	+CMER	+CPWROFF	+UCIND	
SARA	R404M-00B	•	•	•	•	•	•	
	R410M-01B	•	•	•	•	•	•	
	R410M-02B	•	•	•	•	•	•	

	AT command	Network service								
		+CESQ	+CNUM	+COPS	+CSQ	+URAT	+VZWAPNE	+VZWRSRP	+VZWRSRQ	
SARA	R404M-00B	•	•	•	•	•	•	•	•	
	R410M-01B	•	•	•	•	•				
	R410M-02B	•	•	•	•	•				

AT command	Packet switched data services							
	+CEREG	+CGACT	+CGATT	+CGDCONT	+CGDEL	+CGPADDR	D*	H
SARA R404M-00B	•	•	•	•	•	•	•	•
R410M-01B	•	•	•	•	•	•	•	•
R410M-02B	•	•	•	•	•	•	•	•

AT command		Security			
		+CLCK	+CPIN	+CPWD	
SARA	R404M-00B	•	•	•	
	R410M-01B	•	•	•	
	R410M-02B	•	•	•	

AT command	Serial interface																								
	&C	&D	&F	&K	&S	&V	&W	&Y	+CMUX	+ICF	+IFC	+IPR	E	Q	S10	S12	S2	S3	S4	S5	S6	S7	S8	V	X
SARA R404M-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
R410M-01B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
R410M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

	Serial interface		
AT command	N	O	
SARA R404M-00B	•	•	
R410M-01B	•	•	
R410M-02B	•	•	

AT command	Short Messages Service																
		+CMGD	+CMGF	+CMGL	+CMGR	+CMGS	+CMGW	+CMMS	+CMSS	+CNMA	+CNMI	+CPMS	+CRES	+CSAS	+CSCA	+CSMP	+CSMS
SARA	R404M-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R410M-01B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R410M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

AT command		System features							
		+CPSMS	+UANTR	+UFWINSTALL	+UFWUPD	+ULWM2M=0	+ULWM2MSTAT	+UTEST	
SARA	R404M-00B	•	•	•	•	•	•	•	
	R410M-01B	•	•	•	•	•	•	•	
	R410M-02B	•	•	•	•	•	•	•	

AT command		Internet protocol transport layer																			
		+UDCONF=1	+UDCONF=2	+UDCONF=3	+UDCONF=5	+UDCONF=6	+UDCONF=7	+UDCONF=8	+USOCL	+USOCO	+USOCR	+USOCTL	+USODL	+USOER	+USOGO	+USOLI	+USORD	+USORF	+USOSO	+USOST	+USOWR
SARA	R404M-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R410M-01B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R410M-02B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

B.1 Parameters stored in profiles

The parameter settings of some commands can be stored in the profiles available in the memory module. To store, partially display, activate and de-activate these profiles, see the *AT&W*, *AT&V*, *AT&Y* commands description.

☞ Not all the parameter setting are displayed through *AT&V* command.

☞ Some AT commands have a unique configuration for all the AT interfaces while for other AT commands it is possible to set a different configuration for each AT interface: the "AT interface configuration sharing" column in the next table provides this information.
Some AT command interfaces have a dynamic activation, which means they are not statically activated at boot time (MUX AT channel is activated when the MUX protocol is established, USB AT channel is activated if/when the USB cable is plugged-in, deactivated when it is removed). Since the activation reloads the AT command profile from NVM for the activated interface, the shared "AT interface configurations" could be overwritten. It is suggested to reconfigure them at the requested value if an AT command interface is dynamically activated.

The following table lists the AT commands which setting can be stored in the profiles with their parameters as well as the factory-programmed values.

AT command	Description	AT interface configuration sharing	Factory-programmed value / Remarks
&C	DCD status	No	1 (DCD enabled)
&D	DTR status	No	1 (DTR enabled)
&K	Flow control status	No	3 (RTS/CTS DTE flow control enabled)
&S	DSR override	No	1 (DSR line set to ON in data mode and to OFF in command mode)
+CMGF	Preferred message format	Yes	0 (format of messages in PDU mode)
+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) • FFFF (undefined PLMN to register when COPS=1)
+ICF	DTE-DCE character framing	No	• SARA-R4 - 3, 1 (framing format: 8 data 1 stop, no parity)
+IFC	DTE-DCE local flow control	No	2 (<DCE_by_DTE> on circuit 106 (CTS)), 2 (<DTE_by_DCE> on circuit 105 (RTS))
+IPR	Baud rate	No	• SARA-R4 - 0 (autobauding enabled)
E	Echo status	No	1 (echo enabled)
Q	Result code suppression	No	0 (DCE transmits result codes)
S0	Automatic answer	No	0 (automatic answering disabled)
S2	Escape character selection	No	43 (043 corresponds the '+' character)
S3	Command line termination character	No	13 (0x0d corresponds to the carriage return character)
S4	Response formatting character	No	10 (0x0a corresponds to the line feed character)
S5	Command line editing character	No	8 (008 corresponds to the backspace character)
S7	Connection completion timeout	No	60
V	DCE response format	No	1 (Verbose response text)
X	Result code selection and call progress monitoring control	No	4 (CONNECT <text> result code is given upon entering online data state; dial tone and busy detection are both enabled)

B.2 Parameters stored in non volatile memory

The following table lists the AT commands which setting can be stored in the non volatile memory with their parameters and the factory-programmed values.

AT command	Description	Factory-programmed value / Comment
&Y	Designate a default reset profile	0 (profile 0 selected)
+CGDCONT	PDP context definition	• SARA-R4 - all contexts are undefined
+CPMS	Preferred message storage	
+CSAS	Save settings	0 (profile 0 where to store the active message settings)
+UGPIOC	GPIO functionality setting	• SARA-R4 - 255 (<gpio1>), 255 (<gpio2>), 255 (<gpio3>), 0 (<gpio4>), 7 (<gpio5>), 12 (<gpio6>)
+URAT	Selection of Radio Access Technology	• SARA-R4 - 3 (LTE RAT), 3 (LTE as preferred RAT)
+VZWAPNE	Edit Verizon wireless APN table	Verizon wireless APN table (APN list entry, APN class, Network identifier, APN type, APN bearer, APN status, APN inactivity timer) • 1,1,"VZWIMS","ipv4v6","LTE","Enabled",0 • 2,2,"VZWADMIN","ipv4v6","LTE","Enabled",0 • 3,3,"VZWINTERNET","ipv4v6","LTE","Enabled",0 • 4,4,"VZWAPP","ipv4v6","LTE","Enabled",0
+CPSMS	Power Save Mode	• SARA-R4 - 0 (PSM disabled by default)

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* and *Appendix B.2*.

- 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)
- Confirm that the boot loading is performed with the desired parameter profile (e.g. profile 0 if the parameter save was performed with AT&W0; use AT&Y0 to select this)
- 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 command response time

After having sent a command to a u-blox cellular module, the time to obtain a resulting result code depends on the SIM and the network. It is possible to have an immediate response if the command does not interact with either the network or the SIM.

The following table reports the maximum time to get the result code for the AT commands. The commands are grouped by categories.

Category	Estimated maximum time to get response	Commands
Power off	< 40 s	+CPWROFF
Call control and supplementary services	< 20 s	A, H, +CAEMLPP, +CHLD, +CHUP, +CNAP, +COLP, +COLR, +CSVM
	Up to 7 min	+VTS
Network commands	Up to 3 min (<1 s for prompt ">" when present)	D, D>, DL, +CCFC, +CCWA, +CFUN, +CGATT, +CGDATA, +CLCK, +CLIP, +CLIR, +COPS, +CPMS, +CMGL, +CMGR, +CMGS, +CMSS, +CPWD, +CTFR, +CUSD, +UCGOPS, +UCMGL, +UCMGP, +UCMGR, +UCMGS, +UCSDA, +UPSDA
	Up to 1 s	+UDOPN
	< 5 s	+UCELLINFO
	< 40 s	+UEONS
Phonebook commands	< 35 s	+CPBF, +CPBR, +CPBS, +CPBW
Delete all the SMSes	< 55 s	+CMGD
Send an SMS	< 150 s	+CMGS, +CMSS

Category	Estimated maximum time to get response	Commands
	Up to 3 min (<1 s for prompt ">" when present)	+UCMGS3GPP2
New message acknowledgement to MT	< 150 s	+CNMA
SIM management	< 10 s	+CACM, +CAMM, +CAOC, +CMGW, +CNUM, +CPIN, +CPOL, +CPUC, +CR, +CRES, +CRSM, +CSCA, +CSCB, +CSMP, +UCMGW
SIM toolkit	< 20 s	+SATD, +SATE, +SATR, +STKENV, +STKTR, +UCATENV, +UCATTR, +URCATE, +URCATR
PDP context activation	< 150 s	+CGACT, +UPSDA
PDP context deactivation	< 40 s	+CGACT, +UPSDA
ECM data connection	Up to 3 min	+UCEDATA
Restore configuration	< 5 s	+UFACTORY
Audio path testing	< 2 s	+UMAAT
GPIO commands	< 10 s	+UGPIOC, +UGPIOR, +UGPIOW
Internet suite (TCP/IP, DNS, FTP, HTTP, SMTP)	< 10 s (except URC)	+USMTPC, +USMTPM, +USOCL, +USODL, +USOLI, +USORD, +USORF, +USOST, +USOWR
	< 20 s	+USOCO
	< 70 s (except URC)	+UDNSRN
GNSS commands	< 10 s (except +UGPS for which timeout is according to the performed operation)	+UGAOS, +UGGGA, +UGGLL, +UGGSA, +UGGSV, +UGPS, +UGRMC, +UGTMR, +UGUBX, +UGVTG, +UGZDA, +ULOC
Wi-Fi	< 15 s	+UWSCAN
	< 20 s	+UWAPCFG, +UWCFG, +UWSTACFG
Audio recording	Up to 10 s	+URECFILE
OMA-DM alert	~400s (depending on network connectivity)	+UOMADMALERT

B.5 Multiple AT command interfaces

u-blox cellular modules support multiple AT command interfaces, that means a certain number of virtual or physical channels that work as described in *Definitions*.

Each interface maintains an own run-time AT commands configuration (AT command profile); this means that the AT command profile is different among the interfaces and therefore the AT commands configuration for the commands belonging to the profile can be different among the interfaces.

At the module start-up, since there is only a set of the profiles (not one for each interface), all the interfaces are configured in the same way (AT commands configuration for the commands in the profile is the same for all the interfaces). Subsequently, each interface can change its run-time AT profile (stored in RAM). The commands *AT&W*, *AT&V* manage this run-time AT commands configuration for the interface where they are issued.

The USB interface implements multiple AT command interfaces. Unlike what happens for the other physical interfaces (e.g. UART, SPI), the AT command interfaces that run on the USB interface only exists as long as the USB interface connects the module with the DTE. As a result, if the USB connection between the module and the DTE is interrupted (e.g. by USB cable removal), all the AT command interfaces running on it are destroyed. This has two main consequences:

• Any data connection (both circuit switched and packet switched) established over an AT command interface associated to the USB interface is released.
• As already explained in *Appendix B.1*, whenever the USB connection between the module and the DTE is re-established, the AT command interfaces running on it are created, and for each of these interfaces the AT command profile is reloaded from NVM and applied.

☞ The reload of the AT command profile from the NVM also results in the re-application of the *+UPSV* setting, which is a shared "AT interface configuration". This must be kept in mind, since the change could have impacts on the communication over the UART interface.

As mentioned in *Definitions*, generally there is not difference in the execution of an AT command among the interfaces. But, there are some exceptions due to interface restrictions. In particular, the differences relate to AT commands that configure the DCE-DTE interface.

Table 15 provides the major differences.

AT command	UART / AUX UART (where available)	Multiplexer	USB (where available)	SPI (where available)
&K	Effective	When it returns OK (the configuration is allowed), it is effective	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)
\Q	Effective	When it returns OK (the configuration is allowed), it is effective	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)
+ICF	Effective	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)
+IFC	Effective	When it returns OK (the configuration is allowed), it is effective	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)	When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile)
+IPR	Effective	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)

Table 15: Interface comparison

C Appendix: UDP Direct Link workflow

C.1 Data from the IP network to the external port

When a UDP data packet is received from the network, its payload is forwarded through the external port as soon as possible (according to the HW flow control, if any).
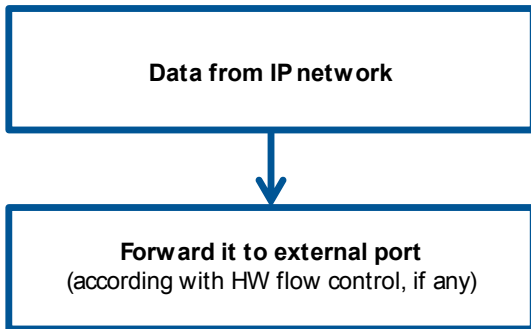

Figure 8: Workflow of data from the IP network to the external port

C.2 Data from the external port to the IP network

When some data comes from the external port, there are 2 parameters involved:

1. The UDP DL packet size (factory-programmed: 1024 bytes; valid range 100-1472)

2. The UDP DL sending timer delay (factory-programmed: 1000 ms; valid range 100-120000)

Both parameters are specific for each socket and could be modified by the user. These values are not saved into the NVM and if not specified, the factory-programmed values are used.

There are 3 different cases that may occur while receiving data from the external port in UDP DL mode:

1. The received data from the external port is equal to the UDP DL packet size: the received data is immediately sent to the network

2. The received data from the external port is more than the UDP DL packet size: the amount of data till UDP DL packet size is immediately sent to the network, the remaining data is saved into an intermediate buffer.

3. The received data from the external port is less than UDP DL packet size: the received data is saved into an intermediate buffer and sent to the network when the UDP DL sending timer expires. The timer is reset (it restarts the countdown) every time new data is received from the external port, this means that the data will be sent to the network after N ms (default 1000 ms) since the last received byte.

☞ The data sent from the serial port is not echoed to the sender.

☞ The configuration of UDP DL packet size and UDP DL sending timer are NOT saved in NVM.

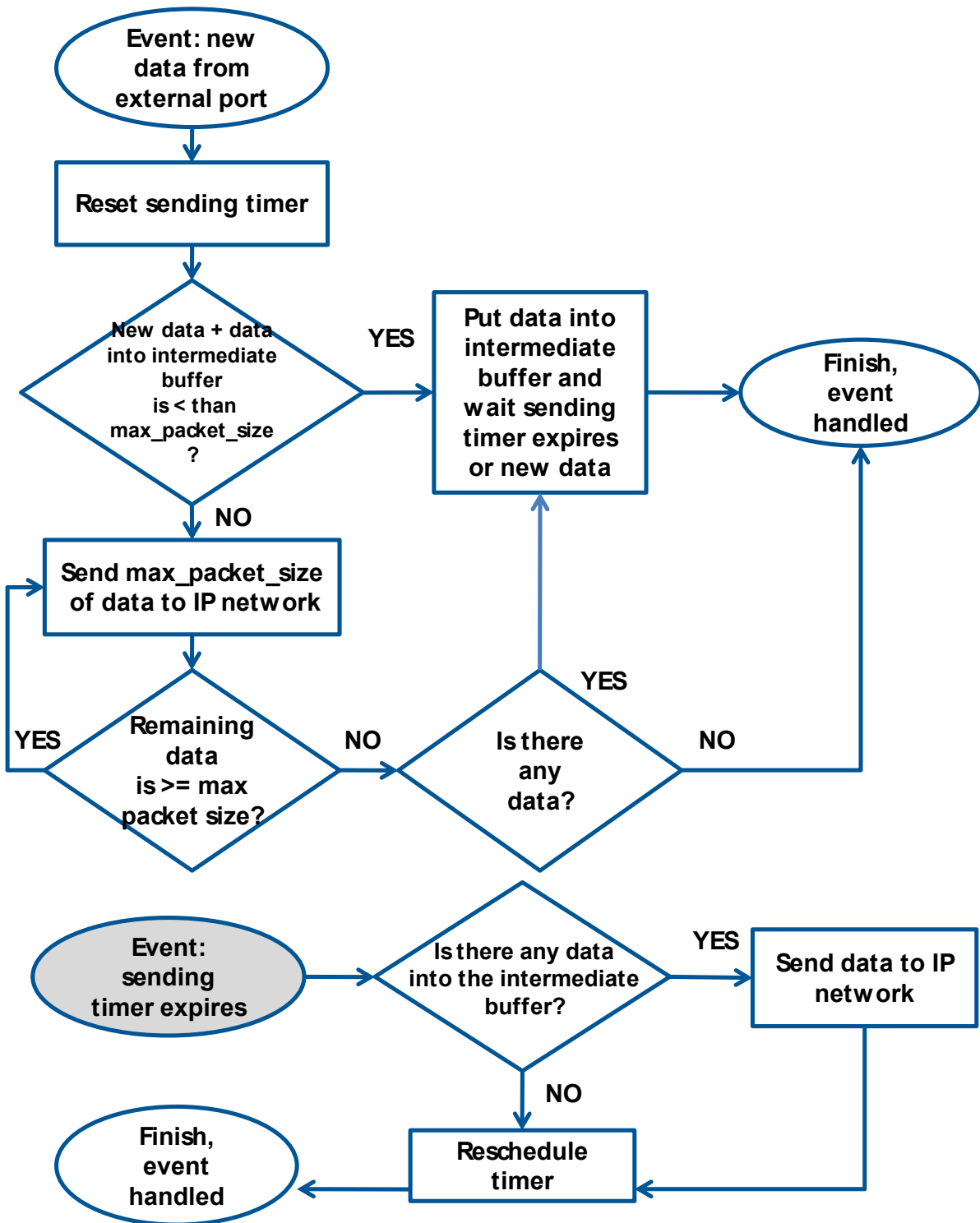The following diagram shows how the events of external data input and sending timer expire are handled.

Figure 9: Workflow of data from the external port to the IP network

D Appendix: Glossary

2G	2nd Generation
3G	3rd Generation
3GPP	3rd Generation Partnership Project
ADC	Analog to Digital Converter
AIeC	Automatically Initiated eCall
ADN	Abbreviated Dialing Numbers
AMR	Adaptive Multi Rate
AP	Access Point
APN	Access Point Name
ASCII	American Standard Code for Information Interchange
AT	AT Command Interpreter Software Subsystem, or attention
BL	Black List
BSD	Berkley Standard Distribution
CB	Cell Broadcast
CBM	Cell Broadcast Message
CLI	Calling Line Identification
CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
COLP	Connected Line Identification Presentation
COLR	Connected Line Identification Restriction
CM	Connection Management
CPHS	Common PCN Handset Specification
CR	Carriage Return
CS	Circuit Switch
CSD	Circuit-Switched Data
CSG	Closed Subscriber Group
CTS	Clear To Send
CUG	Closed User Group
DA	Destination Address
DARP	Downlink Advanced Receiver Performance
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCM	Data Connection Management
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Server
DSR	DSC transponder response
DTE, TE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
DTR	Data Terminal Ready
DUT	Device Under Test
EARFCN	E-UTRAN Absolute Radio Frequency Channel Number
eCall	Emergency Call
EEP	EEPROM Emulation Parameters
EF	Elementary File
EF_{CGST}	Elementary File "Closed Subscriber Group Type"
EF_{HNBN}	Elementary File "Home Node B Number"
$EF_{PLMNwAcT}$	Elementary File "User controlled PLMN Selector with Access Technology"
eIM	eCall In-band Modem
EONS	Enhanced Operator Name from SIM-files EF_{OPL} and EF_{PNN}
EPD	Escape Prompt Delay
ETSI	European Telecommunications Standards Institute
E-UTRAN	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
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^{2}C	Inter-Integrated Circuit
I^{2}S	Inter IC Sound or Integrated Interchip Sound
ICCID	Integrated Circuit Card ID
ICMP	Internet Control Message Protocol
ICP	Inter Processor Communication
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Station Identity
InBM	In-Band Modem (generic)
IP	Internet Protocol
IRA	International Reference Alphabet
IRC	Intermediate Result Code
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
IVS	In-Vehicle System (eCall related)
L3	Layer 3
LCP	Link Control Protocol
LF	Line Feed
LNS	Linux Network Subsystem
M2M	Machine-To-Machine
MCC	Mobile Country Code
ME	Mobile Equipment
MIeC	Manually Initiated eCall
MMI	Man Machine Interface
MN	Mobile Network Software Subsystem
MNC	Mobile Network Code
MNO	Mobile Network Operator
MO	Mobile Originated
MS	Mobile Station
MSD	Minimum Set of Data (eCall related)
MSIN	Mobile Subscriber Identification Number
MSISDN	Mobile Systems International Subscriber Identity Number
MSPR	Multi-Slot Power Reduction
MT	Mobile Terminated
MWI	Message Waiting Indication
NITZ	Network Identity and Time Zone
NVM	Non-Volatile Memory
ODIS	OMA-DM IMEI Sync
OLCM	On Line Commands Mode
PAD	Packet Assembler/Disassembler
P-CID	Physical Cell Id

PCN	Personal Communication Network
PDP	Packet Data Protocol
PDU	Protocol Data Unit
PIN	Personal Identification Number
PLMN	Public Land Mobile Network
PPP	Point-to-Point Protocol
PSAP	Public Safety Answering Point (eCall related)
PSD	Packet-Switched Data
PUK	Personal Unblocking Key
QoS	Quality of Service
RAM	Random Access Memory
RDI	Restricted Digital Information
RFU	Reserved for Future Use
RNDIS	Remote Network Driver Interface Specification
RI	Ring Indicator
RTC	Real Time Clock
RTP	Real-time Transport Protocol
RTS	Request To Send
Rx	Receiver
SAP	SIM Access Profile
SC	Service Centre
SI	SIM Application Part Software Subsystem
SIP	Session Initiation Protocol
SIM	Subscriber Identity Module
SMS	Short Message Service
SMSC	Short Message Service Center
SMTP	Simple Mail Transfer Protocol
SoR	Steering of Roaming
SDIO	Secure Digital Input Output
STA	station
SSID	Service Set Identifier
TA	Terminal Adaptor
TCP	Transfer Control Protocol
TE	Terminal Equipment
TFT	Traffic Flow Template
TP	Transfer layer Protocol
Tx	Transmitter
TZ	Time Zone
UCS2	Universal Character Set
UDI	Unrestricted Digital Information
UDP	User Datagram Protocol
UI	Unnumbered Information
UICC	Universal Integrated Circuit Card
UIH	Unnumbered Information with header Check
URC	Unsolicited Result Code
USIM	UMTS Subscriber Identity Module
UTRAN	Universal Terrestrial Radio Access Network
UUS1	User-to-User Signalling Supplementary Service 1
WLAN	Wireless Local Area Network

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10. 3GPP TS 23.060 - Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description
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126. 3GPP TS 22.084 MultiParty (MPTY) supplementary service; Stage 1

127. 3GPP TS 24.607 Originating Identification Presentation (OIP) and Originating Identification Restriction (OIR) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification

128. 3GPP TS 24.608 Terminating Identification Presentation (TIP) and Terminating Identification Restriction (TIR) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification

129. 3GPP TS 36.213 Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures

130. 3GPP TS 36.212 Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding

131. RFC 4715 - The Integrated Services Digital Network (ISDN) Subaddress Encoding Type for tel URI

132. End User Test Application Note, Docu No UBX-13001922

133. OMA Device Management V1.2.1 (*http://technical.openmobilealliance.org/Technical/technical-information/release-program/current-releases/dm-v1-2-1*)

134. RFC 5626 - Managing Client-Initiated Connections in the Session Initiation Protocol (SIP)

135. 3GPP TS 24.166 - 3GPP IP Multimedia Subsystem (IMS) conferencing Management Object (MO)

136. 3GPP TS 29.061 - Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)

137. 3GPP TS 24.303 - Mobility management based on Dual-Stack Mobile IPv6; Stage 3

138. 3GPP TS 24.327 - Mobility between 3GPP Wireless Local Area Network (WLAN) interworking (I-WLAN) and 3GPP systems; General Packet Radio System (GPRS) and 3GPP I-WLAN aspects; Stage 3

139. 3GPP TS 25.367 - Mobility procedures for Home Node B (HNB); Overall description; Stage 2

140. 3GPP TS 25.304 - User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode

141. 3GPP TS 36.304 - Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode

142. RFC 4867 - RTP Payload Format and File Storage Format for the Adaptive Multi-Rate (AMR) and Adaptive Multi-Rate Wideband (AMR-WB) Audio Codecs

143. RFC 4733 - RTP Payload for DTMF Digits, Telephony Tones, and Telephony Signals

144. 3GPP2 C.S0015-0 - Short Message Service

145. RFC 1518 - An Architecture for IP Address Allocation with CIDR (*https://tools.ietf.org/html/rfc1518*)

146. RFC 1519 - Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy (*https://tools.ietf.org/html/rfc1519*)

147. 3GPP TS 45.008 - GSM/EDGE Radio Access Network; Radio subsystem link control

148. 3GPP TS 25.401 - Universal Mobile Telecommunications System (UMTS); UTRAN Overall Description

149. GSM 04.08 - Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification

150. 3GPP TS 24.237 - Technical Specification Group Core Network and Terminals; IP Multimedia (IM) Core Network (CN) subsystem IP Multimedia Subsystem (IMS) Service Continuity; Stage 3

151. 3GPP TS 36.211 - Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation

152. 3GPP TS 23.682 - Architecture enhancements to facilitate communications with packet data networks and applications

153. 3GPP TS 23.401 - General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access

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Revision history

Revision	Date	Name	Comments
R01	27-Jan-2017	jole	Initial release
R02	03-Apr-2017	jole	Removed +UPSV. Added *+CPSMS*. General document clean-up
R03	04-May-2017	jole	Added SARA-R410M
R04	24-May-2017	jole	Moved to Advance Information for SARA-R404M
R05	19-Jul-2017	jole	Extended document applicability to SARA-R410M-02B. Added *+ULWM2M*, *+ULWM2MSTAT* and *+CNUM*. Changed *+CPSMS* back to it's original 3GPP definition. Added FOAT file tag.

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