LARA-R6 series

Single or multi-mode LTE Cat 1 modules with Secure Cloud

AT commands manual

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

UBX-21046719 - R05
C1-Public

www.u-blox.com

Document information		
Title	**LARA-R6 series**	
Subtitle	Single or multi-mode LTE Cat 1 modules with Secure Cloud	
Document type	AT commands manual	
Document number	UBX-21046719	
Revision and date	R05	11-May-2022
Disclosure restriction	C1-Public	

u-blox reserves all rights to this document and the information contained herein. Products, names, logos and designs described herein may in whole or in part be subject to intellectual property rights. Reproduction, use, modification or disclosure to third parties of this document or any part thereof without the express permission of u-blox is strictly prohibited.
The information contained herein is provided “as is” and u-blox assumes no liability for the use of the information. No warranty, either express or implied, is given, including but not limited, with respect to the accuracy, correctness, reliability and fitness for a particular purpose of the information. This document may be revised by u-blox at any time. For most recent documents, visit www.u-blox.com.
Copyright © 2018, u-blox AG
u-blox is a registered trademark of u-blox Holding AG in the EU and other countries.

Preface

Applicable products

This document applies to the following products:

Name	Type number	Modem version	Application version	PCN reference
LARA-R6001	LARA-R6001-00B-00	01.14	A00.01	UBX-22004012
LARA-R6001D	LARA-R6001D-00B-00	00.13	A00.01	UBX-22008409
LARA-R6401	LARA-R6401-00B-00	01.14	A00.01	UBX-22004012
LARA-R6401D	LARA-R6401D-00B-00	00.11	A00.01	UBX-22003753
LARA-R6801	LARA-R6801-00B-00	01.14	A00.01	UBX-22004012

How to use this manual

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

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

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

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

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

Summary table

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

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

It is composed of two sections:

- **Modules**: lists all the modules that support the command. The modules are grouped in rows by cellular standard (i.e. L for LTE high data rate (Cat 3 and above), R for LTE low data rate (Cat 1 and below), U for UMTS/HSPA, G for GSM/GPRS, N for NB-IoT (LTE Cat NB1 / LTE Cat NB2)). In each row the modules are grouped by: form factor (i.e. SARA, LISA), platform technology (e.g. SARA-G), platform generation (e.g. SARA-G3), product name (e.g. SARA-G350) and ordering code (e.g. SARA-G350-00S). In example: if 'LISA-U2' is reported, the command applies to all the modules having LISA form factor, second chipset version provided with any release of firmware.
- **Attributes**
  - **Syntax**
    - **full**: the command syntax is fully compatible among all the products listed in the "Modules" section
    - **partial**: the products support different syntaxes (usually backward compatible with respect to previous cellular standards)
  - **PIN required**
    - **Yes**: it is necessary to insert the PIN before the set and/or read command execution
    - **No**: the PIN insertion is not needed to execute the command
  - **Settings saved**
    - **Profile**: the command setting can be saved in a personal profile as specified in Chapter 1.4
    - **NVM**: the command setting is saved in the non-volatile memory as specified in Chapter 1.4
    - **<command_name>**: the parameter values set with the command are volatile, but the whole profile can be stored in NVM with <command_name> AT command.

  - **OP**: the command setting can be overwritten by the Mobile Network Operator (MNO) profile set with the +UMNOPROF or +UMNOCONF AT commands (if supported)
  - **No**: the current command setting is volatile and cannot be saved
- **Can be aborted**
  - **Yes**: the command execution can be aborted if a character is sent to the DCE during the command execution
  - **No**: the command cannot be aborted during the command execution
- **Response time**: estimated maximum time to get the final result code for the AT command execution. It is the time needed to provide the response in the worst case, e.g. when all the steps that have to be run to carry out the operation take the longest time to be performed; it is based on a theoretical estimation, derived by the the 3GPP specifications in case of AT commands related to cellular modem features (e.g. registration, de-registration, PDP context activation). For additional details on the response time of cellular network related AT command, see Maximum vs typical response time of cellular network related AT commands.
  More precisely, the response time considers the time from the complete acquisition of the command line to the issuing of the command result code. This kind of response time is generally lower than the time measured by the application on the DTE, because the issuing of the command on the DTE is influenced by the AT interface characteristics (e.g. the synchronous/asynchronous transfer type, the selected baud rate, etc.), by power saving and flow control, which introduce a variable latency in the command acquisition by the DCE.

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

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

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

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

The attributes listed in the summary table apply by default to all u-blox modules supporting the specific AT command. If a u-blox module or module series does not comply to the default behavior, the exception is highlighted in Chapter 1.4 for the saving of settings, in Chapter 1.3.4 for the abortability, and in a product specific note in the AT command description for the PIN check.

u-blox technical documentation

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

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

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

Application Notes: These documents provide guidelines and information on specific u-blox cellular module hardware or software topics.

- For some guidelines when developing applications for LTE Cat 1 technologies, see the LARA-R6 series application development guide [8].
- For some guidelines when developing applications for LTE Cat M1 technologies, see the SARA-R41 application development guide [26] or the SARA-R42 application development guide [27] or the SARA-R5 series application development guide [22].
- For some guidelines when developing applications for NB-IoT technologies, see the SARA-N3 series application development guide [42] or the NB-IoT application development guide [39].
- For more examples of typical scenarios when developing application for LTE Cat 4, LTE Cat 1, UMTS/HSPA and GSM/GPRS technologies, see the AT commands examples application note [44].

See Related documents for application notes related to your cellular module.

Questions

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

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

Technical Support

Worldwide Web

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

By email

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

Helpful Information when Contacting Technical Support

When contacting Technical Support please have the following information ready:

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

Contents

1 AT command settings 13
1.1 Definitions 13
1.2 Operational mode of the AT interface 13
1.3 Command description 14
1.4 Storing of AT commands setting 17
1.5 +UDCONF AT command 17

2 General operation 18
2.1 Start up and initialization 18
2.2 AT commands types 19

3 IPC - Inter Processor Communication 21
3.1 Multiplexing mode +CMUX 21

4 General 23
4.1 Manufacturer identification +CGMI 23
4.2 Manufacturer identification +GMI 23
4.3 Model identification +CGMM 23
4.4 Model identification +GMM 24
4.5 Firmware version identification +CGMR 24
4.6 Firmware version identification +GMR 25
4.7 Request product serial number identification +CGSN 25
4.8 IMEI identification +GSN 26
4.9 Identification information I 27
4.10 TE character set configuration +CSCS 27
4.11 International mobile subscriber identification +CIMI 28
4.12 Card identification +CCID 28
4.13 Request complete capabilities list +GCAP 29

5 Mobile equipment control and status 30
5.1 Phone activity status +CPAS 30
5.2 Module switch off +CPWROFF 30
5.3 Set module functionality +CFUN 31
5.4 Indicator control +CIND 32
5.5 Configuration of indicator control +UCIND 34
5.6 Mobile termination event reporting +CMER 34
5.7 Clock +CCLK 36
5.8 Set greeting text +CSGT 37
5.9 Automatic time zone update +CTZU 37
5.10 Time zone reporting +CTZR 38
5.11 List current calls +CLCC 39
5.12 Report mobile termination error +CMEE 40
5.13 Extended error report +CEER 41

6 Call control 42
6.1 Select type of address +CSTA 42
6.2 Dial command D 42
6.3 Select tone dialling T 44
6.4 Select pulse dialling P 44
6.5 Call answer A 45
6.6 Hook control H 45
6.7 Voice hangup control +CVHU 46
6.8 Monitor speaker loudness L 46
6.9 Voice call mode +CVMOD 47
6.10 Hang up call +CHUP 47

6.11 Set reporting call status +UCALLSTAT....48
6.12 DTMF and tone generation +VTS....48
6.13 Automatic answer S0....49
6.14 Set voice mail number +CSVM....50
7 Network service....51
7.1 Network parameters definition....51
7.2 Subscriber number +CNUM....53
7.3 Signal quality +CSQ....54
7.4 Extended signal quality +CESQ....55
7.5 Operator selection +COPS....56
7.6 Radio Access Technology (RAT) selection +URAT....61
7.7 Full cell scan +UCFSCAN....62
7.8 Preferred PLMN list selection +CPLS....66
7.9 Network registration status +CREG....67
7.10 Preferred operator list +CPOL....70
7.11 Read operator names +COPN....71
7.12 Steering of Roaming configuration +UDCONF=20....72
7.13 No more PS data +CNMPSD....72
7.14 Integrity check on test networks configuration +UDCONF=81....73
7.15 Channel and network environment description +UCGED....73
7.16 Wireless service selection +WS46....79
7.17 Smart jamming detection +UJAD....80
7.18 Edit Verizon wireless APN table +VZWAPNE....81
7.19 Read RSRP values +VZWRSRP....82
7.20 Read RSRQ values +VZWRSRQ....83
7.21 Signalling connection status +CSCON....84
7.22 Radio Policy Manager (RPM) activation +URPM....85
7.23 eDRX setting +CEDRXS....86
7.24 Set MNO profile +UMNOPROF....86
7.25 Band selection bitmask +UBANDMASK....89
7.26 Device service domain configuration +USVCDOMAIN....90
7.27 Modem features customization +UDCONF=92....91
7.28 EEA0 encryption algorithm configuration+UDCONF=98....92
8 IP Multimedia Subsystem (IMS)....94
8.1 Introduction....94
8.2 IMS client configuration +UIMSCFG....94
8.3 IMS client registration / deregistration in network +UIMSREG....98
8.4 IMS registration information +CIREG....98
8.5 Domain configuration for MO SMS messages +UISMS....99
9 Device lock....101
9.1 Enter PIN +CPIN....101
9.2 Change password +CPWD....102
10 Phonebook....103
10.1 Select phonebook memory storage +CPBS....103
10.2 Read phonebook entries +CPBR....104
10.3 Find phonebook entries +CPBF....105
10.4 Write phonebook entry +CPBW....107
11 Short Messages Service....109
11.1 Introduction....109
11.2 Select message service +CSMS....110
11.3 Preferred message storage +CPMS....111
11.4 Preferred message format +CMGF....112
11.5 Save settings +CSAS....112
11.6 Restore settings +CRES....113
11.7 Show text mode parameters +CSDH....113
11.8 New message indication +CNMI....114

11.9 Select service for MO SMS messages +CGSMS ... 117
11.10 Read message +CMGR ... 118
11.11 New message acknowledgement to MT +CNMA ... 120
11.12 List message +CMGL ... 121
11.13 Send message +CMGS ... 124
11.14 Write message to memory +CMGW ... 125
11.15 Send message from storage +CMSS ... 126
11.16 Set text mode parameters +CSMP ... 126
11.17 Delete message +CMGD ... 127
11.18 Service center address +CSCA ... 128
11.19 Select cell broadcast message types +CSCB ... 128
11.20 Read concatenated message +UCMGR ... 129
11.21 List concatenated message +UCMGL ... 132
11.22 Send concatenated message +UCMGS ... 134
11.23 Write concatenated message to memory +UCMGW ... 135
11.24 More messages to send +CMMS ... 136
11.25 Peek message +UCMGP ... 137
11.26 Send SMS command +CMGC ... 138

12 Supplementary services ... 140

12.1 Introduction ... 140
12.2 Call forwarding +CCFC ... 140
12.3 Call waiting +CCWA ... 141
12.4 Calling line identification restriction +CLIR ... 143
12.5 Calling line identification presentation +CLIP ... 144
12.6 Connected line identification presentation +COLP ... 145
12.7 Advice of charge +CAOC ... 145
12.8 Accumulated call meter +CACM ... 146
12.9 Accumulated call meter maximum +CAMM ... 147
12.10 Price per unit and currency table +CPUC ... 147
12.11 Call related supplementary services +CHLD ... 148
12.12 Call deflection +CTFR ... 149
12.13 Supplementary service notifications +CSSN ... 149
12.14 Unstructured supplementary service data +CUSD ... 150
12.15 Closed user group +CCUG ... 151

13 Circuit switched data services ... 153

13.1 Introduction ... 153
13.2 Cellular result codes +CRC ... 153

14 V24 control and V25ter ... 154

14.1 Introduction ... 154
14.2 Circuit 109 behavior &C ... 154
14.3 Circuit 108/2 and escape sequence behavior &D ... 154
14.4 DSR override &S ... 156
14.5 Flow control &K ... 156
14.6 DTE-DCE character framing +ICF ... 157
14.7 Set flow control \Q ... 158
14.8 UART data rate configuration +IPR ... 159
14.9 Return to on-line data state O ... 159
14.10 Escape character S2 ... 160
14.11 Command line termination character S3 ... 161
14.12 Response formatting character S4 ... 161
14.13 Command line editing character S5 ... 162
14.14 Pause before blind dialling S6 ... 162
14.15 Connection completion timeout S7 ... 163
14.16 Command dial modifier time S8 ... 163
14.17 Automatic disconnect delay S10 ... 164
14.18 Command echo E ... 164
14.19 Result code suppression Q ... 165
14.20 DCE response format V ... 165

14.21 Result code selection and call progress monitoring control X....166
14.22 Reset to default configuration Z....166
15 SIM management....168
15.1 Generic SIM access +CSIM....168
15.2 Restricted SIM access +CRSM....168
15.3 Read the SIM language +CLAN....170
15.4 Check for UICC card +UUICC....171
15.5 SIM hot insertion configuration +UDCONF=50....171
15.6 UICC application discovery +CUAD....172
15.7 SIM states reporting +USIMSTAT....173
16 SIM toolkit....175
16.1 Introduction....175
16.2 Bearer Independent Protocol status indication +UBIP....175
16.3 Read the USAT profile +CUSATR....176
16.4 Write the USAT profile +CUSATW....177
16.5 Enable USAT terminal URCs +UCUSATA....177
17 Packet switched data services....179
17.1 PDP contexts and parameter definition....179
17.2 PPP LCP handshake behavior....180
17.3 Printing IP address format +CGPIAF....181
17.4 PDP context definition +CGDCONT....182
17.5 Default PDP and preferred protocol type configuration +UDCONF=19....185
17.6 Quality of service profile (requested) +CGQREQ....186
17.7 Quality of service profile (minimum acceptable) +CGQMIN....187
17.8 GPRS attach or detach +CGATT....188
17.9 PDP context activate or deactivate +CGACT....189
17.10 Enter data state +CGDATA....191
17.11 Enter PPP state/GPRS dial-up D*....193
17.12 Show PDP address +CGPADDR....194
17.13 GPRS network registration status +CGREG....194
17.14 Manual deactivation of a PDP context H....196
17.15 PDP context modify +CGCMOD....196
17.16 3G Quality of service profile (requested) +CGEQREQ....197
17.17 3G Quality of service profile (minimum acceptable) +CGEQMIN....200
17.18 Define secondary PDP context +CGDSCONT....204
17.19 EPS network registration status +CEREG....205
17.20 Configure the authentication parameters of a PDP/EPS bearer +UAUTHREQ....207
17.21 Define EPS quality of service +CGEQOS....208
17.22 PDP context read dynamic parameters +CGCONTRDP....209
17.23 Traffic flow template +CGTFT....211
17.24 Read counters of sent or received PS data +UGCNTRD....214
17.25 Set/reset counter of sent or received PS data +UGCNTSET....215
17.26 PDP IP configuration when roaming +UDCONF=75....215
17.27 Disable data when roaming +UDCONF=76....216
18 System features....218
18.1 Firmware installation +UFWINSTALL....218
18.2 Firmware update Over AT (FOAT) +UFWUPD....220
18.3 Antenna detection +UANTR....221
18.4 RX antenna selection +UANT....221
18.5 Rx diversity +URXDIV....222
18.6 Digital pins testing +UTEST=10....223
18.7 Smart temperature supervisor +USTS....226
18.8 MSPR profile handling configuration +UDCONF=40....227
18.9 RING line handling +URING....228
18.10 UART baud rate and flow control NVM management +UUARTCONF....229
18.11 Serial interfaces configuration selection +USIO....230
18.12 Internal temperature monitor +UTEMP....232

18.13 Restore factory configuration +UFACTORY....233
18.14 Backup and restore the file system +UBKUPDATA....234
18.15 Cancel FOTA download +UFOTA....235
18.16 Sets FOTA status URCs +UFOTASTAT....235
18.17 Last gasp configuration +ULGASP....237
18.18 URC over AT terminal configuration +UURCCONF....239
19 Power management....241
19.1 Power saving control (Power SaVing) +UPSV....241
20 GPIO....243
20.1 Introduction....243
20.2 GPIO select configuration command +UGPIOC....248
20.3 GPIO read command +UGPIOR....251
20.4 GPIO set command +UGPIOW....251
21 File System....253
21.1 File tags....253
21.2 Download file +UDWNFILE....255
21.3 List files information +ULSTFILE....257
21.4 Read file +URDFILE....258
21.5 Partial read file +URDBLOCK....258
21.6 Delete file +UDELFILE....259
21.7 File system limits....259
22 Audio interface....261
22.1 Loudspeaker volume level +CLVL....261
22.2 Mute control +CMUT....262
22.3 Audio path mode setting +USPM....262
22.4 I^2S digital interface mode +UI2S....263
22.5 Play audio resource +UPAR....270
22.6 Stop audio resource +USAR....271
22.7 Tone generator +UTGN....271
22.8 Master clock control +UMCLK....273
22.9 External device configuration +UEXTDCONF....274
22.10 Speech codec information +USPEECHINFO....276
22.11 Speech codec configuration +UDCONF=30....278
22.12 VoLTE speech codec configuration +USPEECHCFG....279
23 DNS....281
23.1 Resolve name / IP number through DNS +UDNSRN....281
23.2 Dynamic DNS update +UDYNDNS....282
23.3 Override DNS configuration +UDNSCFG....285
24 Internet protocol transport layer....287
24.1 Introduction....287
24.2 IPv4/IPv6 addressing....287
24.3 Create Socket +USOCR....288
24.4 SSL/TLS/DTLS mode configuration on TCP/UDP socket +USOSEC....289
24.5 Set socket option +USOSO....290
24.6 Get Socket Option +USOGO....291
24.7 Close Socket +USOCL....292
24.8 Get Socket Error +USOER....293
24.9 Connect Socket +USOCO....294
24.10 Write socket data +USOWR....295
24.11 SendTo command (UDP only) +USOST....297
24.12 SendTo command with flags (UDP only) +USOSTF....298
24.13 Read Socket Data +USORD....300
24.14 Receive From command (UDP only) +USORF....301
24.15 Set Listening Socket +USOLI....303
24.16 HEX mode configuration +UDCONF=1....304
24.17 Set socket in Direct Link mode +USODL....304

24.18 Timer Trigger configuration for Direct Link +UDCONF=5 ... 306
24.19 Data Length Trigger configuration for Direct Link +UDCONF=6 ... 307
24.20 Character trigger configuration for Direct Link +UDCONF=7 ... 307
24.21 Congestion timer configuration for Direct Link +UDCONF=8 ... 308
24.22 Internal IP stack TCP window scaling factor configuration +UDCONF=17 ... 308
24.23 Direct Link disconnect DSR line handling +UDCONF=10 ... 309
24.24 Socket control +USOCTL ... 310
24.25 IP Change Notification +UIPCHGN ... 311
25 Device and data security ... 316
25.1 Introduction ... 316
25.2 Device security ... 316
25.3 Data security ... 322
26 FTP ... 347
26.1 FTP service configuration +UFTP ... 347
26.2 FTP command +UFTPC ... 350
26.3 FTP error +UFTPER ... 353
27 HTTP ... 355
27.1 HTTP control +UHTTP ... 355
27.2 HTTP advanced control+UHTTPAC ... 358
27.3 HTTP command +UHTTPC ... 359
27.4 HTTP protocol error +UHTTPER ... 362
28 Ping ... 363
28.1 Ping command +UPING ... 363
29 Positioning ... 365
29.1 NMEA ... 365
29.2 AssistNow services ... 365
29.3 GNSS ... 366
29.4 CellLocate® and hybrid positioning ... 379
30 DTMF ... 388
30.1 In-band DTMF and Contact ID tones detection +UDTMFCFG ... 388
31 I²C ... 395
31.1 Introduction ... 395
31.2 I²C open logical channel +UI2CO ... 395
31.3 I²C write to peripheral +UI2CW ... 396
31.4 I²C read from peripheral +UI2CR ... 397
31.5 I²C read from peripheral register +UI2CREGR ... 397
31.6 I²C close logical channel +UI2CC ... 398
32 Networking ... 399
32.1 Get the USB IP configuration +UIPADDR ... 399
32.2 Configure port filtering for embedded applications +UEMBPF ... 401
33 Constrained Application Protocol (CoAP) ... 402
33.1 Introduction ... 402
33.2 CoAP profile configuration +UCOAP ... 402
33.3 CoAP command +UCOAPC ... 406
33.4 CoAP error reporting +UCOAPER ... 407
34 MQTT ... 409
34.1 Introduction ... 409
34.2 MQTT profile configuration +UMQTT ... 409
34.3 Save/Restore MQTT profile from NVM +UMQTTNV ... 413
34.4 MQTT command +UMQTTC ... 414
34.5 MQTT error +UMQTTER ... 418
35 MQTT-SN ... 419

35.1 Introduction ... 419
35.2 MQTT-SN profile configuration +UMQTTSN ... 420
35.3 Save/Restore MQTT-SN profile from NVM +UMQTTSNNV ... 423
35.4 MQTT-SN command +UMQTTSNC ... 423
35.5 MQTT-SN error +UMQTTSNER ... 427
36 Lightweight M2M ... 428
36.1 LwM2M Objects management ... 428
36.2 LwM2M connectivity ... 431
A Appendix: Error result codes ... 441
A.1 Mobile termination error result codes +CME ERROR ... 441
A.2 Message service error result codes +CMS ERROR ... 447
A.3 Firmware install final result codes ... 451
A.4 FOAT error result codes ... 452
A.5 Dynamic DNS unsolicited indication codes ... 452
A.6 Internal TCP/UDP/IP stack class error codes ... 453
A.7 Internet suite error classes ... 455
A.8 IP change notification error result codes ... 462
A.9 Ping error result codes ... 462
B Appendix: AT Commands List ... 464
B.1 Parameters stored in profiles ... 494
B.2 Parameters stored in non volatile memory ... 495
B.3 Saving AT commands configuration ... 499
B.4 Estimated command response time ... 499
B.5 Multiple AT command interfaces ... 500
C Mobile Network Operator profiles ... 502
C.1 LARA-R6 Introduction ... 502
C.2 LARA-R6001D Americas MNO and conformance profiles table ... 503
C.3 LARA-R6001D EMEA and global MNO profiles table ... 505
C.4 LARA-R6001 Americas MNO and conformance profiles table ... 507
C.5 LARA-R6001 EMEA and global MNO profiles table ... 509
C.6 LARA-R6401D Americas MNO and conformance profiles table ... 511
C.7 LARA-R6401D EMEA and global MNO profiles table ... 513
C.8 LARA-R6401 Americas MNO and conformance profiles table ... 514
C.9 LARA-R6401 EMEA and global MNO profiles table ... 516
C.10 LARA-R6801 Americas MNO and conformance profiles table ... 517
C.11 LARA-R6801 EMEA and global MNO profiles table ... 519
D Appendix: glossary ... 521
Related documentation ... 525
Revision history ... 531
Contact ... 533

1 AT command settings

u-blox cellular modules provide at least one physical serial interface that is compliant to V.24 [201]. When the module is powered on, it enters the command mode. For more details on command mode, see Chapter 1.1.

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

1.1 Definitions

In this document the following naming conventions are used:

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

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

☞ LARA-R6
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 behavior among the interfaces in reference to the AT command interface.

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

☞ LARA-R6
Where supported, two UART AT interfaces can be used at the same time (it is not the default behavior). See +USIO command description for details on how to set such behavior.
According to the terminology used in the data sheet, UART is the main asynchronous serial interface, while AUX UART is the auxiliary asynchronous interface. For more details on supported serial interfaces and their characteristics, see the corresponding module data sheet.
The same naming will be used in the rest of the document (when not clearly specified, the description shall be considered applicable to both the interfaces).

1.2 Operational mode of the AT interface

The DCE/MT interface can operate in these modes:

- **Command mode**: the DCE waits for AT command instructions. The DCE interprets all the characters received as commands to execute. The DCE may send responses back to the DTE indicating the outcome of the command or further information without having received any commands by the DTE (e.g. unsolicited response code - URC). Any communication in the command mode (in both directions) is terminated by the command line termination character.
- **Data mode**: the DCE transfers data after having sent the "CONNECT" string; all the characters sent to the DCE are intended to be transmitted to the remote party. Any further characters received over the serial link are deemed to be from the remote party, and any characters sent are transmitted to the remote party. The DCE enters data mode immediately after it makes a Circuit Switched Data (CSD) or Packet Switched Data (PSD) connection (PPP or DUN connection).
- **Online command mode**: the DCE has a data connection established with a remote party, but treats signals from the DTE as command lines and sends back responses and unsolicited indications to the DTE.
- **Direct link mode**: intermediate state where the DCE transfers data transparently over a connected TCP/UDP socket (e.g. by means of +USODL), after reporting the "CONNECT" string.
- **SMS mode**: AT commands for writing or sending SMSs lead the AT interface into an intermediate state indicated by the ">" (greater-than sign) where SMS text/PDU can be entered (DCD signal shall be in ON state during this operation). <Ctrl-Z> indicates that the SMS editing is completed, while <ESC> indicates aborting of the edited SMS.
- **Raw mode**: special AT commands lead the AT interface into intermediate state where raw data is being exchanged (e.g. during file transfer).

- **AT commands over an IP connection**: the DCE is accepting a TCP connection on a specific TCP port. The DTE can connect via TCP protocol to the port and can send commands over this TCP connection. The DCE may send responses back to the DTE via the same TCP connection. The communication over IP connection is denoted by a set of two ports:
  - o AT command port;
  - o binary data port. The binary data port is used for the exchange of binary data between the DCE and DTE.

  For more details, on the configuration of the TCP ports see +UIFCONF.

☞ LARA-R6
The AT commands over IP connection is not supported.

☞ LARA-R6
For more details on PSD connection, see the +CGACT AT command description.

1.3 Command description

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

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

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

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

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

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

1.3.1 Default values

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

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

1.3.2 Command line

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

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

Where:

- "AT": prefix to be set at the beginning of each command line
- <command_name>: command name string; it can have a "+" character as prefix
- <string>: string consisting of the parameters value following the syntax provided in this manual
  The following rules are used when describing the command syntax:
  - 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:
  - Number: positive and negative counting numbers, as well as zero {..., -2, -1, 0, 1, 2,...}.
  - String: sequence of characters enclosed within quotation marks (" ").
- <S3_character>: command line termination character; the factory-programmed termination character is <CR>

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

☞ LARA-R6
The command line is not case sensitive unless autobauding is enabled; in this case the prefix "AT" must be typed either as "AT" or "at"; other combinations ("aT" or "Ta") are not allowed.

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

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

1.3.2.1 Concatenation of AT commands

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

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

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

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

☞ LARA-R6
Not all the commands can be entered with other commands on the same command line: +CMGW, +CMGS, +USOWR, +USOST, +UDWNFILE must be used by themselves.

1.3.3 Notes

LARA-R6

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

☞ LARA-R6001D
The maximum length of the command line is 1024 characters.

1.3.4 Information text responses and result codes

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

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

where

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

LARA-R6
The V AT command configures the result code in numeric or verbose format.
The command line termination character can be set with S3 AT command.
The linefeed character can be set with S4 AT command.

Table 1 lists the allowed result codes.

Verbose	Numeric	Result code type	Description
OK	0	Final	Command line successfully processed and the command is correctly executed
CONNECT	1	Intermediate	Data connection established
RING	2	Unsolicited	Incoming call signal from the network
NO CARRIER	3	Final	Connection terminated from the remote part or attempt to establish a connection failed
ERROR	4	Final	General failure. The +CMEE AT command configures the error result format
NO DIALTONE	6	Final	No dialtone detected
BUSY	7	Final	Engaged signal detected (the called number is busy)
NO ANSWER	8	Final	No hang up detected after a fixed network timeout
CONNECT<data rate>	9	Intermediate	Same as CONNECT including also the data rate (data call).
DELAYED	9	Final	Delayed
NOT SUPPORT	10	Final	Operation not supported
INVALID COMMAND LINE	11	Final	Invalid command line
CR	12	Final	Carriage return
SIM DROP	13	Final	SIM not inserted
Command aborted	3000	Final	Command execution aborted issuing a character to the DCE
DISCONNECT	14	Final	Data connection disconnected
ABORTED	18	Final	Aborted terminal

Table 1: Allowed result codes

The following result codes are not supported:

- LARA-R6 - `CONNECT<data rate>`, `Command aborted`, `DISCONNECT` and `ABORTED`.

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

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

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

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

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

The most typical error result codes are the following:

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

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

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

- LARA-R6 - Firmware update Over The Air: see the Appendix A.3
- LARA-R6 - Firmware update Over AT command: see the Appendix A.4

- LARA-R6 - DNS: see the Appendix A.5 and Appendix A.6
- LARA-R6 - TCP and UDP connections: see the Appendix A.6, Appendix A.7
- LARA-R6 - FTP: see the Appendix A.7.1
- LARA-R6 - HTTP: see the Appendix A.7.2
- LARA-R6 - MQTT: see the Appendix A.7.4
- LARA-R6 - MQTT-SN: see the Appendix A.7.5
- LARA-R6 - IP change notification: see the Appendix A.8
- LARA-R6 - CoAP: see the Appendix A.7.6
- LARA-R6 - Ping: see the Appendix A.9

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

1.4 Storing of AT commands setting

Several user settings may be stored in the cellular module's memory. Some are directly stored in the non volatile memory (NVM), while the others are organized into two personal profiles (where supported).

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

☞ LARA-R6
The module does not store the AT commands setting in the personal profiles.

1.5 +UDCONF AT command

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

The generic set command syntax is:

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

while the generic read command syntax is

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

The test command syntax is defined as follows:

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

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

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

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

2 General operation

2.1 Start up and initialization

The characteristics of the boot of the cellular device vary from module to module and are described in the corresponding system integration manual. During the boot phase the module might not respond to the AT interface until all necessary SW modules have been installed (e.g. USB drivers). Monitoring of the greeting text, where supported, can help in detecting the successful end of the boot phase.

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

☞ LARA-R6
If the SIM card has enabled the PIN check, some commands answer with "+CME ERROR: SIM PIN required" and most cellular functionalities are not started. After entering the required PIN via the +CPIN command, or if booting with a SIM with disabled PIN check, SIM initialization is carried out and a lot of SIM files are read: it is possible that some commands (e.g. phonebook AT commands) are affected by this preliminary phase, resulting in a temporary error response.

2.1.1 Auto-registration

If the +COPS <mode> parameter in the profiles or in NVM is left to its factory-programmed value 0 or is set to 1, then after SIM initialization, all u-blox modules will automatically perform PLMN selection and registration for circuit switched/non EPS services as well as packet switched/EPS services. Auto-registration (also sometimes called "auto-COPS", not to be confused with automatic <mode>=0) will also be triggered at SIM insertion, for modules supporting SIM hot insertion, or at SIM driver recovery, occurring when the communication with the SIM card is re-established by the module after an unrecoverable error, caused e.g. by mechanical vibrations or electrical interference.

☞ LARA-R6
During the auto-registration any further network request (by means of AT+COPS=0 or AT+COPS=1) is processed immediately.

☞ LARA-R6
The radio access technology selected by the module at start up is defined by the <1stAcT> parameter of the +URAT command; afterwards the module will reselect the RAT based on the requirements of the cellular standards it complies with and it is not possible to force it to remain in a given RAT unless it is locked on it via +URAT.

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

2.1.2 Operational restrictions

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

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

If 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 an information text response to a previous AT command and can be output, when enabled, at any time to inform the DTE of a specific event or status change.

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

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

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

☞ LARA-R6
The generated URCs are issued on all the AT terminals except during a FOAT update. For more details, see the +UFWUPD 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 if the AT command interface is busy. The AT command interface can be busy in the following cases:

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

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

the executing command (e.g.: ATH); if it is handled as an unsolicited result code, it follows the rule of the other URCs.

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

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

For the above classes, it is possible to select the presentation strategy when the AT interface is busy, according to the 3GPP TS 27.007 [70]; buffering or discarding are the two possible choices (URCs are lost in the latter case). This is done by means of the corresponding AT command (see the AT commands listed in the table above). If the URCs are enabled or, for the three described classes of URCs, the buffered URCs are sent out only when the AT interface is in idle again, then this occurs as soon as:

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

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

☞ If multiple AT interfaces are available, it is best to use one of the AT interfaces to manage all the user-enabled URCs, while using the other ones to send AT commands and receive their responses.
The URCs related to external causes (e.g., RING) are issued on all interfaces.

2.2.6 Intermediate Result Code (IRC)

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

3 IPC - Inter Processor Communication

3.1 Multiplexing mode +CMUX

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

3.1.1 Description

Enables the multiplexing protocol control channel as defined in 3GPP TS 27.010 [99]. The command sets the parameters for the control channel. The result code is returned using the old interface speed. The parameters become active only after sending the OK result code.

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

The multiplexer configuration is as follows:

Modules	Control channel	AT commands / data connection	GNSS tunneling	SAP (SIM Access Profile)
LARA-R6	Channel 0	Channel 1 - 2	Channel 3	

Table 2: Multiplexer configuration

3.1.2 Syntax

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

3.1.3 Defined values

Parameter	Type	Description
<mode>	Number	Multiplexer transparency mechanism: • 0: basic option
<subset>	Number	The way in which the multiplexer control channel is set up: • 0 (default value): UIH frames used only • 1: UI frames used only Allowed values: • LARA-R6 - 0, 1
<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.

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

3.1.4 Notes

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

LARA-R6

- <T1> value is ignored, since the related timer is not implemented.
- The command is only supported on the UART interface. It cannot be used on the USB interface and on the AUX UART interface.
- In case the USB interface is configured as GNSS tunneling (for more details, see +USIO AT command, <requested_variant>=2 and <requested_variant>=3) and the multiplexing protocol is activated, the multiplexer on the UART interface is configured as follows:
  - Control channel: channel 0
  - AT commands / data connection: channel 1 - 3

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 product name.

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 the product

4.4 Model identification +GMM

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

4.4.1 Description

Text string identifying the product name.

4.4.2 Syntax

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

4.4.3 Defined values

Parameter	Type	Description
<model>	String	Name of product

4.5 Firmware version identification +CGMR

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

4.5.1 Description

Returns the firmware version of the module.

4.5.2 Syntax

Type	Syntax	Response	Example
Action	AT+CGMR	<version>	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 Request product serial number identification +CGSN

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

4.7.1 Description

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

4.7.2 Syntax

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

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

4.7.3 Defined values

Parameter	Type	Description
<snt>	Number	It indicates the requested serial number type. Depending on <snt> value, the <param_val> parameter in the information text response provides different information: • 0 (default value): MT serial number, typically the International Mobile station Equipment Identity (IMEI) • 1: International Mobile station Equipment Identity (IMEI) • 2: International Mobile station Equipment Identity and Software Version Number (IMEISV) • 3: Software Version Number (SVN) • 255: IMEI (not including the spare digit), the check digit and the SVN
<sn>	Number	MT serial number, typically the International Mobile station Equipment Identity (IMEI)
<imei>	String	International Mobile station Equipment Identity (IMEI). IMEI is composed of Type Allocation Code (TAC) (8 digits), Serial Number (SNR) (6 digits) and the Check Digit (CD) (1 digit).
<imeisv>	String	International Mobile station Equipment Identity and Software Version Number (IMEISV). The 16 digits of IMEISV are composed of Type Allocation Code (TAC) (8 digits), Serial Number (SNR) (6 digits) and the software version (SVN) (2 digits).
<svn>	String	Software Version Number (SVN) which is a part of IMEISV.
<imei_full	Number	International Mobile station Equipment Identity (IMEI), Check Digit and Software Version Number.
<param_val>	Number/ String	Type and supported content depend on related <snt> (details are given above)

4.8 IMEI identification +GSN

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

4.8.1 Description

The commands handling is the same of +CGSN.

4.8.2 Syntax

Type	Syntax	Response	Example
Action	AT+GSN[=<snt>]	<sn>	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 the modem version and the application version of the module where applicable; it returns "Undefined" where not applicable.

4.9.2 Syntax

Type	Syntax	Response	Example
Action	**Type number request** ATI[0]	<type_number> OK	ATI0 LARA-R6001-00B-00 OK
	Model name ATI7	<model_name> OK	ATI7 LARA-R6001 OK
	Modem and application version request ATI9	<modem_version>,<applications_version> OK	ATI9 00.10,A00.01 OK

4.9.3 Defined values

Parameter	Type	Description
<type_number>	String	Product type number
<model_name>	Number	Model name. For more details on the allowed values, see Notes.
<modem_version>	String	Module modem version
<applications_version>	String	Module application version. Where not applicable the module provides "Undefined".

4.10 TE character set configuration +CSCS

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

4.10.1 Description

Selects the TE character set.

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

LARA-R6
The command setting is not stored in the profile and is volatile.

4.10.2 Syntax

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

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

4.10.3 Defined values

Parameter	Type	Description
<chset>	String	Allowed characters set: • "IRA": International Reference Alphabet (ITU-T T.50) • "GSM": GSM default alphabet (3GPP TS 23.038) • "PCCP437": PC character set Code Page 437 • "8859-1": ISO 8859 Latin 1 character set • "UCS2": 16-bit universal multiple-octet coded character set (USO/IEC10646); UCS2 character strings are converted to hexadecimal numbers from 0000 to FFFF; e.g. "004100620063" equals three 16-bit characters with decimal values 65, 98 and 99 • "HEX": character strings consist only of hexadecimal numbers from 00 to FF; e.g. "032FE6" equals three 8-bit characters with decimal values 3, 47 and 230; no conversions to the original MT character set shall be done • "PCCP936": Chinese character set Allowed values: • LARA-R6 - "IRA" (default value), "GSM", "UCS2"

4.11 International mobile subscriber identification +CIMI

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

4.11.1 Description

Request the IMSI (International Mobile Subscriber Identity).

4.11.2 Syntax

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

4.11.3 Defined values

Parameter	Type	Description
<IMSI>	Number	International Mobile Subscriber Identity

4.12 Card identification +CCID

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

4.12.1 Description

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

4.12.2 Syntax

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

4.12.3 Defined values

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

4.12.4 Notes

- The command needs of the SIM to correctly work.

4.13 Request complete capabilities list +GCAP

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

4.13.1 Description

This command requests the list of capabilities, containing the corresponding command names. The Complete Capabilities List command indicates the major capability areas of the MT. Each area is presented by the selection command name of the specific capability area or some other predefined response.

The first response text (+FCLASS) informs that some fax or voice capabilities are present while the second supported area presented with +CGSM shows that all GSM commands of the present document are supported.

4.13.2 Syntax

Type	Syntax	Response	Example
Action	AT+GCAP	+GCAP: <capability_area 1>[, <capability_area 2>[...]] OK	+GCAP: +FCLASS, +CGSM OK
Test	AT+GCAP=?	OK	

4.13.3 Defined values

Parameter	Type	Description
<capability_area>	String	Command name or predefined response of the specific capability area In the example: +FCLASS response text informs that some fax or voice capabilities are present, while +CGSM response text shows that all GSM commands of the present document are supported by the MT

5 Mobile equipment control and status

5.1 Phone activity status +CPAS

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

5.1.1 Description

Returns the activity status <pas> of the MT.

5.1.2 Syntax

Type	Syntax	Response	Example
Action	AT+CPAS	+CPAS: <pas>	+CPAS: 0
		OK	OK
Test	AT+CPAS=?	+CPAS: (list of supported <pas>s)	+CPAS: (0-5)
		OK	OK

5.1.3 Defined values

Parameter	Type	Description
<pas>	Number	MT activity status: • 0: ready (MT allows commands from DTE) • 1: unavailable (MT does not allow commands from DTE) • 2: unknown (MT is not guaranteed to respond to instructions) • 3: ringing (MT is ready for commands from DTE, but the ringer is active) • 4: call in progress (MT is ready for commands from DTE, but a call is in progress, e.g. call active, hold, disconnecting) • 5: asleep (ME is unable to process commands from DTE because it is in a low functionality state) Allowed values: • LARA-R6 - 0, 3, 4

5.2 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

5.2.1 Description

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

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

See the corresponding system integration manual for the timing and the electrical details of the module power-off sequence via the AT+CPWROFF command.

5.2.2 Syntax

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

5.2.3 Notes

LARA-R6

- The +UCPWROFF URC is not supported.

5.3 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

5.3.1 Description

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

☞ LARA-R6
If the syntax AT+CFUN=15 or AT+CFUN=16 (resets) or AT+CFUN=127 is used (where supported), the rest of the command line, placed after that will be ignored.

5.3.2 Syntax

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

5.3.3 Defined values

Parameter	Type	Description
<fun>	Number	Selected functionality: • 0: sets the MT to minimum functionality (disable both transmit and receive RF circuits by deactivating both CS and PS services) • 1 (factory-programmed value): sets the MT to full functionality, e.g. from airplane mode or minimum functionality • 4: disables both transmit and receive RF circuits by deactivating both CS and PS services and sets the MT into airplane mode. Airplane mode is persistent between power cycles triggered by AT+CFUN=15, AT+CFUN=16 or AT+CPWROFF (where supported). • 10: fast and safe power-off, the command triggers a fast shutdown, without sending a detach request to the network, with storage of current settings in module's non-volatile memory. The "OK" final result code indicates the command request was successful, while the +UUFASTSHUTDOWN URC provides the status of the power-off process. • 15: MT silent reset (with detach from network and saving of NVM parameters), without reset of the SIM card • 16: MT silent reset (with detach from network and saving of NVM parameters), with reset of the SIM card • 19: sets the MT to minimum functionality by deactivating CS and PS services and the SIM card. Re-enable the SIM card by means of <fun>=0, 1, 4. Allowed values: • LARA-R6 - 0, 1, 4, 10, 15, 16, 19
<rst>	Number	Reset mode: • 0 (default value): do not reset the MT before setting it to the selected <fun> • 1: performs a MT silent reset (with detach from network and saving of NVM parameters) with reset of the SIM card before setting it to the selected <fun>

Parameter	Type	Description
<power_mode>	Number	Power mode: • 0: MT is switched on with minimum functionality • 1: MT is switched on • 4: MT is in "airplane mode" • 5: MT is in "test mode" • 19: MT is in minimum functionality with SIM deactivated Allowed values: • LARA-R6 - 0, 1, 4, 5, 19
<value>	Number	Allowed values: • 0: fast power-off ongoing • 1: fast power-off completed

5.3.4 Notes

LARA-R6

- <fun>=15 resets the SIM card.
- The command will provide an error result code while in Online Command Mode (OLCM).
- Only the +UUFASTSHUTDOWN: 1 URC is provided after the trigger of <gpio_mode>=24 GPIO functionality.

5.4 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

5.4.1 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 [70].

5.4.2 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

5.4.3 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:

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

5.4.4 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)

LARA-R6

- <descr>="sounder", "message" and "callheld" are not supported.

5.5 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

5.5.1 Description

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

5.5.2 Syntax

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

5.5.3 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 number (see the <descr> parameter of +CMER) minus 1: the least significant bit is used for the first indicator and so on. 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).

5.6 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

5.6.1 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.

LARA-R6
The command +UCIND allows enabling or disabling indicators.

5.6.2 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	+CMER: (0-3),(0),(0),(0-2),(0,1) OK

Type	Syntax	Response	Example
		<disp>'s),(list of supported <ind>'s), (list of supported <bfr>'s) OK	
URC		+CIEV: <descr>,<value>	

5.6.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 0 (default value): buffer URCs in the MT • 1: discard URCs when the V.24 interface is reserved for data; otherwise directly display them on the DTE • 2: buffer URCs in MT when the V.24 interface is reserved and flush them after reservation; otherwise directly display them on the DTE • 3: same as 1
<keyp>	Number	Allowed values: • 0: no keypad event reporting
<disp>	Number	Allowed values: • 0: no display event reporting
<ind>	Number	Allowed values: • 0: no indicator event reporting • 1: indicator event reporting using the +CIEV URC. Only the indicator events which are not caused by +CIND shall be indicated by the MT to the DTE. • 2: indicator event reporting using the +CIEV URC. All the indicator events shall be directed from MT to DTE.
<bfr>	Number	Allowed values: • 0: MT buffer of URCs defined within this command is cleared when <mode> 1...3 is entered • 1: MT buffer of URCs defined within this command is flushed to the DTE when <mode> 1...3 is entered (the OK final result code shall be given before flushing the codes).
<descr>	Number	Indicates the indicator order number. The name in the brackets indicates the corresponding <descr> parameter of +CIND; <value> is the new value of indicator: • 1 ("battchg"): <value> provides the battery charge level (0-5) • 2 ("signal"): <value> provides the signal level o 0: < -105 dBm o 1: < -93 dBm o 2: < -81 dBm o 3: < -69 dBm o 4: < - 57 dBm o 5: >= -57 dBm • 3 ("service"): <value> provides the network service availability: o 0: not registered to the network o 1: registered to the network • 4 ("sounder"): <value> provides the sounder activity: o 0: no sound o 1: sound is generated • 5 ("message"): <value> provides the unread message available in <mem1> storage: o 0: no messages o 1: unread message available • 6 ("call"): <value> provides the call in progress: o 0: no call in progress o 1: call in progress • 7 ("roam"): <value> provides the registration on a roaming network: o 0: not in roaming o 1: roaming • 8 ("smsfull"): <value> provides the SMS storage status: o 0: SMS storage not full

Parameter	Type	Description
		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

5.6.4 Notes

LARA-R6

- <descr>=4 ("sounder"), 5 ("message") and 11 ("callheld") are not supported.

5.7 Clock +CCLK

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

5.7.1 Description

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

5.7.2 Syntax

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

5.7.3 Defined values

Parameter	Type	Description
<time>	String	Format is "yy/MM/dd,hh:mm:ss+TZ". Characters indicate year, month, day, hours, minutes, seconds, time zone. • LARA-R6 - The factory-programmed value is "80/01/06,00:00:00+00" Values prior to the factory-programmed value are not allowed.

5.7.4 Notes

- If the parameter value is out of range, then the "+CME ERROR: operation not supported" or "+CME ERROR: 4" will be provided (depending on the +CMEE AT command setting).

- "TZ": The Time Zone information is represented by two digits. The value is updated during the registration procedure when the automatic time zone update is enabled (using +CTZU AT command) and the network supports the time zone information.
- The Time Zone information is expressed in steps of 15 minutes and it can assume a value in the range that goes from -96 to +96.

5.8 Set greeting text +CSGT

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

5.8.1 Description

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

5.8.2 Syntax

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

5.8.3 Defined values

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

5.9 Automatic time zone update +CTZU

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

5.9.1 Description

Configures the automatic time zone update via NITZ.

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

5.9.2 Syntax

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

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

5.9.3 Defined values

Parameter	Type	Description
<on_off>	Number	Automatic time zone update: • 0: automatic time zone via NITZ disabled • 1: automatic time zone update via NITZ enabled; if the network supports the service, update the local time to the module (not only time zone) • 2: automatic time zone update via NITZ enabled; if the network supports the service, update the GMT time to the module (not only time zone) Allowed values: • LARA-R6 - 0, 1 (factory-programmed value)

5.10 Time zone reporting +CTZR

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

5.10.1 Description

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

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

5.10.2 Syntax

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

5.10.3 Defined values

Parameter	Type	Description
<mode>	Number	Enables the time zone reporting URCs: • 0: disable the time zone change event reporting • 1: enable the time zone reporting by +CTZV and +CTZDST URCs • 2: enable the time zone reporting by +CTZE URC • 3: enable the time zone reporting and universal time reporting by +CTZEU URC according to 3GPP TS 27.007 Release 13 Allowed values: • LARA-R6 - 0 (default value), 1. The +CTZDST URC is not supported.

Parameter	Type	Description
<tz>	Number	Indicates the time zone. The range goes from -48 to +56.
<time>	String	Current local time in format "yy/MM/dd,hh:mm:ss". The characters indicate year, month, day, hour, minutes, seconds.
<dst>	Number	Indicates the daylight saving time. The allowed values are: • 0: no adjustments • 1: +1 hour adjustment • 2: +2 hours adjustment
<utime>	String	Universal time in format "yyyy/MM/dd,hh:mm:ss". The characters indicate year, month, day, hour, minutes, seconds.

5.10.4 Notes

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

LARA-R6

- The command setting is not stored in the NVM.

5.11 List current calls +CLCC

+CLCC						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

5.11.1 Description

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

5.11.2 Syntax

Type	Syntax	Response	Example
Action	AT+CLCC	[+CLCC: <id1>,<dir>,<stat>,<mode>,<mpty>[,<number>,<type>[,alpha>[,<priority>[,<CLI_validity>]]]] [+CLCC: <id2>,<dir>,<stat>,<mode>,<mpty>[,<number>,<type>[,<alpha>[,<priority>[,<CLI_validity>]]]] [...]]] OK or OK (if no calls)	+CLCC: 1,0,0,0,0,"0913137880",129 OK
Test	AT+CLCC=?	OK	

5.11.3 Defined values

Parameter	Type	Description
<idx>	Number	Indicates the call identification (see +CHLD x)
<dir>	Number	Direction: • 0: mobile originated (MO) call • 1: mobile terminated (MT) call
<stat>	Number	State of the call: • 0: active • 1: held

Parameter	Type	Description
		• 2: dialling (Mobile Originated call) • 3: alerting (Mobile Originated cal) • 4: incoming (Mobile Terminated call) • 5: waiting (Mobile Terminated call)
<mode>	Number	Teleservice: • 0: voice • 1: data • 2: FAX • 9: unknown
<mpty>	Number	• 0: call is not one of multiparty (conference) call parties • 1: call is one of multiparty call parties
<number>	String	Indicates the phone number in format specified by <type>
<type>	Number	Type of address octet (phone number)
<alpha>	String	Optional string alphanumeric representation of <number> corresponding to the entry found in phonebook; this parameter is not managed
<priority>	Number	Indicates the eMLPP priority level of the call, values specified in 3GPP TS 22.067 [103].
<CLI_validity>	Number	Provide details why <number> does not contain a calling party BCD number (see the 3GPP TS 24.008 [79] subclause 10.5.4.30). The parameter is not present for MO call types: • 0: CLI valid • 1: CLI has been withheld by the originator (see the 3GPP TS 24.008 [79] table 10 .5.135a/3GPP TS 24.008 code "Reject by user") • 2: CLI is not available due to interworking problems or limitations of originating network (see the 3GPP TS 24.008 [79] table 10.5.135a/3GPP TS 24.008 code "Interaction with other service") • 3: CLI is not available due to calling party being of type payphone (see the 3GPP TS 24.008 [79] table 10.5.135a/3GPP TS 24.008 code "Coin line/payphone") • 4: CLI is not available due to other reasons (see the 3GPP TS 24.008 [79] table 10 .5.135a/3GPP TS 24.008 code "Unavailable") When the CLI is not available (<CLI_validity>=2, <CLI_validity>=3 or <CLI_validity>= 4), the <number> parameter shall be an empty string ("") and <type> value will not be significant. Nevertheless, the MT may return the recommended value 128 for <type> (TON/NPI unknown in accordance with 3GPP TS 24.008 [79] subclause 10 .5.4.7). When the CLI has been withheld by the originator, (<CLI_validity>=1) and the CLIP is provisioned with the "override category" option (see the 3GPP TS 22.081 [90] and 3GPP TS 23.081 [91]), <number> and <type> is provided. Otherwise, the MT shall return the same setting for <number> and <type> as if the CLI was not available

5.12 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

5.12.1 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.

5.12.2 Syntax

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

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

5.12.3 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

5.12.4 Notes

- The following convention is valid:

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

5.13 Extended error report +CEER

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

5.13.1 Description

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

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

5.13.2 Syntax

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

5.13.3 Defined values

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

6 Call control

6.1 Select type of address +CSTA

+CSTA						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

6.1.1 Description

Selects the type of number for further dialling commands (D) according to 3GPP specifications.

The type of address is automatically detected from the dialling string thus the +CSTA command has no effect.

6.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSTA=[<type>]	OK	AT+CSTA=145 OK
Read	AT+CSTA?	+CSTA: <type> OK	+CSTA: 145 OK
Test	AT+CSTA=?	+CSTA: (list of supported <type>s) OK	+CSTA: (129,145) OK

6.1.3 Defined values

Parameter	Type	Description
<type>	Number	Type of address in integer format • 145: dialing string includes international access code character '+' • 129 (default value): national coded dialing string

6.2 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

6.2.1 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 [72] and initiates the indicated kind of call. No further commands may follow in the command line in case of data or fax calls.

LARA-R6
Supplementary services strings are not supported in the dial command.
Set the DTR line to ON state before making a data call.

LARA-R6001D / LARA-R6401D
Voice calls are not supported.

6.2.2 Syntax

Type	Syntax	Response	Example
Action	ATD<number>[<I>][<G>][;]	See Result codes	**Voice call** ATD123456;

Type	Syntax	Response	Example
			OK
			Data / fax call ATD123456 CONNECT 9600
			Supplementary services ATD*#43# +CCWA: 0,1 +CCWA: 0,2 OK

6.2.3 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 [70]). 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 ☞ LARA-R6 The index and the information parameters used during the call will be the same previously set with +CCUG command.

6.2.4 Notes

LARA-R6

- This command is abortable.

6.2.5 Voice call example

The following diagram illustrates the possible transitions in both Mobile Terminated and Mobile Originated calls. Information text responses and result codes generated by MT are in italic.

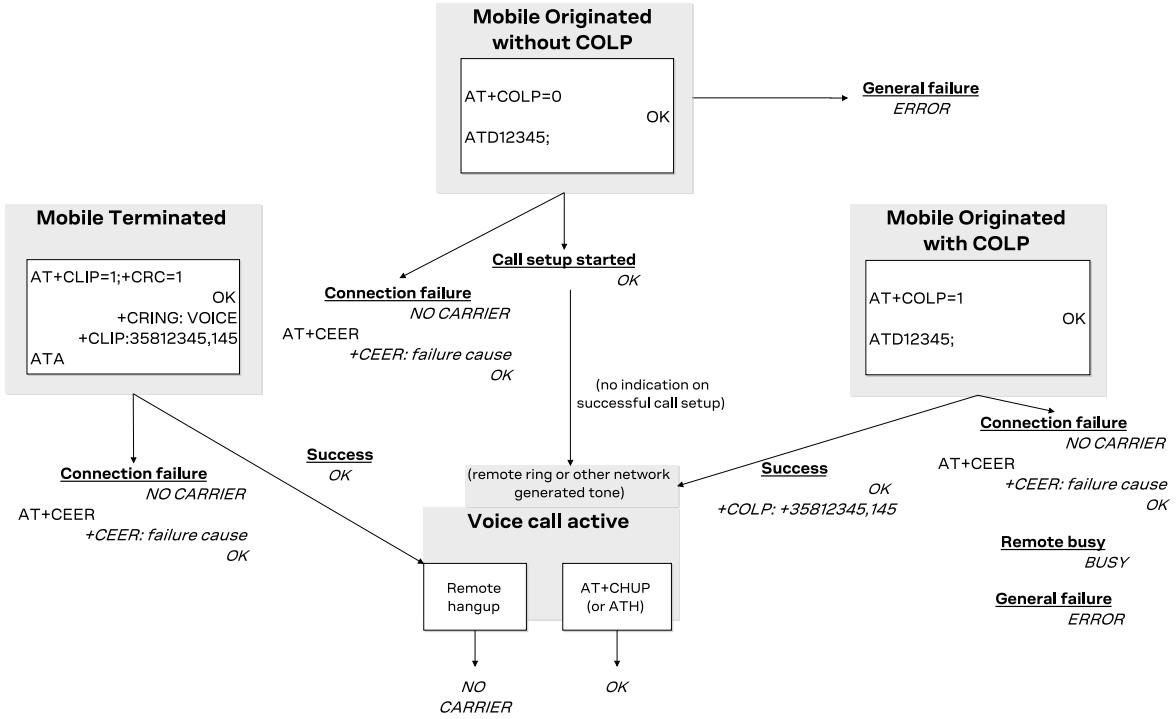


Figure 1: Mobile Terminated and Mobile Originated calls possible transitions

6.3 Select tone dialling T

T						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

6.3.1 Description

Causes subsequent (or previous) D command to assume that DTMF dialling is to be used. Since DTMF dialling is default in GSM, this command has no effect.

6.3.2 Syntax

Type	Syntax	Response	Example
Action	ATT	OK	

6.4 Select pulse dialling P

P						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

6.4.1 Description

Causes subsequent (or previous) D command to assume that pulse dialling is to be used. Since DTMF dialling is default in GSM, this command has no effect.

6.4.2 Syntax

Type	Syntax	Response	Example
Action	ATP	OK	

6.5 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

6.5.1 Description

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

6.5.2 Syntax

Type	Syntax	Response	Example
Action	ATA	RING OK	

6.6 Hook control H

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

6.6.1 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.

☞ LARA-R6
Issue the AT+CVHU=0 command in order to make ATH over Online Command Mode (OLCM) work, according to 3GPP requirements. If the module has a DUN/PPP activated and is in OLCM, the command deactivates the PPP and the associated PDP context (if possible).

☞ LARA-R6001 / LARA-R6401 / LARA-R6801
Issue the AT+CVHU=0 command in order to make ATH release speech calls. By default speech calls are released by +CHUP AT command.

6.6.2 Syntax

Type	Syntax	Response	Example
Action	ATH	OK	

6.7 Voice hangup control +CVHU

+CVHU						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

6.7.1 Description

Sets whether issuing the ATH command or an ON-to-OFF transition on the DTR line causes a voice connection, including alternating mode calls that are currently in voice mode, to be disconnected or not.

6.7.2 Syntax

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

6.7.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 0: the ON-to-OFF transition on the DTR line is ignored, but the "OK" final result code is issued. The ATH command disconnects the remote user. • 1 (default value): both the ON-to-OFF transition on the DTR line and the ATH command are ignored, but the "OK" final result code is issued.

6.8 Monitor speaker loudness L

L						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

6.8.1 Description

This command has no effect. It is implemented for compatibility with ITU-T V.25ter recommendation [21].

6.8.2 Syntax

Type	Syntax	Response	Example
Action	ATL[<value>]	OK	ATL0 OK

6.8.3 Defined values

Parameter	Type	Description
<value>	Number	0-3

6.9 Voice call mode +CVMOD

+CVMOD						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

6.9.1 Description

Selects the voice call mode for making a Mobile Originated voice call from the UE.

☞ The preferences are not applicable for the emergency call.

☞ The preferences are not applicable if operator has set preferences for UE originated calls/sessions, 3GPP TS 24.216 [113] subclause 5.6.

6.9.2 Syntax

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

6.9.3 Defined values

Parameter	Type	Description
<voice_mode>	Number	Call mode. Allowed values: • 0: CS_ONLY; the ATD command will make a call in CS mode • 1: VOIP_ONLY; the ATD command will make a call in VoIP mode • 2: CS_PREFERRED; the ATD command gives preference for CS based voice call • 3 (factory-programmed value): VOIP_PREFERRED; the ATD command gives preference for VoIP based voice call

6.10 Hang up call +CHUP

+CHUP						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 20 s	+CME Error

6.10.1 Description

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

☞ In case of multiple calls, all active calls will be released, while waiting and held calls are not.

☞ The command does not replace the ITU-T V.250 [20] command H, but gives an assured procedure to terminate an alternating mode call. For further information see the 3GPP TS 27.007 [2].

6.10.2 Syntax

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

6.11 Set reporting call status +UCALLSTAT

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

6.11.1 Description

Allows to enable / disable the reporting voice or data call status on the DTE using the URC **+UCALLSTAT**. This URC is generated each time a call status change occurs. When multiple calls change status at the same time (e.g. when all multiparty calls are terminated) a URC +UCALLSTAT is generated for each of them.

6.11.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCALLSTAT=<enable>	OK	AT+UCALLSTAT=1 OK
Read	AT+UCALLSTAT?	+UCALLSTAT: <enable> OK	+UCALLSTAT: 1 OK
Test	AT+UCALLSTAT=?	+UCALLSTAT: (list of supported <enable>'s) OK	+UCALLSTAT: (0-1) OK
URC		+UCALLSTAT: <call_id>,<stat>	+UCALLSTAT: 1,2

6.11.3 Defined values

Parameter	Type	Description
<enable>	Number	• 0: reporting disabled • 1: reporting enabled
<call_id>	Number	Indicates the call identification (see the 3GPP TS 22.030 [72])
<stat>	Number	Indicates the call status: • 0: active • 1: hold • 2: dialling (Mobile Originated call) • 3: alerting (Mobile Originated call; ringing for the remote party) • 4: ringing (Mobile Terminated call) • 5: waiting (Mobile Terminated call) • 6: disconnected • 7: connected (indicates the completion of a call setup first time for MT and MO calls - this is reported in addition to state active)

6.11.4 Notes

- The URC is displayed on the terminal where the command has been issued.
- For the USB terminals, the <enable> flag is reset when the USB cable is disconnected.

6.12 DTMF and tone generation +VTS

+VTS						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 7 min	+CME Error

6.12.1 Description

Allows the transmission of DTMF tones. These tones may be used e.g. when announcing the start of a recording period. The command can only be used during an active voice call. The command can be aborted if a character is sent to DCE during the command execution; this behavior is not covered by the 3GPP specification.

In GSM and UMTS the tone duration is network dependent; hence the value set with +VTS command is only the desired duration and, in particular for short tone durations, it is not guaranteed. Also the actual maximum DTMF tone duration is network dependent, i.e. the receiver can experience a shorter tone duration than the one specified with +VTS (or with +VTD). For more information, see the 3GPP TS 23.014 [109] and the 3GPP TS 27.007 [70].

In VoLTE DTMF tone generation is based on RTP events according to RFC 4733 [188].

6.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+VTS=<DTMF>[,<duration>]	OK	AT+VTS=2 OK
			AT+VTS=2A,10 OK
Test	AT+VTS=?	+VTS: (list of <DTMF>s),(list of supported <duration>s) OK	+VTS: (0-9,#,*,A-D),(0-255) OK

6.12.3 Defined values

Parameter	Type	Description
<DTMF>	String	String (without quotation marks) of ASCII characters from the set 0-9, #, *, A-D.
<duration>	Number	Range 0-255, expressed in <duration>/100 seconds (0.01 s). If left out or set to 0, the tone duration is given by the +VTD setting

6.12.4 Notes

- If the command is invoked when not in a call, an error result code is reported ("+CME ERROR: no connection to phone" if +CMEE: 2).

LARA-R6

- The maximum <DTMF> string length is 1.
- The response to set command is sent after that the dual-tone execution is completed.

6.13 Automatic answer S0

S0						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	Profile	No	-	+CME Error

6.13.1 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.

6.13.2 Syntax

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

6.13.3 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

6.13.4 Notes

LARA-R6

- The command setting is stored in the NVM.

6.14 Set voice mail number +CSVM

+CSVM						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	< 20 s	+CME Error

6.14.1 Description

Sets the phone number of the voice mail server.

If the parameter <mode> is set to 0, the remaining parameters are ignored.

The voice number is stored in EF_{CPHS} or EF_{MBDN}. Their presence on the SIM card is not mandatory. If neither are present, then the set and read command returns an error result code.

To call the voice mail number (if possible), use the ATD1; command.

6.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSVM=<mode>[,<number>[,<type>]]	OK	AT+CSVM=1,"+1234567890",145 OK
Read	AT+CSVM?	+CSVM: <mode>,<number>,<type> OK	+CSVM: 0,"+1234567890",145 OK
Test	AT+CSVM=?	+CSVM: (list of supported <mode>s),(list of supported <type>s) OK	+CSVM: (0-1),(128-255) OK

6.14.3 Defined values

Parameter	Type	Description
<mode>	Number	• 0: voice mail number disabled • 1: voice mail number enabled
<number>	String	Phone number; see the D command description
<type>	Number	Type of address, octet in number format • 145: <number> string includes '+' • 129: otherwise

6.14.4 Notes

- The <number> and <type> parameters can be left out if the parameter <mode> is set to 0.

7 Network service

7.1 Network parameters definition

Parameter	Type	Description	Commands
<MCC>	Number	Mobile Country Code. The range is 0-999 (3 digits). • LARA-R6 - The FFF value is to be considered not known or not detectable	+COPS, +UCGED, +UCFSCAN
<MNC>	Number	Mobile Network Code. The range is 0-999 (1 to 3 digits). • LARA-R6 - the FFF value is to be considered not known or not detectable	+COPS, +UCGED, +UCFSCAN
<LAC>	Number	Location Area Code, The range is 0x0-0xFFFF (2 octets)	+COPS, +UCFSCAN
<CI>	Number	Cell identity. • LARA-R6 - The range is: o 2G cell: range 0x0-0xFFFF (2 octets) o 3G cell: range 0x0-0xFFFFFFF (28 bits), 0 xFFFFFFFF if invalid o 4G cell: range 0x0-0xFFFFFFF (28 bits).	+COPS, +UCFSCAN
<RxLev>	Number	Received Signal Strength Indicator (RSSI) index as defined in 3GPP TS 45.008 [85]: • 0: less than -110 dBm • 1..62: from -110 to less than -48 dBm with 1 dBm steps • 63: -48 dBm or greater	+COPS, +UCGED, +UCFSCAN
<RAC>	Number	Routing Area Code, range 0h-FFh (1 octet); see the 3GPP TS 44.018 [156]	+COPS
<t_adv>	Number	Timing Advance, it is valid during a connection and it will updated during the next connection; see the 3GPP TS 04.18 [96]. The special value -1 means not valid.	+UCGED
<scrambling_code>	Number	Primary scrambling code (PSC). • LARA-R6 - The range is 0-511	+COPS, +UCGED, +UCFSCAN
<dl_frequency>	Number	Downlink frequency. The range is 0-16383.	+COPS, +UJAD
<ul_frequency>	Number	Uplink frequency. The range is 0-16383.	+COPS
<arfcn>	Number	Absolute Radio Frequency Channel Number (ARFCN). • LARA-R6 - The range is 0-1023, 65535 if not known or not detectable.	+COPS, +UCGED, +UCFSCAN
<rscp_lev>	Number	Received Signal Code Power expressed in dBm levels: • 0: less than -115 dBm • 1..90: from -115 dBm to less than -25 dBm with 1 dBm steps • 91: -25 dBm	+COPS
<ecn0_lev>	Number	Energy per Chip/Noise ratio expressed in dB levels: • 0: less than -24 dB • 1..48: from -24 dB to less than 0 dB with 0.5 dB steps • 49: 0 dB	+COPS, +UCGED
<EARFCN>	Number	E-UTRAN Absolute radio frequency channel number as defined in the 3GPP TS 36.101 [122]. As per 3GPP TS 36.101 [122] the allowed values depend on the module supported bands. See the corresponding module data sheet for the complete list of the bands supported by each module. • LARA-R6 - Special value 65535 means not known or not detectable	+UCGED, +UJAD, +VZWRSRP, +VZWRSRQ, +UCFSCAN

Parameter	Type	Description	Commands
<PhysCellID>	Number	Physical cell ID. The range is 0-503.	+COPS, +UJAD, +UCFSCAN
<TAC>	Number	Tracking area code. • LARA-R6 - The range is 0-0xFFFF (2 octets), FFFF if not known or not detectable	+COPS, +UCGED, +UCFSCAN
<LcellId>	Number	E-UTRAN CI (cell identifier) in hexadecimal format; the range is 0h-FFFFFFFh (28 bits), 0000000 if not known or not detectable.	+UCGED
<dl_EARFCN>	Number	Downlink E-UTRAN absolute radio frequency channel number in decimal format.	+COPS
<ul_EARFCN>	Number	Uplink E-UTRAN absolute radio frequency channel number in decimal format.	+COPS
<RSRP>	Number	Reference Signal Received Power (RSRP) as defined in 3GPP TS 36.133 [127]: • 0: less than -140 dBm • 1..96: from -140 dBm to less than -44 dBm with 1 dBm steps • 97: -44 dBm or greater • LARA-R6 - The value 255 is return if not known or not detectable	+COPS, +UCGED, +UCFSCAN
<RSRQ>	Number	• LARA-R6 - Reference Signal Received Quality (RSRQ) as defined in 3GPP TS 36.133 [127]: o 0: less than -19 dB o 1..33: from -19 dB to less than -3 dB o 34: -3 dB or greater	+COPS, +UCGED
<RSRP_value>	Number	Current Reference Signal Received Power (RSRP) expressed in dBm, the range goes from -140.00 dBm to -44.00 dBm.	+UCGED, +UCFSCAN
<RSRQ_value>	Number	Current Reference Signal Received Quality (RSRQ) expressed in dB, the range goes from -20.00 dB to -3.00 dB.	+UCGED, +UCFSCAN
<BSIC>	Number	Base Station Identify Code (BSIC) in hexadecimal format, the range is 0x0-0x3F (6 bits).	+COPS, +UCGED, +UCFSCAN
<Lband>	Number	E-UTRAN band (see 3GPP TS 36.101 Table 5.5-1 [122]). Allowed values: • LARA-R6 - From 1 to 64, 255 if not known or not detectable	+UCGED, +UJAD
<Requested_eDRX_cycle>	String	Requested eDRX cycle value to be allocated to the UE. Half byte in a 4 bit format: the eDRX cycle value refers to bit 4 to 1 of octet 3 of the extended DRX parameters information element. For the coding and the value range, see the extended DRX parameters information element in 3GPP TS 24.008 table 10.5.5.32/3GPP TS 24.008 [79]. • LARA-R6 - The factory-programmed value is 1 ("0 001").	+CEDRXS
<Assigned_eDRX_cycle>	String	Assigned eDRX cycle value. Half byte in a 4 bit format: the eDRX cycle value refers to bit 4 to 1 of octet 3 of the extended DRX parameters information element. For the coding and the value range, see the extended DRX parameters information element in 3GPP TS 24.008 table 10 .5.5.32/3GPP TS 24.008 [79].	+CEDRXS
<Requested_paging_time_window>	String	Requested paging time window value to be allocated to the UE. Half byte in a 4 bit format: the paging time window (PTW) refers to bit 8 to 5 of octet 3 of the extended DRX parameters information element. For the coding and the value range, see the extended DRX parameters information element in 3GPP TS 24.008 table 10 .5.5.32/3GPP TS 24.008 [79].	+CEDRXS
<Assigned_paging_time_window>	String	Assigned paging time window value. Half byte in a 4 bit format: the paging time window (PTW)	+CEDRXS

Parameter	Type	Description	Commands
		refers to bit 8 to 5 of octet 3 of the extended DRX parameters information element. For the coding and the value range, see the extended DRX parameters information element in 3GPP TS 24.008 table 10.5.5.32/3GPP TS 24.008 [79].	
<LTE_rrc>	Number	LTE radio resource control (RRC) state: • 0: null • 1: IDLE • 2: ATTEMPT TO CONNECT • 3: CONNECTED • 4: LEAVING CONNECTED STATE • 5: ATTEMPT LEAVING E-UTRA • 6: ATTEMPT ENTERING E-UTRA • 255: not known or not detectable	+UCGED

7.2 Subscriber number +CNUM

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

7.2.1 Description

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

MSISDN is read from the SIM.

7.2.2 Syntax

Type	Syntax	Response	Example
Action	AT+CNUM	+CNUM: [<alpha1>],<number1>,<type1>	+CNUM: "Mario Rossi","+39320 821708",145
		[+CNUM: [<alpha2>],<number2>,<type2>	+CNUM: "ABCD . AAA","123456789012",129
		[...]]	OK
		OK	
		or	
		OK	
Test	AT+CNUM=?	OK	

7.2.3 Defined values

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

7.3 Signal quality +CSQ

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

7.3.1 Description

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

LARA-R6
The radio signal strength <signal_power> will be also used to build and display the indicator "signal" i.e. signal quality in the information text response of +CIND and in the +CIEV URC (see the +CMER command description).

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

7.3.2 Syntax

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

7.3.3 Defined values

Parameter	Type	Description
<signal_power>	Number	The allowed range is 0-31 and 99. Remapped indication of the following parameters: • the Received Signal Strength Indication (RSSI) in GSM and LTE RATs. For more details on the RSSI values mapping in LTE RAT, see Notes. • the Received Signal Code Power (RSCP) in UMTS RAT. When the RF power level of the received signal is the highest possible, the value 31 is reported. When it is not known, not detectable or currently not available, 99 is returned.
<qual>	Number	The allowed range is 0-7 and 99. The information provided depends on the selected RAT: • In 2G RAT CS dedicated and GPRS packet transfer mode indicates the Bit Error Rate (BER) as specified in 3GPP TS 45.008 [150] • In 2G RAT EGPRS packet transfer mode indicates the Mean Bit Error Probability (BEP) of a radio block. 3GPP TS 45.008 [150] 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 [128] 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 [127] specifies the range 0-34 for RSRQ which is mapped to the range 0-7 of <qual> See Table 3 for the complete parameter mapping.

7.3.4 Notes

<qual>	2G RAT CS and GPRS	2G RAT EGPRS	UMTS RAT	LTE RAT
0	BER < 0.2%	28 <= MEAN_BEP <= 31	ECN0_LEV >= 44	RSRQ_LEV < 5
1	0.2% < BER < 0.4%	24 <= MEAN_BEP <= 27	38 <= ECNO_LEV < 44	5 <= RSRQ_LEV < 10
2	0.4% < BER < 0.8%	20 <= MEAN_BEP <= 23	32 <= ECNO_LEV < 38	10 <= RSRQ_LEV < 14
3	0.8% < BER < 1.6%	16 <= MEAN_BEP <= 19	26 <= ECNO_LEV < 32	14 <= RSRQ_LEV < 18
4	1.6% < BER < 3.2%	12 <= MEAN_BEP <= 15	20 <= ECNO_LEV < 26	18 <= RSRQ_LEV < 22
5	3.2% < BER < 6.4%	8 <= MEAN_BEP <= 11	14 <= ECNO_LEV < 20	22 <= RSRQ_LEV < 26
6	6.4% < BER < 12.8%	4 <= MEAN_BEP <= 7	8 <= ECNO_LEV < 14	26 <= RSRQ_LEV < 30

<qual>	2G RAT CS and GPRS	2G RAT EGPRS	UMTS RAT	LTE RAT
7	BER > 12.8%	0 <= MEAN_BEP <= 3	ECNO_LEV < 8	RSRQ _LEV >= 30
99	Not known or not detectable			

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

LARA-R6

- Table 4 maps <signal_power> values reported from UE and the RSSI. RSSI includes the signal transmitted by the network plus noise.

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

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

LARA-R6

- If RAT is UMTS or LTE, the <qual> parameter is not supported, and will be always set to 99.

7.4 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

7.4.1 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.

7.4.2 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

7.4.3 Defined values

Parameter	Type	Description
<rxlev>	Number	Received Signal Strength Indication (RSSI).
<ber>	Number	Bit Error Rate (BER):

Parameter	Type	Description
		• 0..7: as RXQUAL values in the table in 3GPP TS 45.008 [150], subclause 8.2.4 • 99: not known or not detectable
<rscp>	Number	Received Signal Code Power (RSCP): • 0: less than -120 dBm • 1..95: from -120 dBm to -26 dBm with 1 dBm steps • 96: -25 dBm or greater • 255: not known or not detectable
<ecn0>	Number	Ratio of received energy per PN chip to the total received power spectral density (see 3GPP TS 25.133 [128] subclause): • 0: less than -24 dB • 1..48: from -24 dB to -0.5 dBm with 0.5 dB steps (i.e. 1: -24 dB <= Ec/Io < -23.5 dB) • 49: 0 dB or greater • 255: not known or not detectable
<rsrq>	Number	Reference Signal Received Quality (RSRQ): • 0: less than -19.5 dB • 1..33: from -19.5 dB to -3.5 dB with 0.5 dB steps • 34: -3 dB or greater • 255: not known or not detectable
<rsrp>	Number	Reference Signal Received Power (RSRP): • 0: less than -140 dBm • 1..96: from -140 dBm to -45 dBm with 1 dBm steps • 97: -44 dBm or greater • 255: not known or not detectable

7.5 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

7.5.1 Description

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

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

The response time refers to the worst case for AT+COPS=0 and AT+COPS=1 command on a specific PLMN, where the AT command can last up to 3 minutes due to abnormal cases in radio resource and mobility management procedures. In case NB-IoT bands must be scanned to find a suitable cell, or when the module is in roaming and attempts registration on several PLMN before getting access to the cellular services, the response time can dramatically increase: for more details, see Maximum vs typical response time of cellular network related AT commands.

LARA-R6
The PIN insertion is mandatory.

LARA-R6
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 [112], 3GPP TS 34.121-2 [113], 3GPP TS 36.521-2 [134] and 3GPP TS 36.523-2 [135], is a statement of the implemented and supported capabilities and options of a device. If the user changes

the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

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

The set command handling depends on the <mode> parameter value (for more details on the <mode> parameter allowed values, see Defined values):

- **<mode>=0 and <mode>=1**: the AT command setting is immediately stored in the current activated profile or in the NVM if the personal profile are not supported. If the MT is set in automatic selection mode (<mode>= 0), only the mode will be saved. If the MT is set in manual mode (<mode>= 1), also the format (<format>) and operator (<oper>) will be stored.
- **<mode>=4**: the module starts a manual selection of the specified operator; if this operation is not successful, the module will start an automatic network selection and will remain in automatic mode.
- **<mode>=5 and <mode>=6**: an extended network search, also called deep scan, is triggered; all cells detected during the PLMN scan are reported at the AT interface, more precisely:
  - **for GSM networks**: all cells found of any visible PLMNs will be reported, including those belonging to the neighbor list of the serving cell. The command response includes the following data (if supported): AcT, MCC, MNC, LAC, CI, BSIC, Arfcn, RxLev (see the Network parameters definition section for the parameter description)
  - **for UMTS networks**: all cells found on any visible PLMNs will be reported, including those belonging to the neighbor list of the serving cell. For each cell, the scan will trigger the additional reception of the SIB type 1 and type 3, to properly report the LAC, RAC, and CI of the cell. The command response includes the following data: MCC, MNC, LAC, RAC, CI, DLF, ULF, SC, RSCP LEV, ECN0 LEV (see the Network parameters definition section for the parameter description)
  - **for LTE networks**: all cells found will be reported, including those belonging to the neighbor list of the serving cell. For each cell, the command response includes the following data: MCC, MNC, TAC, CI, DLF, ULF, PCI, RSRP and RSRQ (see the Network parameters definition section for the parameter description).

☞ LARA-R6
The deep scan via AT+COPS=5 and AT+COPS=6 command is not supported. A full cell scan can be triggered by means of the +UCFSCAN AT command.

- **<mode>=8**: when a module is registered on the GSM network, a network timing advance search is performed
  - The network timing advance search is performed only on the serving cell and the 6 neighbor cells of BA list with the higher power levels.
  - The information text response always includes the following data for the serving cell and for the other 6 neighbor cells: MCC, MNC, LAC, CI, BSIC, Arfcn, RxLev (see the Network parameters definition section for the parameter description) and TA. When the <CI> value is not valid, no data of the correspondent neighbor cell is inside the information text response.
  - It can be started only when the module is in idle mode and no cell reselection is ongoing. The network condition could sometimes increase the estimated response time.
  - No mobile terminated/originated SMS, PS or CS call are handled when the network timing advance search is running. Furthermore mobility management procedures (for example: routing area update procedure or location update procedure) are delayed after the end of timing advance search.

If the set command with <mode>=0 is issued, a further set command with <mode>=0 is managed as a user reselection (see the 3GPP TS 23.122 [107]), i.e. the module triggers a search for the HPLMN or a higher order PLMN excluding the previously selected PLMN/access technology combination. This is useful when roaming in areas where the HPLMN or a higher order PLMN is available. If no HPLMN or higher order PLMN is found, the module either selects another PLMN that has the best signal quality or remains in the state it was in prior to the search (e.g. camped and/or registered on the PLMN before the search). Both behaviors are accepted by 3GPP TS 23.122 [107]

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

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

The user should not rely only on the set command "OK" final result code as a confirmation that the network selection has been performed. To determine check the current network registration status:

- LARA-R6 - Network registration status +CREG
- LARA-R6 - GPRS network registration status +CGREG
- LARA-R6 - EPS network registration status +CEREG

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

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

☞ LARA-R6
The response time of a manual PLMN selection specifying the target network in alphanumeric format can exceed the documented value, because the device tries to register on all PLMNs in the ROM list whose alphanumeric code matches the one specified in the +COPS command.

☞ LARA-R6
In +COPS: 2 (module deregistered from the network), the UE is deregistered from the network but RF circuits are not disabled, hence the radio synchronization is retained and the cell selection and reselection procedures run as in limited service state.
If AT+COPS=0 is issued when the module is deregistered from network (+COPS: 2), it triggers a user reselection (see 3GPP TS 23.122 [107]). To perform a registration cycle on the same RPLMN, issue the AT +CFUN=0/AT+CFUN=1 sequence.

7.5.2 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:<scrambling_code>, RSCP LEV:<rscp_lev>, ECN0 LEV:<ecn0_lev>	MCC:222, MNC:10, LAC:61ef, RAC:14, CI:07d2088, 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:<scrambling_code>, RSCP LEV:<rscp_lev>, ECN0 LEV:<ecn0_lev>	MCC:222, MNC:10, LAC:61ef, RAC:14, CI:07d2085, 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>=5 and on LTE networks:	AT+COPS=5

Type	Syntax	Response	Example
		[MCC:<MCC>, MNC:<MNC>, TAC:<TAC>, CI:<CI>, DLF:<dl_EARFCN>, ULF:<ul_EARFCN>, PCI:<PhysCellID>, RSRP LEV:<RSRP>, RSRQ LEV:<RSRQ> [MCC:<MCC>, MNC:<MNC>, TAC:<TAC>, CI:<CI>, DLF:<dl_EARFCN>, ULF:<ul_EARFCN>, PCI:<PhysCellID>, RSRP LEV:<RSRP>, RSRQ LEV:<RSRQ> [...]]] OK	MCC:222, MNC:88, TAC:562c, CI:57367043, DLF: 1325, ULF:19325, PCI:163, RSRP LEV:25, RSRQ LEV:1 MCC:222, MNC:10, TAC:5a25, CI:10086944, DLF: 1850, ULF:19850, PCI:287, RSRP LEV:25, RSRQ LEV:6 ... ... MCC:293, MNC:40, TAC:27ec, CI:519425, DLF: 6400, ULF:24400, PCI:393, RSRP LEV:27, RSRQ LEV:9 OK
		If <mode>=6 and on GSM networks: [<AcT>,<MCC>,<MNC>,<LAC>,<CI>,<BSIC>,<arfcn>,<RxLev> [<AcT>,<MCC>,<MNC>,<LAC>,<CI>,<BSIC>,<arfcn>,<RxLev> [...]]] OK	AT+COPS=6 0,222,88,55fa,ffff,3f,00104,037 ... 0,222,10,4e54,ffff,32,00080,032 ... OK
		If <mode>=6 and on UMTS networks: [<MCC>,<MNC>,<LAC>,<RAC>,<CI>,<dl_frequency>,<ul_frequency>,<scrambling_code>,<RSCP LEV>,<ecn0_lev> [<MCC>,<MNC>,<LAC>,<RAC>,<CI>,<dl_frequency>,<ul_frequency>,<scrambling_code>,<RSCP LEV>,<ecn0_lev> [...]]] OK	AT+COPS=6 222,99,754f,2,03554d7,10713,9763,341,255,14 ... 222,01,ef8d,0,52d2647,10663,9713,453,4,23 ... OK
		If <mode>=6 and on LTE networks: [<AcT>,<MCC>,<MNC>,<TAC>,<CI>,<dl_EARFCN>,<ul_EARFCN>,<PhysCellID>,<RSRP>,<RSRQ> [<AcT>,<MCC>,<MNC>,<TAC>,<CI>,<dl_EARFCN>,<ul_EARFCN>,<PhysCellID>,<RSRP>,<RSRQ> [...]]] OK	AT+COPS=6 7,222,88,562c,57367043,1325,19325,163,35,10 7,222,01,3aa3,179291197,6300,24300,271,48,14 7,222,01,3aa3,179290685,6300,24300,402,27,11 7,293,40,27ec,519425,6400,24400,393,24,1 OK
		If <mode>=8 and on GSM networks: [MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<arfcn>, RxLev:<RxLev>, TA:<TA> [MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<arfcn>, RxLev:<RxLev>, TA:<TA> [...]]] OK	AT+COPS=8 MCC:222, MNC: 10, LAC:4e54, CI:12f1, BSIC:3f, Arfcn:00104, RxLev:037, TA:3 MCC:222, MNC: 10, LAC:4e54, CI:8841, BSIC:32, Arfcn:00080, RxLev:032, TA:5 MCC:222, MNC: 10, LAC:4e54, CI:1ef4, BSIC:31, Arfcn:00082, RxLev:022, TA:255 ... MCC:222, MNC: 10, LAC:55fa, CI:1d39, BSIC:3d, Arfcn:00756, RxLev:005, TA:7 OK
Read	AT+COPS?	+COPS: <mode>[,<format>,<oper>[,<AcT>]] OK	+COPS: 0,0,"vodafone IT" OK

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

7.5.3 Defined values

Parameter	Type	Description
<mode>	Number	Is used to chose whether the network selection is automatically done by the MT or is forced by this command to the operator <oper> given in the format <format>: • 0 (default value and factory-programmed value): automatic (<oper> field is ignored) • 1: manual • 2: deregister from network • 3: set only <format> • 4: manual/automatic • 5: extended network search • 6: extended network search without the tags (e.g. MCC, RxLev will not be printed, see the syntax and the command example) • 8: network timing advance search Allowed values: • LARA-R6 - 0, 1, 2, 3, 4
<format>	Number	• 0 (factory-programmed value): long alphanumeric <oper> • 1: short format alphanumeric <oper> • 2: numeric <oper>
<oper>	String	Given in format <format> this field may be up to 24 characters long for long alphanumeric format, up to 10 characters for short alphanumeric format and 5 or 6 characters long for numeric format (MCC/MNC codes). The factory-programmed value is FFFFF (undefined).
<stat>	Number	• 0: unknown • 1: available • 2: current • 3: forbidden
<AcT>	Number	Indicates the radio access technology: • 0: GSM • 1: GSM COMPACT • 2: UTRAN • 3: GSM/GPRS with EDGE availability • 4: UTRAN with HSDPA availability • 5: UTRAN with HSUPA availability • 6: UTRAN with HSDPA and HSUPA availability • 7: LTE • 8: EC-GSM-IoT (A/Gb mode) • 9: E-UTRAN (NB-S1 mode) Allowed values: • LARA-R6401 / LARA-R6401D - 7 • LARA-R6001 / LARA-R6001D / LARA-R6801 - 0, 2, 7
<TA>	Number	Timing Advance; the range is 0-63. If the information is not known or not detectable or currently not available, the value is 255.
<MCC>	Number	See <MCC>.
<MNC>	Number	See <MNC>.
<LAC>	Number	See <LAC>.
<CI>	Number	See <CI>.
<BSIC>	Number	See <BSIC>.
<arfcn>	Number	See <arfcn>.
<RxLev>	Number	See <RxLev>.

Parameter	Type	Description
<RAC>	Number	See <RAC>.
<dl_frequency>	Number	See <dl_frequency>.
<ul_frequency>	Number	See <ul_frequency>.
<scrambling_code>	Number	See <scrambling_code>.
<rscp_lev>	Number	See <rscp_lev>.
<ecn0_lev>	Number	See <ecn0_lev>.
<TAC>	Number	See <TAC>.
<dl_EARFCN>	Number	See <dl_EARFCN>.
<ul_EARFCN>	Number	See <ul_EARFCN>.
<PhysCellID>	Number	See <PhysCellID>.
<RSRP>	Number	See <RSRP>.
<RSRQ>	Number	See <RSRQ>.

7.5.4 Notes

LARA-R6

- If no network is available, the test command returns the 'No Network Service' error result code.
- <format> and <oper> parameters are optional only if the <mode> parameter is set to 0, 2 or 3.
- It is not possible to issue the test command if the module is set to minimum functionality (+CFUN: 0) or in the airplane mode (+CFUN: 4).
- When <format> is set to alphanumeric (0 or 1) the read command's <oper> value is retrieved from the first match found in the following "name sources" (from highest to lowest priority):
  - EF_{OPL} and EF_{PNN} files (SIM card dependent, see below)
  - NITZ service (network dependant)
  - Hardcoded list in the module's firmware

  If no match is found in the "name sources" the broadcasted MCC-MNC is displayed. If the PLMN network name and operator name list services are "enabled" in the SIM card, then the EF_{OPL} and EF_{PNN} are used for displaying the <oper> name if a match can be found.
- If there is no opportunity to use the radio, the test command returns the 'Temporary Failure' error result code after three internal retries, separated by 5 s each, are completed with same status. However, in this case, partial results could still be displayed (only if available). The user may retry later on.

LARA-R6001 / LARA-R6001D / LARA-R6801

- Issuing the AT+COPS=1,..,<RAT> command forces the single RAT behavior. Issue the AT+COPS=0 command to restore the multi-RAT and trigger detach and reattach or RAU (depending on target RAT, LTE or legacy respectively).

7.6 Radio Access Technology (RAT) selection +URAT

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

7.6.1 Description

Allows to select the Radio Access Technologies (RAT) to be activated at next registration cycle and, in case of multi-RAT configuration, defines the RAT priority order.

Depending on how many parameters are specified, it is possible to select single or multi-RAT behavior. The order of the RAT parameters defines the priority of the related radio access technologies selected at boot or when entering full functionality from deregistered state. The <1stAcT> parameter identifies the RAT to be selected firstly. If <2ndAcT> parameter is specified, it determines which RAT is selected if no cellular service can be obtained by the module on the <1stAcT>. If <3rdAcT> parameter is specified, it determines the remaining RAT selected when no service can be obtained in the preferred one(s).

☞ 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 [112], 3GPP TS 34.121-2 [113], 3GPP TS 36.521-2 [134] and 3GPP TS 36.523-2 [135], is a

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

7.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+URAT=<1stAcT>[,<2ndAcT>[,<3rdAcT>]]	OK	AT+URAT=7,8 OK
Read	AT+URAT?	+URAT: <1stAcT>[,<2ndAcT>[,<3rdAcT>]] OK	+URAT: 7 OK
Test	AT+URAT=?	+URAT: (list of the supported <1stAcT>s)[,(list of the supported <2ndAcT>s)[,(list of the supported <3rdAcT>s)]] OK	+URAT: (7-9),(7-9),(7-9) OK

7.6.3 Defined values

Parameter	Type	Description
<1stAcT>	Number	Indicates the single or highest priority RAT enabled and may be: • 0: GSM / GPRS / eGPRS • 2: UMTS • 3: LTE • 7: LTE Cat M1 • 8: NB-IoT • 9: GPRS / eGPRS Allowed values depend on the module series: • LARA-R6001 / LARA-R6001D / LARA-R6801 - 0, 2, 3 (factory-programmed value) • LARA-R6401 / LARA-R6401D - 3 (factory-programmed value)
<2ndAcT>	Number	Indicates the second priority RAT enabled and has the same range as <1stAcT>. The factory-programmed value is: • LARA-R6001 / LARA-R6001D / LARA-R6801 - 2 (UMTS) • LARA-R6401 / LARA-R6401D - The parameter is not supported.
<3rdAct>	Number	Indicates the third priority RAT enabled and has the same range as <1stAcT>. The factory-programmed value is: • LARA-R6001 / LARA-R6001D / LARA-R6801 - 0 (GSM / GPRS / eGPRS) • LARA-R6401 / LARA-R6401D - The parameter is not supported.

7.6.4 Notes

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

7.7 Full cell scan +UCFSCAN

+UCFSCAN						
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

7.7.1 Description

Performs an extended network search on the provided radio access technology (RAT); the network search is performed on all the supported bands or only on a subset specified by means of the <bitmask_1_64> and <bitmask_65_127> parameters. All the cells detected during the PLMN search are reported at the AT interface:

- **GSM networks**: all the cells found of any visible PLMNs are reported, including the serving cell and those belonging to the neighbor list of the serving cell.

- **WCDMA networks**: all the cells found of any visible PLMNs are reported, including the serving cell and those belonging to the neighbor list of the serving cell.
- **LTE Cat 1/M1/NB-IoT networks**: all the cells found are reported, including the serving cell and those belonging to the neighbor list of the serving cell.

☞ If the requested <AcT> is not enabled by means of the +URAT AT command, the +UCFSCAN will return an error result code.

☞ The set command can be aborted. The scan might take many seconds, depending on the network conditions and the module's current activities.

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

☞ LARA-R6
The command should be issued over the same RAT the device is registered to, otherwise the scan will return 0 cells found.

7.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCFSCAN=<AcT>[,<bitmask_band1_64>[,<bitmask_band65_127>]]	**If <AcT>=7 (LTE Cat 1 / LTE Cat M1) or 9 (NB-IoT)** +UCFSCAN: <AcT>,<EARFCN>,<dl_bandwitdh>,<PhysCellID>,<MCC>,<MNC>,<TAC>,<CI>,<cell_barred>,<RSRP_value>,<RSRQ_value>,<RSSI_value> [...] [+UCFSCAN: <AcT>,<EARFCN>,<dl_bandwitdh>,<PhysCellID>,<MCC>,<MNC>,<TAC>,<CI>,<cell_barred>,<RSRP_value>,<RSRQ_value>,<RSSI_value>] OK	AT+UCFSCAN=9 +UCFSCAN: 9,6152,101,353,222,88,584C,3761E87,0,"-81","-10","-70" +UCFSCAN: 9,6290,101,388,222,01,9095,AB431A1,0,"-114","-24","0" OK
		If <AcT>=2 (UMTS) +UCFSCAN: <AcT>,<uarfcn>,<band_class>,<scrambling_code>,<MCC>,<MNC>,<LAC>,<CI>,<RSSI_WCDMA> [...] [+UCFSCAN: <AcT>,<uarfcn>,<band_class>,<scrambling_code>,<MCC>,<MNC>,<LAC>,<CI>,<RSSI_WCDMA>] OK	AT+UCFSCAN=2 +UCFSCAN: 2,3063,64,4672,222,88,5FB5,25C1298,-89 +UCFSCAN: 2,10713,1024,1328,222,01,EF8D,52D36FA,-89 OK
		If <AcT>=0 (GSM) +UCFSCAN: <AcT>,<arfcn>,<arfcn_band>,<BSIC>,<MCC>,<MNC>,<LAC>,<CI>,<cell_barred>,<RxLev>,<grps_supported> [...] [+UCFSCAN: <AcT>,<arfcn>,<arfcn_band>,<BSIC>,<MCC>,<MNC>,<LAC>,<CI>,<cell_barred>,<RxLev>,<grps_supported>] OK	AT+UCFSCAN=0 +UCFSCAN: 0,50,0,53,222,10,4E54,209,0,50,1 +UCFSCAN: 0,49,0,49,222,10,4E54,E3D3,0,50,1 OK
		If no cell is found on requested AcT +UCFSCAN: <AcT> OK	AT+UCFSCAN=7 +UCFSCAN: 7 OK

Type	Syntax	Response	Example
Test	AT+UCFSCAN=?	+UCFSCAN: (list of supported <AcT>s),18446744073709551615, 18446744073709551615 OK	+UCFSCAN: (0,7,9),18446744073709551615,18446744073709551615 OK

7.7.3 Defined values

Parameter	Type	Description
<AcT>	Number	Indicates the radio access technology. Allowed values: • 0: GSM • 2: WCDMA • 7: LTE Cat 1 / LTE Cat M1 • 9: NB-IoT Allowed values: • LARA-R6 : 0, 2, 7
<bitmask_1_64>	Number	Depending on the <AcT> parameter values, configures the bitmask for the LTE or GSM bands. When <AcT>=7 (LTE Cat 1 / LTE Cat M1) or <AcT>=9 (NB-IoT), it indicates the bandmask for LTE bands 1 through 64. Each bit enables/disables a band for the scan: • Bit 0: band 1 • Bit 1: band 2 • Bit 2: band 3 • Bit 3: band 4 • ... • Bit 63: band 64 When <AcT>=0 (GSM), it indicates bandmask for GSM bands 800 / 900 / 1800 / 1900. The following bit enables/disables a band for the scan: • Bit 7: DCS 1800 • Bit 8: ESGM 900 • Bit 19: GSM 850 • Bit 21: PCS 1900 When <AcT>=2 (WCDMA), it indicates bandmask for WCDMA bands. The following bit enables/disables a band for the scan: • Bit 22: WCDMA I (2100 MHz) • Bit 23: WCDMA II (1900 MHz) • Bit 26: WCDMA V (850 MHz) • Bit 49: WCDMA VIII (900 MHz) The special value 0 enables all the bands for the scan. The default value is 0.
<bitmask_65_127>	Number	When <AcT>=7 (LTE Cat 1 / LTE Cat M1) or <AcT>=9 (NB-IoT), it indicates the bandmask for LTE bands 65 through 128. Each bit enables/disables a band for the scan: • Bit 0: band 65 • Bit 1: band 66 • Bit 2: band 67 • Bit 3: band 68 • .. • Bit 63: band 128 The special value 0 enables all the bands for the scan. The default value is 0. If <AcT>=0 (GSM) or <AcT>=2 (WCDMA) the parameter is not supported.
<EARFCN>	Number	See <EARFCN>.
<dl_bandwidth>	Number	Downlink bandwidth. Allowed values: • 6: NB 6 (1.4 MHz) • 15: NB 15 (3 MHz) • 25: NB 25 (5 MHz) • 50: NB 50 (10 MHz) • 75: NB 75 (15 MHz) • 100: NB 100 (20 MHz) • 101: not known

Parameter	Type	Description
<PhysCellID>	Number	See <PhysCellID>.
<MCC>	Number	See <MCC>.
<MNC>	Number	See <MNC>.
<TAC>	Number	See <TAC>.
<CI>	Number	See <CI>.
<cell_barred>	Number	Allowed values: • 0: cell not barred • 1: cell barred
<RSRP_value>	Number	See <RSRP_value>.
<RSRQ_value>	Number	See <RSRQ_value>.
<RSSI_value>	Number	Cell received signal strength indication (RSSI) value in dBm. The range goes from -120 .0 dBm to 0 dBm.
<uarfcn>	Number	UTRAN Absolute Radio Frequency Channel Number (UARFCN).
<band_class>	Number	Band class allowed values: • 1024: band I, minimum UARFCN=10562, maximum UARFCN=10838 (IMT band) • 1: band II, minimum UARFCN=9661, maximum UARFCN=9938 (PCS band) • 32: band III, minimum UARFCN=1162, maximum UARFCN=1513 (WCDMA 1800 band) • 256: band IV, minimum UARFCN=1537, maximum UARFCN=1738 (additional frequencies 1887, 1912, 1937, 1962, 1987, 2012, 2037, 2062, 2087) (WCDMA 1700-210 0 bands) • 16: band V, minimum UARFCN=4357, maximum UARFCN=4458 (additional frequencies 1007, 1012, 1032, 1037, 1062, 1087) (WCDMA 850 band) • 8: band VI (Japan), minimum UARFCN=4387, maximum UARFCN=4413 (additional frequencies 1037, 1062) (WCDMA 800 band) • 64: band VIII, minimum UARFCN=2937, maximum UARFCN=3088 (WCDMA 900 band) • 128: band IX, minimum UARFCN=9237, maximum UARFCN=9387 (WCDMA 1700 band) • 512: band XI, minimum UARFCN=3712, maximum UARFCN=3787 (WCDMA 1500 band) • 4: band XIX, minimum UARFCN=363, maximum UARFCN=712 (additional frequencies 787, 812, 837) (WCDMA BC19 band)
<scrambling_code>	Number	See <scrambling_code>.
<RSSI_WCDMA>	Number	Cell received signal strength indication (RSSI) value in dBm. The range goes from -105 dBm to -60 dBm.
<arfcn>	Number	See <arfcn>.
<arfcn_band>	Number	Allowed values: • 0: EGSM 900 • 1: PGSM 900 • 2: PCS 1900 • 3: DCS 1800 • 4: 850
<BSIC>	Number	See <BSIC>.
<LAC>	Number	See <LAC>.
<RxLev>	Number	See <RxLev>.
<gprs_supported>	Number	Allowed values: • 0: PS not supported • 1: PS supported • 2: not known

7.7.4 Examples

Command	Response	Description
AT+URAT?	+URAT: 7,8,9 OK	Check the radio access technologies module configuration. The module is configured in LTE, NB-IoT and GSM.
AT+UCFSCAN=9	+UCFSCAN: 9,6152,101,353,222,88,584C, 3761E87,0,-81,-10,-70	Perform a scan on any NB-IoT band.

Command	Response	Description
	+UCFSCAN: 9,6290,101,388,222,01,9095, AB431A1,0,-114,-24,0 OK	
AT+UCFSCAN=0	+UCFSCAN: 0,50,0,53,222,10,4E54,209,0, 50,1 +UCFSCAN: 0,49,0,49,222,10,4E54,E3D3,0 ,50,1 +UCFSCAN: 0,20,0,22,222,01,D5BD,43A,0 ,26,1 +UCFSCAN: 0,107,0,58,222,88,5FC2,0,0, 28,1 +UCFSCAN: 0,47,0,51,222,10,4E54,0,0,27,1 +UCFSCAN: 0,15,0,19,222,01,D5BD,43B,0, 25,1 +UCFSCAN: 0,104,0,60,222,88,5FC2,FCED, 0,22,1 +UCFSCAN: 0,5,0,16,222,01,D5BD,548D,0, 23,1 OK	Perform a scan on any GSM band.
AT+UCFSCAN=7	+UCFSCAN: 7	Perform a scan on any LTE band. No result is found.
AT+UCFSCAN=9		Perform a scan on any NB-IoT band.
<input a character>	OK	The scan is aborted.
AT+URAT=8	OK	Allows the module to register only on NB-IoT network at next reboot.
AT+CFUN=15	OK	Reboot the module.
AT+URAT?	+URAT: 8 OK	The module is configured in NB-IoT only.
AT+UCFSCAN=0	+CME ERROR: operation not allowed	A scan on a disabled access technology (GSM) is triggered, therefore an error result code is returned.

7.8 Preferred PLMN list selection +CPLS

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

7.8.1 Description

Selects one PLMN selector with Access Technology list in the SIM card or active application in the UICC (GSM or USIM), that is used by +CPOL command.

The set command selects a list in the SIM/USIM. The read command returns the selected PLMN selector list from the SIM/USIM.

The test command returns the whole index range supported lists by the SIM/USIM.

7.8.2 Syntax

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

Type	Syntax	Response	Example
		OK	OK

7.8.3 Defined values

Parameter	Type	Description
<list>	Number	• 0 (factory-programmed and default value): user controlled PLMN selector with Access Technology $EF_{PLMNwAcT}$, if not found in the SIM/UICC then PLMN preferred list $EF_{PLMNsel}$ (this file is only available in SIM card or GSM application selected in UICC); these files can be read and updated (see the 3GPP TS 31.102 [84]). • 1: operator controlled PLMN selector with Access Technology $EF_{OPLMNwAcT}$; this file can be read only (see the 3GPP TS 31.102 [84]). • 2: HPLMN selector with Access Technology $EF_{HPLMNwAcT}$; this file can be read only (see the 3GPP TS 31.102 [84]).

7.9 Network registration status +CREG

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

7.9.1 Description

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

- +CREG: <stat> if <n>=1 and there is a change in the MT's circuit switched mode network registration status in GERAN/UTRAN/E-UTRAN.
- +CREG: <stat>[,<lac>,<ci>[,<AcTStatus>]] if <n>=2 and there is a change of the network cell in GERAN/UTRAN/E-UTRAN.
- +CREG: <stat>,[<lac>],[<ci>],[<AcTStatus>][,<cause_type>,<reject_cause>] if <n>=3 and the MT registration status (<stat>) changes. The <cause_type> and the <reject_cause> parameters are returned only if the MT is not registered, but it is currently searching a new operator to register to (<stat>=2) or if the registration is denied (<stat>=3).

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

The read command provides the same information issued by the URC together with the current value of the <n> parameter. The location information elements <lac>, <ci> and <AcTStatus>, if available, are returned only when <n>=2 or <n>=3 and the MT is registered with the network. The <cause_type>, <reject_cause> parameters are returned only if <n>=3 and the MT is not registered, but it is currently searching a new operator to register to (<stat>=2) or if the registration is denied (<stat>=3).

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

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

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

7.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+CREG=[<n>]	OK	AT+CREG=1 OK

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

7.9.3 Defined values

Parameter	Type	Description
<n>	Number	Network registration URC configuration. Allowed values: • 0 (default value and factory-programmed value): network registration URC disabled • 1: network registration URC enabled • 2: network registration and location information URC enabled • 3: network registration and reject cause URC enabled
<stat>	Number	Network registration status. Allowed values: • 0: not registered, the MT is not currently searching a new operator to register to • 1: registered, home network • 2: not registered, but the MT is currently searching a new operator to register to • 3: registration denied • 4: unknown (e.g. out of GERAN/UTRAN/E-UTRAN coverage) • 5: registered, roaming • 6: registered for "SMS only", home network (applicable only when <AcTStatus> indicates E-UTRAN) • 7: registered for "SMS only", roaming (applicable only when <AcTStatus> indicates E-UTRAN) • 8: attached for emergency bearer services only (see 3GPP TS 24.008 [79] and 3GPP TS 24.301 [114] that specify the condition when the MS is considered as attached for emergency bearer services) • 9: registered for "CSFB not preferred", home network (applicable only when <AcTStatus> indicates E-UTRAN) • 10: registered for "CSFB not preferred", roaming (applicable only when <AcTStatus> indicates E-UTRAN)
<lac>	String	Two bytes location area code or tracking area code (if <AcTStatus>=7) in hexadecimal format (e.g. "00C3"). The value FFFF means that the current <lac> value is invalid.
<ci>	String	From 2 to 4 bytes cell ID in hexadecimal format (e.g. "A13F" or "129080B"). The value FFFFFFFF means that the current <ci> value is invalid.
<AcTStatus>	Number	Indicates the radio access technology: • 0: GSM • 1: GSM COMPACT • 2: UTRAN • 3: GSM/GPRS with EDGE availability • 4: UTRAN with HSDPA availability • 5: UTRAN with HSUPA availability • 6: UTRAN with HSDPA and HSUPA availability • 7: E-UTRAN • 8: EC-GSM-IoT (A/Gb mode) • 9: E-UTRAN (NB-S1 mode) • 255: the current <AcTStatus> value is invalid Allowed values: • LARA-R6001 / LARA-R6001D / LARA-R6801 - 0, 2, 3, 4, 5, 6, 7 • LARA-R6401 / LARA-R6401D - 7
<cause_type>	Number	<reject_cause> type. Allowed values: • 0: indicates that <reject_cause> contains an EMM cause value, see 3GPP TS 24.301 [114] Annex A
<reject_cause>	Number	Cause of the failed registration. The value is of type as defined by <cause_type>

7.9.4 Notes

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

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

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

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

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

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

  It may be issued after the failure of a registration procedure, before starting a PLMN search, when <stat>=2.
- 5: the MT is registered for circuit-switched services on a VPLMN, in national or international roaming
- 6: in LTE, the MT is registered only for the SMS circuit-switched service on the HPLMN (or on one of the equivalent HPLMN's)
- 7: in LTE, the MT is registered only for the SMS circuit-switched service on a VPLMN, in national or international roaming
- 8: the MT is attached for emergency bearer services only.
- 9: in LTE, the MT is registered only for the SMS circuit-switched service on the HPLMN (or on one of the equivalent HPLMN's). CS fallback is not supported for voice services, therefore if the device is configured as "voice centric" (see +CEMODE) and does not support VoLTE, it will disable LTE and reselect 3G or 2G RAT if supported.
- 10: in LTE, the MT is registered only for the SMS circuit-switched service on a VPLMN, in national or international roaming. CS fallback is not supported for voice services, therefore if the device is configured as "voice centric" (see +CEMODE) and does not support VoLTE, it will disable LTE and reselect 3G or 2G RAT if supported.

LARA-R6

- <n>=3 is not supported.

7.10 Preferred operator list +CPOL

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

7.10.1 Description

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

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

LARA-R6
The command accesses the list of preferred PLMNs previously selected by +CPLS, if implemented. If +CPLS is not implemented the command tries to access $EF_{PLMNwAcT}$ and if this file is not present and a UICC GSM application is selected or a SIM card is used then the $EF_{PLMNsel}$ file is accessed.

LARA-R6
When an entry is added to the preferred operator list, it should have a correspondence in the ROM PLMN names returned by the +COPN command. If <index> is given but <oper> is left out, the entry is deleted. If only <format> is given, the <oper> format in the read command is changed. The <GSM_AcT>, <GSM_Compact_AcT>, <UTRAN_AcT> and <E-UTRAN_AcT> parameters are required when writing user controlled PLMN selector with Access Technology ($EF_{PLMNwAcT}$).

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

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

7.10.2 Syntax

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

7.10.3 Defined values

Parameter	Type	Description
<index> / <indexn>	Number	Represents the order number of operator in the SIM preferred operator list. The parameter range depends on the number of entries in SIM card (i.e. its size), but can be further limited by the module capabilities of the module.
<format>	Number	See also +COPS command description: • 0: long format alphanumeric <oper> • 1: short format alphanumeric <oper> • 2 (default value): numeric <oper>
<oper> / <opern>	String	Format indicated by <format>

Parameter	Type	Description
<GSM_AcT>	Number	GSM access technology. Allowed values: • 0: access technology not selected • 1: access technology selected
<GSM_Compact_AcT>	Number	GSM compact access technology. Allowed values: • 0: access technology not selected • 1: access technology selected
<UTRAN_AcT>	Number	UTRA access technology. Allowed values: • 0: access technology not selected • 1: access technology selected
<E-UTRAN_AcT>	Number	E-UTRAN access technology. Allowed values: • 0: access technology not selected • 1: access technology selected

7.10.4 Notes

LARA-R6

- When an entry is added to the preferred operator list in alphanumeric format, it shall have a correspondence in the ROM PLMN names returned by the +COPN command, otherwise an error is returned.
- The <oper> format in the read command is always aligned to the <format> parameter given in the last set command.
- The default value of <format> parameter is 2 (numeric <oper>).

7.11 Read operator names +COPN

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

7.11.1 Description

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

7.11.2 Syntax

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

7.11.3 Defined values

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

7.12 Steering of Roaming configuration +UDCONF=20

+UDCONF=20						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM / OP	No	-	+CME Error

7.12.1 Description

Enables / disables the Steering of Roaming feature.

The setting can be changed only when the module is not registered to, and not searching for, a network (i.e. when +CREG's <stat> is 0). The new setting is saved in NVM and takes place at the next network registration / search.

7.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=20,<SoR_enable>	OK	AT+UDCONF=20,1 OK
Read	AT+UDCONF=20	+UDCONF: 20,<SoR_enable> OK	AT+UDCONF=20 +UDCONF: 20,1 OK

7.12.3 Defined values

Parameter	Type	Description
<SoR_enable>	Number	Enables / disables the Steering of Roaming feature: • 0: Steering of Roaming disabled • 1: Steering of Roaming enabled • 2: Steering of Roaming enabled with automatic switch from manual to automatic PLMN selection mode if the maximum number of registration attempts rejected with cause 17 (Network Failure) has been reached The factory-programmed value is: • LARA-R6001 / LARA-R6001D / LARA-R6801 - see Mobile Network Operator profiles. • LARA-R6401 / LARA-R6401D - 0

7.12.4 Notes

LARA-R6

- Reboot the module to make the new setting effective.
- <SoR_enable>=2 is not supported.

7.13 No more PS data +CNMPSD

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

7.13.1 Description

In case the external application has no more packets to send, it can use this command to trigger a Fast Dormancy request to the network. The constraints to be satisfied before sending a SCRI are the following:

- The module is currently registered in UMTS RAT
- No RRC procedure (e.g. RRC Connection establishment or cell reselection) is ongoing
- No NAS signaling is ongoing
- Inhibit Timer (T323, set after any SRCI is sent out) is not running

If all above conditions are satisfied a Signaling Connection Release Indication (SCRI) is sent to the network that can eventually release the RRC connection. If the above conditions are not met, an error result code will be returned.

7.13.2 Syntax

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

7.14 Integrity check on test networks configuration +UDCONF=81

+UDCONF=81						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

7.14.1 Description

Configures the integrity check on 3G/4G test networks.

Integrity check on 3G/4G test networks shall be disabled only when the authentication and integrity are disabled on the 3G/4G test network on which the module will be registered.

Disabling integrity and security will not affect IMS, thus the command cannot be used when using IMS.

LARA-R6
Reboot of the module (e.g. by means of the AT+CFUN=15/AT+CFUN=16 command) to make the change effective.

7.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=81,<integrity_check_enabled>	OK	AT+UDCONF=81,0 OK
Read	AT+UDCONF=81	+UDCONF: 81,<integrity_check_enabled> OK	AT+UDCONF=81 +UDCONF: 81,1 OK

7.14.3 Defined values

Parameter	Type	Description
<integrity_check_enabled>	Number	Integrity check on 3G/4G test networks configuration. Allowed values: • 0: integrity check on test networks disabled (MCC/MNC not available in +COPN set command's response) • 1 (factory-programmed value): integrity check on test networks enabled (MCC/MNC not available in +COPN set command's response)

7.15 Channel and network environment description +UCGED

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

7.15.1 Description

Enables the protocol stack and network environment information collection.

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

☞ LARA-R6
The command provides only the information on the serving cell, unless <mode>=2 (short form reporting enabled) and <rat>=2 (2G).
If <mode>=2 (short form reporting enabled) and <rat>=2 (2G), where supported, the module returns also the information on the neighbor cells.

Table 5 lists the supported <mode> parameter values:

Modules	<mode>=0	<mode>=2	<mode>=3	<mode>=4	<mode>=5	<mode>=6
LARA-R6	*	*				

Table 5: <mode> parameter applicability

7.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCGED=<mode>	AT+UCGED=2 OK	OK
Read	AT+UCGED?	**<mode>=0:** +UCGED: 0 OK	+UCGED: 0 OK
		<mode>=2, <rat>=2: +UCGED: 2 <rat>,<MCC>,<MNC> <arfcn>,<band1900>,<GcellId>,<BSIC>,<Glac>,<Grac>,<RxLev>,<t_adv>,<C1>,<C2>,<NMO>,<channel_type> [N1: <MCC>,<MNC>,<arfcn>,<GcellId>,<BSIC>,<Glac>,<RxLev>,<C1>,<C2> [N2: <MCC>,<MNC>,<arfcn>,<GcellId>,<BSIC>,<Glac>,<RxLev>,<C1>,<C2> [...]]] OK	+UCGED: 2 2,222,1 1009,0,5265,11,d5bd,00,36,-1,30,30,1,1 N1: 222,1,1023,3a26,16,d5bd,29,23,23 N2: 222,1,13,5266,17,d5bd,28,22,22 OK
		<mode>=2, <rat>=3: +UCGED: 2 3,<svc>,<MCC>,<MNC> <uarfcn>,<Wband>,<WcellId>,<Wlac>,<Wrac>,<scrambling_code>,<Wrrc>,<rssi>,<ecn0_lev>,<Wspeech_mode> OK	+UCGED: 2 3,4,001,01 4400,5,0000000,0000,80,9,4,62,42,255 OK
		<mode>=2, <rat>=4: +UCGED: 2 4,<svc>,<MCC>,<MNC> <EARFCN>,<Lband>,<ul_BW>,<dl_BW>,<TAC>,<LcellId>,<P-CID>,<mTmsi>,<mmeGrId>,<mmeCode>,<RSRP>,<RSRQ>,<Lsinr>,<LTE_rrc>,<RI>,<CQI>,<avg_rsrp>,<totalPuschPwr>,<avgPucchPwr>,<drx>, <l2w>,<volte_mode>[,<meas_gap>,<tti_bundling>] OK	+UCGED: 2 4,0,001,01 2525,5,25,50,2b67,69f6bc7,111,00000000,ffff,ff,67,19,0.00,255,255,255,67,11,255,0,255,255,0,0 OK

Type	Syntax	Response	Example
		OK	
Test	AT+UCGED=?	+UCGED: (list of supported <mode>s) OK	+UCGED: (0,2) OK

7.15.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 0: reporting disabled • 2: short form reporting enabled • 3: retrieve the short form text information report • 4: mobility management (MM) transition state reporting enabled • 5: RSRP and RSRQ reporting enabled • 6: short form reporting with mobility management (MM) transition state enabled See Table 5 for the list of allowed values by series modules.
<rat>	Number	Current Radio Access Technology: • 2: 2G • 3: 3G • 4: 4G • 5: unknown. The parameter is set to a 5 until a network information update is not successfully performed through the AT+UCGED=2 command or when the MT is set to minimum functionality (+CFUN: 0, +CFUN: 4, +CFUN: 19). • 6: LTE Cat M1 • 7: NB-IoT
<svc>	Number	Current radio service state: • 0: not known or not detectable • 1: radio off • 2: searching • 3: no service • 4: registered The radio service state is updated at each change from a valid network service state (2G, 3G or 4G) to another valid network service state (2G, 3G or 4G). To retrieve the network registration status information refer to +CREG, +CGREG and +CEREG AT commands.
<MCC>	Number	See <MCC>.
<MNC>	Number	See <MNC>.
<EARFCN>	Number	See <EARFCN>.
<Lband>	Number	See <Lband>.
<ul_BW>	Number	Number of Uplink Resource Blocks (see 3GPP TS 36.101 table 5.6-1 [122]), 255 if not known or not detectable.
<dl_BW>	Number	Number of Downlink Resource Blocks (see 3GPP TS 36.101 table 5.6-1 [122]), 255 if not known or not detectable.
<TAC>	Number	See <TAC>.
<LcellId>	Number	See <LcellId>.
<mTmsi>	Number	4 bytes MME Temporary Mobile Subscriber Identity in hexadecimal format; 00000000 if not known or not detectable.
<mmeGrId>	Number	2 bytes MME Group Identifier in hexadecimal format; FFFF if not known or not detectable.
<RSRP>	Number	See <RSRP>.
<RSRQ>	Number	See <RSRQ>.
<mmeCode>	Number	1 byte MME Code in hexadecimal format; FF if not known or not detectable.
<Lsinr>	Number	E-UTRAN Signal to Interference and Noise ratio in dB.
<LTE_rrc>	Number	See <LTE_rrc>.
<RI>	Number	Rank Indicator value; 255 if not known or not detectable. It is updated every 480 ms with the value which has been most often reported to the network in the previous 480 ms period. See 3GPP TS 36.213 [141] section 7.2 and 3GPP TS 36.212 [142] section 5.2.2.6 for more details.

Parameter	Type	Description
<CQI>	Number	Channel Quality Indicator value; 255 if not known or not detectable. It is updated every 480 ms with the value which has been most often reported to the network in the previous 480 ms period. See 3GPP TS 36.213 [141] section 7.2 for more details.
<avg_rsrp>	Number	Average value of last 10th Reference Signal Received Power (RSRP).
<totalPuschPwr>	Number	Mobile output power for PUSCH transmission averaged over 480 ms in dBm. LARA-R6 Special value 255 means "not known" or "not detectable".
<avgPucchPwr>	Number	Mobile output power for PUCCH transmission averaged over 480 ms in dBm. LARA-R6 Special value 255 means "not known" or "not detectable".
<drx>	Number	Discontinuous Reception "drx-Inactivity-Timer" value in ms; 0 if not known or not detectable.
<l2w>	Number	SIB3 LTE to WCDMA reselection criteria: (threshServingLow)x2 +(q-RxLevMin)x2; 255 if not known or not detectable.
<volte_mode>	Number	Reserved for future use.
<meas_gap>	Number	Measurement gap configuration: • 0: disabled • 40: 40 ms measurement gap repetition period corresponding to the measurement gap pattern ID 0 (see table 8.1.2.1-1 of 3GPP TS 36.133 [127]) • 80: 80 ms measurement gap repetition period corresponding to the measurement gap pattern ID 1 (see table 8.1.2.1-1 of 3GPP TS 36.133 [127])
<rai_support>	Number	Indicates if the network supports the release assistance indication (RAI): • 0: RAI not supported • 1: RAI supported
<tti_bundling>	Number	TTi (Transmission Time interval) bundling status: • 0: off • 1: on
<NBMsinr>	Number	Logarithmic value of SINR values expressed in 1/5th of a dB. The range goes from 0 to 250 which translates to a range from -20 dB to 30 dB
<esm_cause>	Number	ESM cause value as defined in 3GPP TS 24.301 [114]
<emm_state>	Number	EMM state value as defined in 3GPP TS 24.301 [114]. Allowed values: • 0: EMM-NULL • 1: EMM-DEREGISTERED • 2: EMM-REGISTERED-INITIATED • 3: EMM-REGISTERED • 4: EMM-TRACKING-AREA-UPDATING-INITIATED • 5: EMM-SERVICE-REQUEST-INITIATED • 6: EMM-DEREGISTERED-INITIATED • 7: undefined (or invalid)
<tx_pwr>	Number	TX power value in 1/10 dBm if device is in traffic, 255 otherwise
<drx_cycle_len>	Number	Idle DRX cycle length in 10 ms radio-frame units
<tmsi>	String	TMSI in hexadecimal format, with most significant byte first
<P-CID>	Number	E-UTRAN cell Physical Cell ID; the range is 0-503, 65535 if not known or not detectable.
<RSRP_value>	Number	See <RSRP_value>.
<RSRQ_value>	Number	See <RSRQ_value>.
<MMtransition>	Number	Mobility management transition state. Allowed values: • 0: no change • 1: handover to UMTS • 2: handover to GSM • 3: handover to LTE • 4: reselection to UMTS • 5: reselection to GSM • 6: reselection to LTE • 7: cell change order to UMTS • 8: cell change order to GSM • 9: cell change order to LTE • 10: RAT change

Parameter	Type	Description
		• 255: unknown
<UL_IPcounter>	Number	Counter of the uplink IP packets; it reports the aggregated value from all active PDP contexts. The counter is reset only with module reset. The range goes from 0 to 4294967295.
<DL_IPcounter>	Number	Counter of the downlink IP packets; it reports the aggregated value from all active PDP contexts. The counter is reset only with module reset. The range goes from 0 to 4294967295.

7.15.3.1 2G and 3G RAT parameters

Parameter	Type	Description
<arfcn>	Number	See <arfcn>.
<band1900>	Number	Indicates whether the given <arfcn> in the range 512-810 is part of band 1900 or not, to avoid ambiguity between bands 1800 and 1900: • 0: the given <arfcn> is not part of band 1900 • 1: the given <arfcn> is part of band 1900
<GcellId>	Number	GERAN Cell Identifier (CI) in hexadecimal format; the range is 0h-FFFFh (2 octets).
<BSIC>	Number	See <BSIC>.
<Glac>	Number	Two bytes location area of the GERAN cell in hexadecimal format; FFFF if not known or not detectable.
<Grac>	Number	One byte routing area of the GERAN cell in hexadecimal format; FF if not known or not detectable.
<RxLev>	Number	See <RxLev>.
<grr>	Number	Reserved for future use.
<t_adv>	Number	Reserved for future use.
<Gspeech_mode>	Number	Reports the latest obtained value of the GSM speech code. Allowed values: • 0: GSM Enhanced Full Rate (12.2 kb/s) • 1: GSM Full Rate (13.0 kb/s) • 2: GSM Half Rate (5.6 kb/s) • 3..10: AMR NB FR (from 4.75 kb/s to 12.2 kb/s) the value indicates the first codec type chosen from the DUT; see the corresponding value of <Wspeech_mode> parameter for the baud rate mapping • 3..8: AMR NB HR (from 4.75 kb/s to 7.95 kb/s) the value indicates the first codec type chosen from the DUT; see the corresponding value of <Wspeech_mode> parameter for the baud rate mapping • 11..13: AMR WB FR (from 6.60 kb/s to 12.65 kb/s) the value indicates the first codec type chosen from the DUT; see the corresponding value of <Wspeech_mode> parameter for the baud rate mapping • 255: not known or not detectable See 3GPP TS 26.201 [132] for more details on GSM codecs used during a voice call In case a set of speech codecs is assigned by the network, then the parameter reports the lowest one and this one is not necessary the one used.
<uarfcn>	Number	UTRAN Absolute Radio Frequency Channel Number (UARFCN); the range is 1537-10 838, 65535 if not known or not detectable.
<Wband>	Number	UTRAN band: • 1: band 1 (2 GHz) • 2: band 2 (1900 MHz) • 4: band 4 (2100 MHz) • 5: band 5 (800 MHz) • 8: band 8 (900 MHz) • 255: not known or not detectable
<WcellId>	Number	UTRAN CI (cell identifier) in hexadecimal format; the range is 0h-FFFFFFFh (28 bits), 0000000 if not known or not detectable.
<Wlac>	Number	Two bytes location area of the UTRAN cell in hexadecimal format; FFFF if not known or not detectable.
<Wrac>	Number	One byte routing area of the GERAN cell in hexadecimal format; FF if not known or not detectable.
<scrambling_code>	Number	See <scrambling_code>.
<Wrrc>	Number	3G RRC state:

Parameter	Type	Description
		• 0: idle • 1: URA_PCH • 2: CELL_PCH • 3: CELL_FACH • 4: CELL_DCH • 255: not known or not detectable
<rssi>	Number	UTRAN cell Received Signal Strength Indicator as defined in 3GPP TS 25.133 [128]: • 0: less than -100 dBm • 1..75: from -100 to -25 dBm with 1 dBm steps • 76: -25 dBm or greater • 255: not known or not detectable
<ecn0_lev>	Number	See <ecn0_lev>.
<Wspeech_mode>	Number	Reports the latest obtained value of the UMTS speech code. Allowed values: • 3: AMR NB (4.75 kb/s) • 4: AMR NB (5.15 kb/s) • 5: AMR NB (5.90 kb/s) • 6: AMR NB (6.70 kb/s) • 7: AMR NB (7.40 kb/s) • 8: AMR NB (7.95 kb/s) • 9: AMR NB (10.2 kb/s) • 10: AMR NB (12.2 kb/s) • 11: AMR WB (6.60 kb/s) • 12: AMR WB (8.85 kb/s) • 13: AMR WB (12.65 kb/s) • 14: AMR WB (14.25 kb/s) • 15: AMR WB (15.85 kb/s) • 16: AMR WB (18.25 kb/s) • 17: AMR WB (19.85 kb/s) • 18: AMR WB (23.05 kb/s) • 19: AMR WB (23.85 kb/s) • 255: not known or not detectable See 3GPP TS 26.201 [132] for more details on UMTS codecs used during a voice call. In case a set of speech codecs is assigned by the network, then the parameter reports the lowest one and this one is not necessary the one used.

Table 6: 2G and 3G RAT parameters

7.15.3.2 2G parameters

Parameter	Type	Description
<arfcn>	Number	See <arfcn>.
<band1900>	Number	Indicates whether the given <arfcn> in the range 512-810 is part of band 1900 or not, to avoid ambiguity between bands 1800 and 1900: • 0: the given <arfcn> is not part of band 1900 • 1: the given <arfcn> is part of band 1900
<GcellId>	Number	GERAN Cell Identifier (CI) in hexadecimal format; the range is 0h-FFFFh (2 octets).
<BSIC>	Number	See <BSIC>.
<Glac>	Number	Two bytes location area of the GERAN cell in hexadecimal format; FFFF if not known or not detectable.
<Grac>	Number	One byte routing area of the GERAN cell in hexadecimal format; FF if not known or not detectable.
<RxLev>	Number	See <RxLev>.
<t_adv>	Number	See <t_adv>.
<C1>	Number	Value of c1; see the 3GPP TS 05.08 [85]
<C2>	Number	Value of c2; see the 3GPP TS 05.08 [85]
<NMO>	Number	Network Mode of Operation (NMO); see the 3GPP TS 03.60 [166]: • 0: NMO I • 1: NMO II

Parameter	Type	Description
		• 2: NMO III • -1: invalid
<channel_type>	Number	Current channel type: • 0: traffic channel / packet data traffic channel (TCH/PDTCH) • 1: broadcast control channel (BCCH)

Table 7: 2G parameters

7.16 Wireless service selection +WS46

+WS46						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

7.16.1 Description

Select the cellular service (Wireless Data Service; WDS) to operate with the MT according to PCCA STD-101 [208]. PCCA calls the WDS-Side Stack Selection. The command may be used when the MT is asked to indicate the wireless services in which it can operate.

☞ 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 [112], 3GPP TS 34.121-2 [113], 3GPP TS 36.521-2 [134] and 3GPP TS 36.523-2 [135], is a statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

7.16.2 Syntax

Type	Syntax	Response	Example
Set	AT+WS46=[<n>]	OK	AT+WS46=25 OK
Read	AT+WS46?	+WS46: <n> OK	+WS46: 25 OK
Test	AT+WS46=?	+WS46: (list of supported <n>s) OK	+WS46: (12,22,25) OK

7.16.3 Defined values

Parameter	Type	Description
<n>	Number	WDS-Side stack selection indication and may be: • 12: GERAN only (single mode GSM) • 22: UTRAN only (single mode UMTS) • 25: GERAN, UTRAN and E-UTRAN • 28: E-UTRAN only (single mode LTE) • 29: GERAN and UTRAN • 30: GERAN and E-UTRAN • 31: UTRAN and E-UTRAN

7.16.4 Notes

- It is possible to configure the WDS-Side stack only when is not registered on the wireless service.
- The +URAT command provides extended functionalities with respect to +WS46 command.

LARA-R6001 / LARA-R6001D / LARA-R6801

- The factory-programmed value of <n> is 25.

LARA-R6401 / LARA-R6401D

- <n>=12, 22, 25, 29, 30 and 31 are not supported.

- The factory-programmed value of <n> is 28.

7.17 Smart jamming detection +UJAD

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

7.17.1 Description

The feature consists of detecting, at the application level, an anomalous source of interference or jammer installed in the cellular network and signalling it to the client. The jamming condition occurs when simultaneously:

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

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

LARA-R6
The command automatically sets and adjusts the thresholds for jamming detection based on the environment (number of visible cells and signal levels). For this purpose, the feature periodically performs network scans and signal level measurements on the entire band.

LARA-R6
Network scans and signal level measurements are performed on bands enabled in the current MNO profile and the current +UBANDMASK setting.

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

If jamming detection is activated, an unsolicited indication is issued when the jamming condition is entered or released. If the smart jamming detection per carrier is enabled (<op_code>=2, where supported) the +UJAD URC may be generated for each jammed cell detected by the module.

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

7.17.2 Syntax

Type	Syntax	Response	Example
Set	AT+UJAD=<op_code>	OK	AT+UJAD=1 OK
Read	AT+UJAD?	+UJAD: <op_code>[,<active>] OK	**If jamming detection disabled:** +UJAD: 0 OK **If jamming detection enabled:** +UJAD: 1,0 OK **Or:** +UJAD: 2,0 OK
Test	AT+UJAD=?	+UJAD: (list of supported <op_code>s) OK	+UJAD: (0-1) OK
Smart jamming detection status (<op_code>=1)			
URC		+UJAD: <active>	+UJAD: 1

Type	Syntax	Response	Example
Smart jamming detection per carrier status (<op_code>=2)			
URC		+UJAD: <op_code>,<active>,<Lband>,<PhysCellID>,<EARFCN>,<dl_frequency>	+UJAD: 2,"DETECTED",1,1,300,2140

7.17.3 Defined values

Parameter	Type	Description
<op_code>	Number	Jamming detection operation mode: • 0: smart jamming detection disabled • 1: smart jamming detection enabled; the +UJAD URC may be generated • 2: smart jamming detection per carrier enabled; the +UJAD URC may be generated for each jammed cell detected by the module Allowed values: • LARA-R6 - 0 (factory-programmed value), 1
<active>	Number / String	Jamming detection status. Allowed values: • LARA-R6 o 0: jamming not detected o 1: jamming detected o 2: jamming unknown
<Lband>	Number	See <Lband>.
<PhysCellID>	Number	See <PhysCellID>.
<EARFCN>	Number	See <EARFCN>.
<dl_frequency>	Number	See <dl_frequency>.

7.17.4 Notes

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

LARA-R6

- When jamming detection is enabled it may be temporarily (the worst case is 180 s) not possible to perform a full cell scan via the +UCFSCAN set command.

7.18 Edit Verizon wireless APN table +VZWAPNE

+VZWAPNE						
Modules	LARA-R6401 LARA-R6401D					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

7.18.1 Description

Reads and writes the APN table stored in the NVM:

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

7.18.2 Syntax

Type	Syntax	Response	Example
Set	AT+VZWAPNE=<wapn>,<apncl>,<apnni>,<apntype>,<apnb>,<apned>,<apntime>	OK	AT+VZWAPNE=1,1,"IMS","IPv6","LTE","Enabled",0 OK
Read	AT+VZWAPNE?	[+VZWAPNE: <apncl>,<apnni>,<apntype>,<apnb>,<apned>,<apntime> [..]] OK	+VZWAPNE: 1,"IMS","IPv4v6","LTE","Enabled",0 +VZWAPNE: 2,"VZWADMIN","IPv4v6","LTE","Enabled",0

Type	Syntax	Response	Example
			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

7.18.3 Defined values

Parameter	Type	Description
<wapn>	Number	APN list entry
<apncl>	Number	APN class
<apnni>	String	Network identifier: • "IMS" or "VZWIMS": Verizon IMS PDN, factory-programmed value for <apncl>=1 entry • "VZWADMIN": Verizon Administrative PDN, factory-programmed for <apncl>=2 entry • "VZWINTERNET": Verizon Internet PDN, factory-programmed for <apncl>=3 entry • "VZWAPP": Verizon Application PDN, factory-programmed for <apncl>=4 entry • "ENTERPRISE": Verizon Enterprise PDN, factory-programmed for <apncl>=6 entry • "THINGSPACE": Verizon Thingspace PDN, factory-programmed for <apncl>=7 entry • "VZWEMERGENCY": Verizon Emergency IMS PDN, factory-programmed for <apncl>=0 entry
<apntype>	String	• "IPv6": IPv6 type • "IPv4v6" (factory-programmed value): IPv4 and IPv6 type
<apnb>	String	APN bearer: • "LTE" (factory-programmed value): LTE bearer used
<apned>	String	Enable/disable the APN: • "Enabled" (factory-programmed value): APN enabled • "Disabled": APN disabled
<apntime>	Number	APN inactivity timer value in minutes. • LARA-R6 -The range goes from 0 to 122820. The value '0' (factory-programmed value) sets the timer to infinity.

7.18.4 Notes

LARA-R6

- If the current MNO profile is not set to Verizon (see the +UMNOPROF AT command, <MNO>=3) and the command is issued, the module returns an error result code.
- The class 6 APN NI is "VZWCLASS6" and the class 7 APN NI is "VZWCLASS7".

7.19 Read RSRP values +VZWRSRP

+VZWRSRP						
Modules	LARA-R6401 LARA-R6401D					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

7.19.1 Description

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

7.19.2 Syntax

Type	Syntax	Response	Example
Read	AT+VZWRSRP?	+VZWRSRP:	+VZWRSRP:

Type	Syntax	Response	Example
		[<cellID1>,<EARFCN1>,<RSRP1>[, <cellID2>,<EARFCN2>,<RSRP2>[, ...]]] OK	000,2175,"-61.00" OK

7.19.3 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, see <EARFCN>.
<RSRPn>	String	nth cell RSRP value in dBm/15 kHz where the format is "-XX.XX".

7.19.4 Notes

LARA-R6

- If the current MNO profile is not set to Verizon (see the +UMNOPROF AT command, <MNO>=3) and the command is issued, the module returns an error result code.

7.20 Read RSRQ values +VZWRSRQ

+VZWRSRQ						
Modules	LARA-R6401 LARA-R6401D					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

7.20.1 Description

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

7.20.2 Syntax

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

7.20.3 Defined values

Parameter	Type	Description
<cellID>	Number	nth cell physical cell identifier in "xxx" format. The range goes from 0 to 503.
<EARFCNn>	Number	nth cell EARFCN in decimal format, see <EARFCN>.
<RSRQn>	String	nth cell RSRQ value in dB/15 kHz where the format is "-XX.XX".

7.20.4 Notes

LARA-R6

- If the current MNO profile is not set to Verizon (see the +UMNOPROF AT command, <MNO>=3) and the command is issued, the module returns an error result code.

7.21 Signalling connection status +CSCON

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

7.21.1 Description

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

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

LARA-R6
The URC is sent from the MT each time an RRC connection is activated on LTE RAT.

LARA-R6
The information text response of the read command returns only the URC configuration (<n>).

7.21.2 Syntax

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

7.21.3 Defined values

Parameter	Type	Description
<n>	Number	URC configuration: • 0: +CSCON URC disabled • 1: URC +CSCON: <mode> enabled • 2: URC +CSCON: <mode>[,<state>] enabled • 3: URC +CSCON: <mode>[,<state>[,<access>]] enabled Allowed values: • LARA-R6 - 0 (factory-programmed value), 1
<mode>	Number	Indicates the signaling connection status: • 0: idle • 1: connected
<state>	Number	Allowed values: • 0: UTRAN URA_PCH • 1: UTRAN Cell_PCH • 2: UTRAN Cell_FACH • 3: UTRAN Cell_DCH • 4: GERAN CS connected • 5: GERAN PS connected • 6: GERAN CS and PS connected • 7: E-UTRAN connected
<access>	Number	Indicates the radio access technology: • 4: E-UTRAN FDD

7.21.4 Notes

LARA-R6

- The <state> and <access> parameters are not supported.

7.22 Radio Policy Manager (RPM) activation +URPM

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

7.22.1 Description

Activates or deactivates the Radio Policy Manager (RPM) feature for SIM cards not belonging to AT&T network operator, where the feature is enabled by default.

Generally a UE can aggressively retry the registration procedure until it is successful and can behave similarly if the PDP context activation procedure fails. This behavior may cause signaling overload and consequently prolonged network outage. To avoid these scenarios and provide a more efficient access to the network, the Radio Policy Manager (RPM) feature controls the number of network accesses per service type over a fixed amount of time. For more details on the RPM feature see AT&T Device Requirements [214] and GSMA Connection Efficiency [169].

Some network reject error causes require specific behaviors which the RPM feature does not alter (see the 3GPP TS 24.008 [79]).

☞ LARA-R6
RPM can be configured also for SIM cards belonging to AT&T network operator, where the feature is not enabled by default anymore.

7.22.2 Syntax

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

7.22.3 Defined values

Parameter	Type	Description
<mode>	Number	Indicates the action to perform: • 0 (factory-programmed value): RPM feature deactivated • 1: RPM feature activated The factory-programmed value depends on the series module: • LARA-R6 - see Mobile Network Operator profiles

7.22.4 Notes

LARA-R6

- If enabled by the selected MNO profile factory-programmed configuration (for more details, see Mobile Network Operator profiles) do not change the RPM algorithm enabling status.

7.23 eDRX setting +CEDRXS

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

7.23.1 Description

Configures the UEs extended discontinuous reception (eDRX) parameters. The command controls whether the UE wants to apply the eDRX or not, as well as the requested eDRX cycle value.

☞ The requested paging time window is by factory-programmed configuration 4 s long and it cannot be modified.

☞ Deregister the module from the network to change the command setting. Issue AT+COPS=2 or AT +CFUN=0 to deregister from network, issue the +CEDRXS command and reboot the module (by means of the AT+CFUN=15 command) in order to apply the +CEDRXS settings.

7.23.2 Syntax

Type	Syntax	Response	Example
Set	AT+CEDRXS=<mode>,<AcT_type>[,<Requested_eDRX_cycle>]	OK	AT+CEDRXS=1,4,"0101" OK
Test	AT+CEDRXS=?	+CEDRXS: (0-3),<AcT-type(2-4)>,<Requested_eDRX_value(0-15) in bits> OK	+CEDRXS: (0-3),<AcT-type(2-4)>,<Requested_eDRX_value(0-15) in bits> OK

7.23.3 Defined values

Parameter	Type	Description
<mode>	Number	Indication to disable or enable the use of eDRX in the UE. Allowed values: • 0: use of eDRX disabled • 1 (factory-programmed value): use of eDRX enabled
<AcT_type>	Number	Indicates the type of access technology: • 4: LTE
<Requested_eDRX_cycle>	String	See <Requested_eDRX_cycle>.

7.23.4 Notes

LARA-R6

- The <Requested_eDRX_cycle> parameter is mandatory when enabling eDRX (<mode>=1).

7.24 Set MNO profile +UMNOPROF

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

7.24.1 Description

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

Follow this procedure to properly set up the configuration:

- Deregister the module from the network (perform a AT+CFUN=0 or AT+CFUN=4 cycle or issue the AT +COPS=2 command)
- Issue AT+UMNOPROF=<MNO>

- To apply the new configuration reboot the module
  - LARA-R6 - by means of the AT+CFUN=15 or AT+CFUN=16AT command

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

☞ LARA-R6
Changing the Mobile Network Operator (MNO) profile with the +UMNOPROF AT command overwrites some AT command settings and applies the default MNO profile values. For the list of AT commands affected by +UMNOPROF AT command, see Mobile Network Operator profiles.

Follow this procedure to restore the profile factory-programmed configuration:

- LARA-R6 - Set the <MNO> parameter to the currently selected profile and reboot the module (AT +CFUN=15) to make the change effective

☞ LARA-R6
The version of the MNO profiles can be displayed by issuing the set command AT+UMNOPROF=,1 and then the test command AT+UMNOPROF=?. The MNO profile version will be displayed after each profile in the list. AT+UMNOPROF=,0 restores the default response syntax of the test 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 [112], 3GPP TS 34.121-2 [113], 3GPP TS 36.521-2 [134] and 3GPP TS 36.523-2 [135], is a statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

7.24.1.1 SIM ICCID selection

If the <MNO> parameter is set to 1 (SIM ICCID select), the mobile network operator profile is selected according to the recognized SIM Issuer Identifier Number (IIN). If the SIM IIN does not match any allowed <MNO>, after the reboot:

- LARA-R6 - the global profile (<MNO>=90) configuration is applied.

If the SIM is not inserted, the last valid <MNO> remains active and is consequently shown by the <MNO_detected> parameter.

7.24.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMNOPROF=<MNO>[,<reset>,<urc_notification_enabled>]	OK	AT+UMNOPROF=1,0,1 OK
Read	AT+UMNOPROF?	+UMNOPROF: <MNO>[,[<MNO_detected>],<reset>,<urc_notification_enabled>] OK	+UMNOPROF: 3 OK
URC		+UMNOPROF: <MNO>,<MNO_detected>	+UMNOPROF: 1,2

7.24.3 Defined values

Parameter	Type	Description
<MNO>	Number	Mobile Network Operator (MNO) profile: • 0: undefined / regulatory. For more details, see Notes. • 1: SIM ICCID/IMSI select • 2: AT&T • 3: Verizon • 4: Telstra • 5: T-Mobile US • 6: China Telecom • 8: Sprint • 19: Vodafone • 20: NTT DoCoMo • 21: Telus

Parameter	Type	Description
		• 28: SoftBank • 31: Deutsche Telekom • 32: US Cellular • 33: VIVO • 38: LG U+ • 39: SKT • 41: KDDI • 43: Rogers • 44: Claro Brasil • 45: TIM Brasil • 46: Orange France • 47: Bell • 90: global • 100: standard Europe • 101: standard Europe No-ePCO. The factory-programmed configuration of this profile is the same of the standard Europe profile (<MNO>=100), but the ePCO is disabled. • 102: standard JP (global) • 198: AT&T 2-4-12. The factory-programmed configuration of this profile is the same of the AT&T profile (<MNO>=2), but the LTE band 5 is disabled. • 199: Generic voice capable AT&T • 201: GCF-PTCRB. This profile is meant only for conformance testing. • 206: FirstNet Allowed values depend on the module series: • LARA-R6001 - 1, 90 (factory-programmed value), 201 • LARA-R6001D - 1, 2, 90 (factory-programmed value), 201 • LARA-R6401 / LARA-R6401D - 1, 2, 3, 90 (factory-programmed value), 201, 206 • LARA-R6801 - 1, 90 (factory-programmed value), 201
<MNO_detected>	Number	If <MNO>=1 (SIM ICCID/IMSI select) and the SIM is inserted, it specifies the <MNO> value that matches the SIM Issuer Identifier Number (IIN) or the <MNO> retrieved by the IMSI and that is actually applied.
<reset>	Number	Configure the automatic reset. Allowed values: • 0: the automatic reset is disabled; the user shall reboot the module by itself • 1: the automatic reset is enabled It must be issued only if <MNO>=1.
<urc_notification_enabled>	Number	Configure the URC notification. Allowed values: • 0: URC is not issued if the <MNO_detected> value changes • 1: URC is issued any time the <MNO_detected> value changes It must be issued only if <MNO>=1.

7.24.4 Notes

- The standard Europe profile should be used as the basis for all other MNOs in Europe outside of Vodafone and Deutsche Telekom. However, there may be changes that need to be applied to the module for proper operation with any given European MNO such as attach type, RAT preference, band selection, etc. Please consult with the preferred network provider.

LARA-R6

- The PIN insertion is not mandatory before the command execution.
- The <reset>, <urc_notification_enabled> parameters are not supported.

7.25 Band selection bitmask +UBANDMASK

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

7.25.1 Description

Sets the supported LTE / NB-IoT / GSM bands for different Radio Access Technologies (RATs). The LTE bands supported are set by means of bitmasks where each bit in an 64 bit integer corresponds to a LTE / NB-IoT band (where supported). The GSM bands supported are set by means of a bitmask where specific bits correspond to 850 / 900 / 1800 / 1900 bands.

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

☞ LARA-R6
Restart the cellular functionality (e.g. via AT+CFUN=16 or AT+CFUN=0/1 cycle) to make the setting effective.

☞ u-blox cellular modules are certified according to all the capabilities and options stated in the Protocol Implementation Conformance Statement document (PICS) of the module. The PICS, according to 3GPP TS 51.010-2 [112], 3GPP TS 34.121-2 [113], 3GPP TS 36.521-2 [134] and 3GPP TS 36.523-2 [135], 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.

☞ LARA-R6
In compliance with GCF/PTCRB certification and/or mobile network operator specifications, this command may be disabled for certain mobile network operator profiles. For more details, see +UMNOPROF AT command.

7.25.2 Syntax

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

7.25.3 Defined values

Parameter	Type	Description
<RAT>	Number	Indicates the Radio Access Technology (RAT): • 2: GSM / UMTS • 3: LTE Allowed values: • LARA-R6001 / LARA-R6001D / LARA-R6801 - 2, 3 • LARA-R6401 / LARA-R6401D - 3
<bitmask1>	Number	Depending on the <RAT> parameter value, configures the bitmask for LTE or GSM/UMTS bands. GSM and UMTS bands are combined into one bitmask. Where bit number 1 to 22 are dedicated for GSM, and, 23 to 64 are dedicated for UMTS according to the list below. When <RAT>=2 (GSM/UMTS), it indicates bandmask for GSM/UMTS bands. The following bit enables/disables a band:

Parameter	Type	Description
		• Bit 7: DCS 1800 • Bit 8: ESGM 900 • Bit 19: GSM 850 • Bit 21: PCS 1900 • Bit 22: WCDMA IMT 2000 • Bit 23: WCDMA PCS 1900 • Bit 24: WCDMA III 1700 • Bit 25: WCDMA IV 1700 • Bit 26: WCDMA V 850 • Bit 27: WCDMA VI 800 • Bit 48: WCDMA VII 2600 • Bit 49: WCDMA VIII 900 • Bit 50: WCDMA IX 1700 • Bit 60: WCDMA XIX 850 • Bit 61: WCDMA XI 1500 If any other bit of the bitmask is set to 1, the module return an error result code is issued. When <RAT>=3 (LTE), it indicates the bandmask for LTE bands 1 through 64. Each bit enables/disables a band: • Bit 0: band 1 • Bit 1: band 2 • Bit 2: band 3 • Bit 3: band 4 • .. • Bit 63: band 64 For the factory-programmed value, see Mobile Network Operator profiles.
<bitmask2>	Number	When <RAT>=3 (LTE), it indicates the bandmask for LTE bands 65 through 128. Each bit enables/disables a band: • Bit 0: band 65 • Bit 1: band 66 • Bit 2: band 67 • Bit 3: band 68 • .. • Bit 64: band 128 For the factory-programmed value, see Mobile Network Operator profiles. When <RAT>=2 (UMTS/GSM) the parameter is not supported.

7.26 Device service domain configuration +USVCDOMAIN

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

7.26.1 Description

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

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

Reboot the module in order to apply the new settings.

7.26.2 Syntax

Type	Syntax	Response	Example
Set	AT+USVCDOMAIN=<domain>[,<voice_domain_preference>[,<ue_usage_setting>]]	OK	AT+USVCDOMAIN=2 OK

Type	Syntax	Response	Example
Read	AT+USVCDOMAIN?	+USVCDOMAIN: <domain>[,<voice_domain_preference>[,<ue_usage_setting>]] OK	+USVCDOMAIN: 2,1,1 OK
Test	AT+USVCDOMAIN=?	+USVCDOMAIN: (list of supported <domain>s),(list of supported<voice_domain_preference>s),(list of supported<ue_usage_setting>s) OK	+USVCDOMAIN: (0-2),(0-4),(0-1) OK

7.26.3 Defined values

Parameter	Type	Description
<domain>	Number	Service domain: • 0: CS only • 1: PS only • 2 (factory-programmed value): CS/PS combined Allowed values: • LARA-R6 - 0, 1, 2
<voice_domain_preference>	Number	Voice domain preference IE configuration. The parameter setting is ignored if <domain>=0. Allowed values: • 0 (factory-programmed value): IE not present • 1: PS only • 2: CS only • 3: CS preferred • 4: PS preferred Allowed values: • LARA-R6 - 0, 1, 2, 3, 4
<ue_usage_setting>	Number	Voice domain preference UE usage setting configuration. The parameter setting is ignored if <domain>=0 or if <voice_domain_preference>=0. Allowed values: • 0: voice centric • 1 (factory-programmed value): data centric

7.27 Modem features customization +UDCONF=92

+UDCONF=92						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM / OP	No	-	+CME Error

7.27.1 Description

Configures several customizations available in modem FW. Depending on the <item> value different setting can be configured:

- 3: NAS release compliance configuration. The feature allows to set the NAS release behaviour of the module
- 50: SIM boot delay time configuration. The feature allows to delay the initialization of SIM card. It is a helpful tool in debugging

☞ Reboot the module to apply the new configuration.

7.27.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UDCONF=92,<item>,<param1>[,<param2>]	OK	AT+UDCONF=92,3,4 OK
Read	AT+UDCONF=92,<item>[,<param1>]	+UDCONF: 92,<item>,<param1>[,<param2>]	AT+UDCONF=92,3

Type	Syntax	Response	Example
		OK	+UDCONF: 92,3,4 OK
NAS release compliance			
Set	AT+UDCONF=92,3,<nas_release_compliance>	OK	AT+UDCONF=92,3,4 OK
Read	AT+UDCONF=92,3	+UDCONF: 92,3,<nas_release_compliance> OK	AT+UDCONF=92,3 +UDCONF: 92,3,4 OK
SIM boot delay configuration			
Set	AT+UDCONF=92,50,<SIM_boot_delay>	OK	AT+UDCONF=92,50,20 OK
Read	AT+UDCONF=92,50	+UDCONF: 92,50,<SIM_boot_delay> OK	AT+UDCONF=92,50 +UDCONF: 92,50,20 OK

7.27.3 Defined values

Parameter	Type	Description
<item>	Number	Modem customization. Allowed values: • 3: NAS release compliance • 50: SIM boot delay configuration Allowed values: • LARA-R6 - 3, 50
<nas_release_compliance>	Number	Sets the UE NAS behavior's release version. Allowed values: • 3: UE behaves as 3GPP compliance release 7. Above release version will not work. • 4 (factory-programmed value): UE behaves as 3GPP compliance release 10. Above release version will not work
<SIM_boot_delay>	Number	SIM boot delay time of UIM driver at boot in seconds. The range goes from 0 to 255. The factory-programmed value is 0.

7.28 EEA0 encryption algorithm configuration+UDCONF=98

+UDCONF=98						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

7.28.1 Description

Configures the EEA0 encryption algorithm.

☞ Reboot the module to apply the new configuration.

7.28.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=98,<EEA0_enabled>	OK	AT+UDCONF=98,0 OK
Read	AT+UDCONF=98	+UDCONF: 98,<EEA0_enabled> OK	AT+UDCONF=98 +UDCONF: 98,1 OK

7.28.3 Defined values

Parameter	Type	Description
<EEA0_enabled>	Number	Enables/disables the EEA0 encryption algorithm:

Parameter	Type	Description
		• 0: EEA0 algorithm not supported • 1 (factory-programmed value): EEA0 algorithm supported

8 IP Multimedia Subsystem (IMS)

8.1 Introduction

8.2 IMS client configuration +UIMSCFG

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

8.2.1 Description

Configures the IMS managed objects by means of proper keys that configure the corresponding functionality.

8.2.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set / Read	AT+UIMSCFG=<op_code>[,<num_of_Config_items>,<ImsConfig1>[,<data1>[,<ImsConfig2>[,<data2>[...]]]]]	OK	
IMS setting configuration			
Set	AT+UIMSCFG=0[,<num_of_Config_items>,<ImsConfig1>[,<data1>[,<ImsConfig2>[,<data2>[...]]]]]	OK	
IMS setting reading			
Read	AT+UIMSCFG=1[,<num_of_Config_items>,<ImsConfig1>[,<ImsConfig2>[...]]]	[+UIMSCFG :<ImsConfig1>,<data1> [+UIMSCFG :<ImsConfig2>,<data2> [..]]] OK	AT+UIMSCFG=1 +UIMSCFG: 50,0 +UIMSCFG: 51,"ims" +UIMSCFG: 53,2 +UIMSCFG: 253,1 OK
Test	AT+UIMSCFG=?	+UIMSCFG: (list of supported <op_code>'s),(list of supported <num_of_Config_items>),(list of supported <ImsConfig>) OK	+UIMSCFG: (0-1),(1-16),(50,51,53,253) OK

8.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	Allowed values: • 0: sets/configures the corresponding <data> of the IMS configuration data specified in <ImsConfig>. It can be used to set/configure more than one <ImsConfig>s. If the <ImsConfig> parameter is omitted, then the command will set the default <data> of all <ImsConfig>s. • 1: gets the configured <data> value of a specific IMS configuration data mentioned by <ImsConfig>. It can be used to retrieve more than one <ImsConfig>s. If the <ImsConfig> parameter is omitted, then the command will return the <data> of all <ImsConfig>s.
<data>	Number / String	Contains the numeric data if <ImsConfig> is a numeric parameter. Otherwise it will contain the string data if <ImsConfig> is a string parameter.
<num_of_Config_items>	Number	Number of IMS configuration elements to be set or retrieved.

Parameter	Type	Description
<ImsConfig>	Number	For more details on the values supported by u-blox cellular modules see Notes. IMS object keys: • 9: 3GPP_CONFERENCE_URI <data> is a string parameter and defines the Conference Factory URI. See 3GPP TS 24.166 [143], Conf_Factory_URI; it should be a null terminated string, the maximum size is 255. The default and factory-programmed value differ depending on product version: o LARA-R6 - <ImsConfig>=9 is not supported. • 50: AUTOLOGIN_MODE <data> is an integer parameter and set the autologin mode of IMS. Allowed values: o 0 (default value): AUTOLOGIN_NEVER o 1: AUTOLOGIN_ALWAYS o 2: AUTOLOGIN_HOME_NETWORK o 3: AUTOLOGIN_LTE_EPS_ONLY. IMS registration starts only if the MT registers to LTE network with EPS services only (CS domain rejected with cause #18). The factory-programmed value differs depending on the product version: o LARA-R6 - For the complete list of the factory-programmed values, see Mobile Network Operator profiles. • 51: APN_NAME <data> is a string parameter representing the IMS APN name to be used for the VoLTE; it shall be a null terminated string. The maximum length is 255. The default and factory-programmed value differ depending on product version: o LARA-R6 - The default and factory-programmed value is "ims". • 53: PREFFERED_PDPTYPE <data> is an integer parameter and represents the preferred PDP type for IMS. Allowed values: o 0: IPv4 o 1: IPv6 o 2 (default and factory-programmed value): IPv4v6 • 162: IMSI_in_Contact_header <data> is an integer parameter and enables the insertion of the IMSI in the SIP "contact" header. To apply the new setting the module must re-register to the network (AT+COPS=2 / AT+COPS=0 or AT+CFUN=4 / AT+CFUN=1 or AT +CFUN=16). The flag is configured as per operator requirements, and it is also updated by +UMNOCONF AT command. Allowed values are: o 0: IMSI not present in SIP "contact" header o 1: IMSI present in SIP "contact" header The default and factory-programmed value differs depending on product version: o LARA-R6 - <ImsConfig>=162 is not supported. • 164: aSRVCC_configuration <data> is an integer parameter and enables/disables the aSRVCC support. To apply the new setting the module must re-register to the network (AT+COPS= 2 / AT+COPS=0 or AT+CFUN=4 / AT+CFUN=1 or AT+CFUN=16). The flag is configured as per operator requirements, and it is also updated by +UMNOCONF AT command (<MNO>=0 (regulatory) or <MNO>=2 (AT&T) or <MNO>=5 (T-Mobile) or <MNO>=21 (Telus) enable the feature). In order to be compliant with certification requirements, the feature shall be enabled in AT&T and T-mobile configuration. Allowed values are: o 0: aSRVCC call disabled o 1 (default and factory-programmed value): aSRVCC call enabled • 200: XCAP_APN <data> is a string parameter and represents the APN name to be used for supplementary service provisioning; it should be a null terminated string. The maximum length is 255. The factory-programmed value differs depending on product version: o LARA-R6 - For the complete list of the factory-programmed values, see Notes. • 201: XCAP_ROOT_URI <data> is a string parameter and represents the Root URI of the XCAP server; it should be a null terminated string. The "http//" prefix is required. The maximum length is 255. The default and factory-programmed value is an empty string.

Parameter	Type	Description
		• 202: XCAP_AUTH_USER_NAME <data> is a string parameter and represents the username to be used for HTTP authentication of XCAP requests; it should be a null terminated string. The maximum length is 255. The default and factory-programmed value is an empty string. • 203: XCAP_AUTH_PASSWORD <data> is a string parameter and represents the user password to be used for HTTP authentication of XCAP requests; it should be a null terminated string. The maximum length is 255. The default and factory-programmed value is an empty string. • 204: XCAP_TRANSPORT_TYPE <data> is an integer parameter and represents the transport type to be used for XCAP Requests. Allowed values: o 0 (default and factory-programmed value): TRANSPORT_HTTP o 1: TRANSPORT_HTTPS o 2: TRANSPORT_HTTPS_PREFFERED • 205: XCAP_Bearer_Deactivation_Timer <data> is an integer parameter and represents the time in seconds after which IMS will automatically deactivate the XCAP bearer with APN defined by <ImsConfig>=200, if it has been activated by IMS itself (i.e. if it was not active during Supplementary Services related AT command execution). According to AT&T <CDR-LTE-1982> requirement (Supplementary Services Configuration), the XCAP shall be used for supplementary services regardless the RAT and IMS registration status. Allowed values: o The range goes from 0 to 65535 o 0: deactivates the XCAP bearer upon XCAP completion o 65535: never deactivates the XCAP bearer o Default and factory-programmed value: 3 • 253: SIP_URI_FORMAT <data> is an integer parameter and represents the URI format to be used for converting MSISDN numbers into URI's. Allowed values: o 0: URI_NONE o 1: URI_SIP o 2: URI_TEL The default and factory-programmed value differs depending on product version: o LARA-R6 - For the complete list of the factory-programmed values, see Notes. • 264: VoPS_registration <data> is an integer parameter and enables the VoPS support check. The IMS will register only if VoPS is declared as supported by the network. Allowed values are: o 0: VoPS support check disabled o 1: VoPS support check enabled The default and factory-programmed value differs depending on product version: o LARA-R6 - The factory-programmed value is 1. • 269: VoLTE_conference <data> is an integer parameter and configures the VoLTE conference subscription event. Allowed values are: o 0: disable the subscription event o 1 (default and factory-programmed value): enable the subscription event

8.2.4 Notes

Module	9 (3GPP_CONFERENCE_URI)	50 (AUTOLOGIN_MODE)	51 (APN_NAME)	53 (PREFFERED_PDPTYPE)	162 (IMSI_in_Contact_header)	164 (aSRVCC_configuration)	200 (XCAP_APN)	201 (XCAP_ROOT_URI)	202 (XCAP_AUTH_USER_NAME)	203 (XCAP_AUTH_PASSWORD)	204 (XCAP_TRANSPORT_TYPE)	205 (XCAP_Bearer_Deactivation_Timer)	253 (SIP_URI_FORMAT)	264 (VoPS_registration)	269 (VoLTE_conference)
LARA-R6		*	*	*			*	*					*	*	

Table 8: <ImsConfig> allowed values

LARA-R6
If <ImsConfig>=50, then <data>=2 and 3 are not supported.

LARA-R6001D

- Table 9 reports the <ImsConfig>=200 and 253 factory-programmed value for each allowed MNO profile (see +UMNOPROF):

	AT&T	Global	GCF-PTCRB
MNO profile			
<MNO>	2	90 (factory-programmed value)	201
Factory-programmed values			
XCAP_APN (200)	"broadband"	""	""
SIP_URI_FORMAT (253)	1	2	2

Table 9: MNO profiles factory-programmed values

LARA-R6401D

- Table 10 reports the <ImsConfig>=200 and 253 factory-programmed value for each allowed MNO profile (see +UMNOPROF):

	AT&T	Verizon	Global	GCF-PTCRB	FirstNet
MNO profile					
<MNO>	2	3	90 (factory-programmed value)	201	206
Factory-programmed values					
XCAP_APN (200)	"broadband"	""	""	""	"firstnet-broadband"
SIP_URI_FORMAT (253)	1	2	2	2	1

Table 10: MNO profiles factory-programmed values

8.3 IMS client registration / deregistration in network +UIMSREG

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

8.3.1 Description

Sends the registration/deregistration request to the network.

The AT+UIMSREG=0 command can be used during certification to trigger an IMS deregistration, but the IMS automatic registration feature (AT+UIMSCFG=0,1,50,1 or AT+UIMSCFG=0,1,50,2) has higher priority: in case of LTE cell reselection the IMS registration will be restarted. When the IMS shall be steadily deregistered, issue AT+UIMSCFG=0,1,50,0 before issuing AT+UIMSREG=0.

☞ Only an IMS client session is possible at any given time. The user must first configure the session's parameters using AT+UIMSCFG command before using AT+UIMSREG.

☞ The final result code to the set command only implies that the request is success/failure. It does not guarantee the IMS client registration. The registration status of the IMS client is provided by means of the +CIREG AT command.

8.3.2 Syntax

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

8.3.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 0 (default value): deregister the IMS client from network • 1: register the IMS client to network

8.3.4 Notes

LARA-R6

- The command is supported only if the IMS is enabled (+UIMSCFG: 50,1).

8.4 IMS registration information +CIREG

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

8.4.1 Description

Configures the IMS registration information. Depending on the <n> parameter value a URC can be issued when the MT's IMS registration information changes:

- +CIREGU: <reg_info> if <n>=1
- +CIREGU: <reg_info>[,<ext_info>] if <n>=2

The read command provides the same information issued by the URC together with the current value of <n> parameter.

8.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+CIREG=[<n>]	OK	AT+CIREG=1 OK
Read	AT+CIREG?	+CIREG: <n>,<reg_info>[,<ext_info>] OK	+CIREG: 1,1 OK
Test	AT+CIREG=?	+CIREG: (list of supported <n>s) OK	+CIREG: (0,1) OK
URC		+CIREGU: <reg_info>[,<ext_info>]	+CIREGU: 0

8.4.3 Defined values

Parameter	Type	Description
<n>	Number	Configures the reporting of changes in the MT's IMS registration information: • 0: reporting URC disabled • 1: reporting URC +CIREGU: <reg_info> enabled • 2: extended reporting URC +CIREGU: <reg_info>,<ext_info> enabled
<reg_info>	Number	Indicates the IMS registration status. The MT is seen as registered as long as one or more of its public user identities are registered with any of its contact addresses, see 3GPP TS 24.229 [125]. • 0: not registered • 1: registered The parameter shows whether one or more of the public user identities are registered
<ext_info>	Number	Numeric value in hexadecimal format. The range goes from 1 to FFFFFFFF. It is a sum of hexadecimal values, each representing a particular IMS capability of the MT. The MT can have IMS capabilities not covered by the below list. This parameter is not present if <reg_info>=0. • 1: RTP-based transfer of voice according to MMTEL, see 3GPP TS 24.173 [123]. This functionality can not be indicated if the UE is not available for voice over PS, see 3GPP TS 24.229 [125] • 2: RTP-based transfer of text according to MMTEL, see 3GPP TS 24.173 [123] • 4: SMS using IMS functionality, see 3GPP TS 24.341 [124] • 8: RTP-based transfer of video according to MMTEL, see 3GPP TS 24.173 [123] The hexadecimal values 10, 20, 40 and 80000 are reserved. It shows the status of the MT's IMS capabilities. For <ext_info>, all relevant values are always summarized and reported as a complete set of IMS capabilities in the URC.

8.4.4 Notes

LARA-R6

- <n>=2 is not supported.
- The <ext_info> parameter is not supported.
- The command is supported only if the IMS is enabled (+UIMSCFG: 50,1).

8.5 Domain configuration for MO SMS messages +UISMS

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

8.5.1 Description

Configures for routing the outgoing SMS messages either over IMS or not over IMS.

If the selected configuration is IMS, then IMS settings will have higher priority while sending messages, other 2G/3G settings for MO SMS (e.g. +CGSMS settings) will be ignored.

8.5.2 Syntax

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

8.5.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 0: SMS messages are not sent over IMS • 1: SMS messages are preferably sent over IMS LARA-R6 For the factory-programmed value, see Mobile Network Operator profiles.

9 Device lock

9.1 Enter PIN +CPIN

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

9.1.1 Description

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

9.1.2 Syntax

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

9.1.3 Defined values

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

9.1.4 Notes

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

Command	Response
AT+CMEE=2	OK
AT+COPS=0	+CME ERROR: SIM PIN required
AT+CMEE=0	OK
AT+COPS=0	ERROR

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

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

9.2 Change password +CPWD

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

9.2.1 Description

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

9.2.2 Syntax

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

9.2.3 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)

9.2.4 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.

LARA-R6

- A detach from the cellular network is automatically performed in case the PIN is wrongly entered more than 3 times.

10 Phonebook

10.1 Select phonebook memory storage +CPBS

+CPBS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 35 s	+CME Error

10.1.1 Description

Selects a phonebook memory storage for further use in phonebook related commands.

☞ The information text response of the test command depends on SIM dependent parameters (e.g. "EC").

10.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPBS=<storage>[,<password>]	OK	AT+CPBS="SM" OK
Read	AT+CPBS?	+CPBS: <storage>[,<used>,<total>] OK	+CPBS: "SM",25,150 OK
Test	AT+CPBS=?	+CPBS: (list of supported <storages>s) OK	+CPBS: ("SM","FD","LD","SN","EC","ON","BL") OK

10.1.3 Defined values

Parameter	Type	Description
<storage>	String	Phonebook memory storage: • "SM": SIM phonebook (depending on SIM card, it may not be available when the FDN is enabled) • "AP": USIM application phonebook (depending on SIM card, it may not be available when the FDN is enabled) • "FD": SIM fixed dialling phonebook (only valid with PIN2) • "LD": SIM last-dialling phonebook • "BN": SIM barred-dialling-number phonebook (only valid with PIN2) • "SN": SIM service-dialling-number phonebook (read only) • "EC": SIM emergency-call-codes phonebook (read only) • "ON": Own number phone-book (read/write); the content is also shown by +CNUM • "BL": Blacklist phonebook (delete only) • "EN": SIM/USIM (or MT) emergency number • "DC": MT dialed calls list (the +CPBW AT command may not be applicable for this storage) • "MC": missed call list from NV • "ME": ME phonebook • "RC": received call list from NV For the values allowed by each module series, see Table 11.
<password>	String	PIN2-code required when selecting PIN2-code locked <storage>s above (e.g. "FD"), if the PIN2 is applicable
<used>	Number	Indicates the number of used locations in selected memory
<total>	Number	Indicates the total number of locations in selected memory

10.1.4 Notes

Module series	"SM"	"AP"	"FD"	"LD"	"BN"	"SN"	"EC"	"ON"	"BL"	"EN"	"DC"	"MC"	"ME"	"RC"
LARA-R6	•									•	•	•	•	•

Table 11: Phonebook memory storage (<storage>) allowed values

- <storage>="SM" and <storage>="AP" definitions from 3GPP TS 27.007 [70]:
  - "SM": SIM/UICC phonebook. In the currently selected card slot, if a SIM card is present or if a UICC with an active GSM application is present, the EF_{ADN} under $DF_{Telecom}$ is selected. If a UICC with an active USIM application is present, the global phonebook, $DF_{PHONEBOOK}$ under $DF_{Telecom}$ is selected.
  - "AP": selected application phonebook. In the currently selected card slot, if a UICC with an active USIM application is present, the application phonebook, $DF_{PHONEBOOK}$ under ADF_{USIM} is selected.

LARA-R6

- By default "ME" storage is selected.

10.2 Read phonebook entries +CPBR

+CPBR						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 35 s	+CME Error

10.2.1 Description

Returns phonebook entries in location number range <index1> ... <index2> from the current phonebook memory storage selected with +CPBS. If <index2> is left out, only location <index1> is returned. Entry fields returned are:

- location number <indexn>
- phone number stored there <number> of format <type>
- text <text> associated with the number
- <group> indicating a group the entry may belong to (if the selected phonebook supports it)
- <adnumber> an additional number (of format <adtype>) (if the selected phonebook supports it)
- <secondtext> a second text field associated with the number (if the selected phonebook supports it)
- <email> an email field (if the selected phonebook supports it)

No text lines are returned for empty (but available) locations.

If the set command is issued to retrieve an entry with an empty <number> from the phonebook:

- LARA-R6 - the entry is returned and the displayed <type> is always 129.

10.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPBR=<index1>[,<index2>]	[+CPBR: <index1>,<number>, <type>,<text>[,<group>[, <adnumber>[,<adtype>[, <secondtext>[,<email>[,<sip_uri>[, <tel_uri>]]]]] [...] [+CPBR: <index2>,<number>, <type>,<text>[,<group>[, <adnumber>[,<adtype>[, <secondtext>[,<email>[,<sip_uri>[, <tel_uri>]]]]]]] OK	AT+CPBR=1,4 +CPBR: 1,"040123456",129, "RossiCarlo" +CPBR: 2,"040123457",129, "RossiMario" +CPBR: 4,"040123458",129, "RossiGiuseppe" OK
Test	AT+CPBR=?	+CPBR: (list of supported <index>s), <nlength>,<tlength>[,<glength>[, <slength>[,<elength>[,<siplength>[, <tellength>]]]]] OK	+CPBR: (1-100),20,18 OK

10.2.3 Defined values

Parameter	Type	Description
<index1>, <index2>, <index>	Number	Range of location numbers of phonebook memory
<number>	String	Phone number of format <type>
<type>	Number	Type of address octet (see the 3GPP TS 24.008 [79] subclause 10.5.4.7)
<text>	String	Text associated with the phone number of maximum length <tlength>
<group>	String	Group the phonebook entry may belong to, of maximum length <glength>
<adnumber>	String	Additional phone number of format <adtype>
<adtype>	Number	Type of address octet (see the 3GPP TS 24.008 [79] subclause 10.5.4.7)
<secondtext>	String	Second text associated with the number, of maximum length <slength>
<email>	String	Email of maximum length <elength>
<sip_uri>	String	Field of maximum length <siplength>; character set as specified by the +CSCS AT command
<tel_uri>	String	Phone number of maximum length <tellength>; character set as specified by the +CSCS AT command
<nlength>	Number	Maximum length of field <number>
<tlength>	Number	Maximum length of field <text>
<glength>	Number	Maximum length of field <group>
<slength>	Number	Maximum length of field <secondtext>
<elength>	Number	Maximum length of field <email>
<siplength>	Number	Maximum length of field <sip_uri>
<tellength>	Number	Maximum length of field <tel_uri>

10.2.4 Notes

- The <sip_uri>, <tel_uri>, <siplength> and <tellength> parameters are not supported.

10.3 Find phonebook entries +CPBF

+CPBF						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 35 s	+CME Error

10.3.1 Description

Returns the phonebook entries from the current phonebook memory storage (previously selected by +CPBS), whose alphanumeric field <text> starts with string <findtext>.

Entry fields returned are:

- location number <indexn>
- phone number stored there <number> of format <type>
- text <text> associated with the number
- <group> indicating a group the entry may belong to (if the selected phonebook supports it)
- <hidden> indicating if the entry is hidden (if the selected phonebook supports hidden entries)
- <adnumber> an additional number (of format <adtype>) (if the selected phonebook supports it)
- <secondtext> a second text field associated with the number (if the selected phonebook supports it)
- <email> an email field (if the selected phonebook supports it)

☞ The string <findtext> is case sensitive.

10.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPBF=<findtext>	[+CPBF: <index1>,<number>, <type>,<text>[,<hidden>][, <group>[,<adnumber>[,<adtype>[,	AT+CPBF="u-blox" OK

Type	Syntax	Response	Example
		<secondtext>[,<email>[,<sip_uri>[,<tel_uri>]]]]]]] [...] [+CPBF: <index2>,<number>,<type>,<text>[,<hidden>][,<group>[,<adnumber>[,<adtype>[,<secondtext>[,<email>[,<sip_uri>[,<tel_uri>]]]]]]]] OK	
Test	AT+CPBF=?	+CPBF: [<nlength>],[<tlength>][,<glength>[,<slength>[,<elength>[,<siplength>[,<tellength>]]]]] OK	+CPBF: 40,18 OK

10.3.3 Defined values

Parameter	Type	Description
<index1>, <index2>, <index>	Number	Location numbers of phonebook memory
<number>	String	Phone number of format <type>
<type>	Number	Type of address octet (see the 3GPP TS 24.008 [79] subclause 10.5.4.7)
<findtext>,<text>	String	Maximum length <tlength>
<group>	String	Group the phonebook entry may belong to, of maximum length <glength>
<hidden>	Number	Indicates if the entry is hidden or not: • 0 (default value): phonebook entry not hidden • 1: phonebook entry hidden
<adnumber>	String	Additional phone number of format <adtype>
<adtype>	Number	Type of address octet (see the 3GPP TS 24.008 [79] subclause 10.5.4.7)
<secondtext>	String	Second text associated with the number, of maximum length <slength>
<email>	String	Email of maximum length <elength>
<sip_uri>	String	Field of maximum length <siplength>; character set as specified by the +CSCS AT command
<tel_uri>	String	Phone number of maximum length <tellength>; character set as specified by the +CSCS AT command
<nlength>	Number	Maximum length of field <number>
<tlength>	Number	Maximum length of field <text>
<glength>	Number	Maximum length of field <group>
<slength>	Number	Maximum length of field <secondtext>
<elength>	Number	Maximum length of field <email>
<siplength>	Number	Maximum length of field <sip_uri>
<tellength>	Number	Maximum length of field <tel_uri>

10.3.4 Notes

- The <sip_uri>, <tel_uri>, <siplength> and <tellength> parameters are not supported.
- The <hidden> parameter is not applicable, since "AP" phonebook is not supported by +CPBS command (see the 3GPP TS 27.007 [70]).

10.4 Write phonebook entry +CPBW

+CPBW						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 35 s	+CME Error

10.4.1 Description

Stores the phonebook entry in the current phonebook memory storage (selectable with the +CPBS AT command) at the location specified by the <index> field. Other entry fields are:

- the phone number <number> (in the <type> format)
- <text> text associated with the number
- <group> indicating a group the entry may belong to
- <adnumber> an additional number (of format <adtype>)
- <secondtext> a second text field associated with the number
- <email> an email field

If all the fields are omitted, except for <index>, the corresponding phonebook entry is deleted. If the <index> field is left out, but the <number> is given, the entry is written in the first free location in the current phonebook memory storage.

If no phonebook entries are available the information text response of the test command will be +CPBW: 0 <CR><LF>OK

LARA-R6
When trying to add an entry in the SM storage, if the entry includes one or more parameters for which there is no space available in the SIM, the entry will not be stored and an error result code will be returned.

If the <number> and the <type> parameters are omitted but the <index> and at least one other parameter is provided (e.g. <AT+CPBW=<index>,,,<text>):

- LARA-R6 - an entry with no number and <type>=129 is stored in the phonebook. Providing an empty string "" instead of omitting the <number> parameter is equivalent.

<group>, <adnumber>, <adtype>, <secondtext>, <email> parameters are not supported by 2G SIM; but they could be supported by USIM. Not all the fields are always supported on the used USIM: to verify which fields are supported see the test command.

When BL (blacklist) phonebook is selected, only <index>=0 is accepted.

The set command is not applicable for the storages "SN", "EC" (read only storages), while it is applicable to "LD" storage only to delete an item.

10.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPBW=[<index>][,<number>[,<type>[,<text>[,<group>[,<adnumber>[,<adtype>[,<secondtext>[,<email>[,<sip_uri>[,<tel_uri>[,<hidden>]]]]]]]]]]	[+CPBW: <written_index>] OK	AT+CPBW=5,"091137880",,"u-blox" OK
			AT+CPBW=,"091137880",,"u-blox" +CPBW: 5 OK
Read	AT+CPBW?	+CPBW: <written_index> OK	+CPBW: 1 OK
Test	AT+CPBW=?	+CPBW: (list of supported <index>s),<nlength>,(list of supported <type>s),<tlength>[,<glength>[,<slength>[,<elength>[,<siplength>[,<tellength>]]]]] OK	+CPBW: (1-250),40,(129,145),18 OK
		+CPBW: 0 OK	+CPBW: 0 OK

10.4.3 Defined values

Parameter	Type	Description
<index>	Number	Location numbers of phonebook memory
<number>	String	Phone number of format <type>
<type>	Number	Type of address; default is 145 when dialling string includes '+', otherwise 129
<text>	String	Text associated with the number. The maximum length is <tlength>
<group>	String	Group the phonebook entry may belong to, of maximum length <glength>
<adnumber>	String	Additional phone number of format <adtype>
<adtype>	Number	Type of address; default is 145 when dialling string includes '+', otherwise 129
<secondtext>	String	Second text associated with the number, of maximum length <slength>
<email>	String	Email of maximum length <elength>
<hidden>	Number	Indicates if the entry is hidden or not: • 0 (default value): phonebook entry not hidden • 1: phonebook entry hidden
<sip_uri>	String	Field of maximum length <siplength>; character set as specified by the +CSCS AT command
<tel_uri>	String	Phone number of maximum length <tellength>; character set as specified by the +CSCS AT command
<nlength>	Number	Maximum length of field <number>
<tlength>	Number	Maximum length of field <text>
<glength>	Number	Maximum length of field <group>
<slength>	Number	Maximum length of field <secondtext>
<elength>	Number	Maximum length of field <email>
<siplength>	Number	Maximum length of field <sip_uri>
<tellength>	Number	Maximum length of field <tel_uri>
<written_index>	Number	Last location number <index> of the written phonebook entry

10.4.4 Notes

- The <sip_uri>, <tel_uri>, <siplength> and <tellength> parameters are not supported.
- The <hidden> parameter is not applicable, since "AP" phonebook is not supported by +CPBS AT command (see the 3GPP TS 27.007 [70]).

11 Short Messages Service

11.1 Introduction

For a complete overview of SMS, see 3GPP TS 23.040 [75] and 3GPP TS 27.005 [81].

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

11.1.1 Class 0 SMS

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

- LARA-R6 - all incoming SMSes stored in <mem3> (preferred memory for storing the received SMS, see +CPMS) with increasing index.

11.1.2 <index> parameter range

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

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

- LARA-R6
  - Values between 0 and 255: SMS stored in ME.
  - Values between 0 and n-1: SMS stored in SIM (n is the number of records of the EF_{SMS} file in the SIM card used).
  - MT storage is not supported.

BM (Broadcast Message):

- LARA-R6 - Broadcast Message storage is not supported.

SR (Status Report):

- LARA-R6 - values between 0 and m-1: Status Report messages stored in the SIM (m is the number of records of the EF_{SMSR} file in the SIM card). A Status Report message is stored in EF_{SMSR} file if, and only if, the EF_{SMSR} file is present on the SIM card and the MO SMS that requested the report is still present in EF_{SMS}. In case the MO SMS is not present in EF_{SMS}, and the <ds> parameter of the +CNMI AT command is set to 2, the URC indication corresponding to an incoming Status Report will always be **+CDSI: "SR",x** but **x** will indicate the position in memory (RAM) where it has been temporarily stored. This memory cannot be recalled for actually reading the Status Reports stored in it, but it is only used to report their reception.

11.1.3 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.

11.2 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

11.2.1 Description

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

11.2.2 Syntax

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

11.2.3 Defined values

Parameter	Type	Description
<service>	Number	Allowed values: • 0: see 3GPP TS 23.040 [75] and 3GPP TS 23.041 [76]; syntax of AT commands is compatible with 3GPP TS 27.005 [81] phase 2; phase 2+ features may be supported if no new command syntax is required • 1: see 3GPP TS 23.040 [75] and 3GPP TS 23.041 [76]; syntax of AT commands is compatible with 3GPP TS 27.005 [81] 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

11.2.4 Notes

LARA-R6

- To activate correctly the manual acknowledge (see +CNMA AT command), set <service> to 1 before changing the settings of the +CNMI AT command to route the messages directly to TE.
- 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.

11.3 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

11.3.1 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.

11.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPMS=<mem1>[,<mem2>[,<mem3>]]	AT+CPMS: <used1>,<total1>,<used2>,<total2>,<used3>,<total3> OK	AT+CPMS="BM","SM","SM" +CPMS: 0,5,0,50,0,50 OK
Read	AT+CPMS?	+CPMS: <mem1>,<used1>,<total1>,<mem2>,<used2>,<total2>,<mem3>,<used3>,<total3> OK	+CPMS: "MT",4,350,"MT",4,350,"MT",4,350 OK
Test	AT+CPMS=?	+CPMS: (list of supported <mem1>s),(list of supported <mem2>s),(list of supported <mem3>s) OK	+CPMS: ("MT","ME","SM","BM","SR"),("MT","ME","SM"),("MT","ME","SM") OK

11.3.3 Defined values

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

11.3.4 Notes

- LARA-R6 - the factory-programmed value is "ME", "ME" and "ME".

LARA-R6

- "MT" message storage is not supported.

11.4 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

11.4.1 Description

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

11.4.2 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

11.4.3 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

11.4.4 Notes

LARA-R6

- The command setting is not stored in the personal profile.

11.5 Save settings +CSAS

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

11.5.1 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).

11.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSAS[=<profile>]	OK	AT+CSAS OK

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

11.5.3 Defined values

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

11.6 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

11.6.1 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).

11.6.2 Syntax

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

11.6.3 Defined values

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

11.7 Show text mode parameters +CSDH

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

11.7.1 Description

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

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

11.7.2 Syntax

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

Type	Syntax	Response	Example
		OK	OK

11.7.3 Defined values

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

11.8 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

11.8.1 Description

Selects the procedure to indicate the reception of a new SMS if the MT is active (the DTR signal is ON). If the MT is inactive (the DTR signal is OFF), the message reception should be done as specified in 3GPP TS 23.038 [74].

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).

11.8.2 Syntax

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

Type	Syntax	Response	Example
		+CBM: <sn>,<mid>,<dcs>,<page>,<pages><CR><LF><data>	The quick brown fox jumps over the lazy dog 0123456789
		PDU mode (+CMGF=0): +CBM: <length><CR><LF><pdu>	
URC		+CDSI: <mem>,<index>	+CDSI: "MT",2
URC		**Text mode (+CMGF=1):** +CDS: <fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st>	+CDS: 6,202,"+393492323583",145,"14/07/25,13:07:16+02","14/07/25,16:35:44+02",0
		PDU mode (+CMGF=0): +CDS: <length><CR><LF><pdu>	

11.8.3 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

Parameter	Type	Description
<length>	Number	Two meanings: • in text mode: number of characters • in PDU mode: PDU's length in octets without the Service Center's address. In example: 039121430100038166F6000004E374F80D: this is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length>=13.
<pdu>	String	Protocol data unit: each 8-bit octet is presented as two IRA character long hexadecimal numbers, e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)
<oa>	String	Originator address
<scts>	String	Service center time stamp in time-string format, see the <dt>
<data>	String	In the case of SMS: 3GPP TS 23.040 [75] TP-User-Data in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [74] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS command in 3GPP TS 27.007 [70]): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [76] CBM Content of Message in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [74] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS in 3GPP TS 27.007 [70]): 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 [76]
<pages>	Number	CBM Page Parameter bits 0-3 in integer format as described in 3GPP TS 23.041 [76]
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [75])
<mr>	Number	Message reference
<ra>	String	Recipient address field
<tora>	Number	Type of address of <ra> - octet
<dt>	String	Discharge time in format "yy/MM/dd,hh:mm:ss+zz"; the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<st>	Number	Status of a SMS STATUS-REPORT
<message_id>	Number	Message-ID of the 3GPP2 SMS
<priority>	Number	3GPP2 priority: • 0: normal • 1: interactive • 2: urgent • 3: emergency
<privacy>	Number	3GPP2 privacy: • 0: not restricted • 1: restrictive • 2: confidential • 3: secret
<callback_number>	String	Callback number
<encoding>	Number	Text encoding: • 0: octet, unspecified

Parameter	Type	Description
		• 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

11.8.4 Notes

LARA-R6

- The command setting is not stored in the personal profile.
- <mode> = 3 is not supported.
- MT 3GPP2 SMS are not saved, they can only be displayed by +UCMT URC.
- The +UCMT URC is enabled only if <mode>=1 and <mt>=2
- The +UCMT URC parameters <priority>,<privacy>,<callback_number>,<encoding>,<status>,<num_sms>,<part>,<reference> are not supported.
- The <ds> parameter can be set to 1 only if <mode>=1.
- The <mt> parameter can be set to 2 or 3 only if <mode>=1. If <mode>=2 or 3, then the <mt> parameter can only be 0 or 1.
- <bm> = 1 and <bm> = 3 are not supported.

11.9 Select service for MO SMS messages +CGSMS

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

11.9.1 Description

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

In particular:

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

11.9.2 Syntax

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

11.9.3 Defined values

Parameter	Type	Description
<service>	Number	Service or service preference to be used:

Parameter	Type	Description
		• 0 (default value): PS • 1 (factory-programmed value): CS • 2: PS preferred (use CS if PS is not available) • 3: CS preferred (use PS if CS is not available)

11.10 Read message +CMGR

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

11.10.1 Description

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

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

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

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

11.10.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGR=<index>	**SMS-DELIVER** +CMGR: <stat>,<oa>,[<alpha>],<scts>[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>] <data> OK	AT+CMGR=303 +CMGR: "REC READ","+393488535999",,"07/04/05,18:02:28+08",145,4,0,0,"+393492000466",145,93 You have a missed called. Free information provided by your operator. OK
		SMS-SUBMIT +CMGR: <stat>,<da>,[<alpha>][,<toda>,<fo>,<pid>,<dcs>,[<vp>],<sca>,<tosca>,<length>] <data> OK	
		SMS-STATUS-report +CMGR: <stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> OK	
		SMS-COMMAND +CMGR: <stat>,<fo>,<ct>[,<pid>,[<mn>],[<da>],[<toda>],<length> [<cdata>]] OK	
		CBM storage +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 0791934329002000040C919323098266140000807 0

Type	Syntax	Response	Example
			328045218018D4F29CFE0 6B5CBF379F87C4EBF41E4340 82E7FDBC3 OK
Test	AT+CMGR=?	OK	

11.10.3 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 [79]. 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 [75])
<pid>	Number	TP-Protocol-Identifier (default 0); see the 3GPP TS 23.040 [75]
<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 [79]); default 145 when string includes '+', otherwise default 129
<length>	Number	Two meanings: • in text mode: number of characters • in PDU mode: PDU's length in octets without the Service Center's address. In example 0391214301000381 66F6000004E374F80D: this is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length> = 13.
<data>	String	In the case of SMS: 3GPP TS 23.040 [75] TP-User-Data in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [74] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see +CSCS command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [76] CBM Content of Message in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [74] 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 [75]

Parameter	Type	Description	
		<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 [75]); 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 [75] 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 [76] CBM Page Parameter bits 4-7 in integer format	
<pages>	Number	3GPP TS 23.041 [76] 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)	

11.10.4 Notes

LARA-R6

- The <stat> parameter is blank in **SMS-STATUS-report** displaying case.

11.11 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

11.11.1 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 [80] to the network. The MT shall automatically disable routing to the TE by setting both <mt> and <ds> values of +CNMI to zero. If the command is executed, but no acknowledgement is expected, or some other MT related error occurs, the +CMS ERROR: <err> error result code is returned.

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

LARA-R6
The "+CMS ERROR: no +CNMA acknowledgement expected" error result code is issued upon expiry of TR2M timer.

11.11.2 Syntax

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

11.11.3 Defined values

Parameter	Type	Description
<n>	Number	Allowed values: • 0: the command operates similarly as defined for the text mode • 1: sends RP-ACK (or buffered result code received correctly) • 2: sends RP-ERROR (if PDU is not given, ME/TA shall send SMS-DELIVER-REPORT with 3GPP TS 23.040 [75] TP-FCS value set to 'FF' (unspecified error cause))
<length>	Number	PDU's length in octets without the Service Center's address

11.12 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

11.12.1 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".

11.12.2 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>[...]]	

Type	Syntax	Response	Example
		OK	
		Command successful and SMS-STATUS-REPORTs: +CMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> [+CMGL: <index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st> [...]] OK	
		Command successful and SMS-COMMANDs: +CMGL: <index>,<stat>,<fo>,<ct> [+CMGL: <index>,<stat>,<fo>,<ct>[...]] OK	
		Command successful and CBM storage: +CMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages><data> [+CMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages>,<data>[...]] OK	
	PDU mode (+CMGF=0): AT+CMGL[=<stat>]	**Command successful:** +CMGL: <index>,<stat>,[<alpha>],<length> <pdu> [+CMGL: <index>,<stat>,[<alpha>],<length>] <pdu> [...]	AT+CMGL=1 +CMGL: 305,1,,57 079193432900 1185440ED0D637396C7EBBCB0 000909092708024802A050 003000303DEA0584CE60 205D974791994769BDF3A90 DB759687E9F534FD0DA2C9603419 OK
Test	AT+CMGL=?	+CMGL: (list of supported <stat>s) OK	+CMGL: ("REC UNREAD","REC READ","STO UNSENT","STO SENT","ALL") OK

11.12.3 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 [79]. The parameter is not managed.
<scts>	String	Service center time stamp in time-string format; see the <dt> parameter
<tooa>	Number	Type of address of <oa> - octet
<length>	Number	Two meanings: • in text mode: number of characters • in PDU mode: PDU's length in octets without the Service Center's address. In example 039121430100038166F6000004E374F80D: this is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length> = 13.

Parameter	Type	Description
<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 [75]; format: • if DCS indicates that 3GPP TS 23.038 [74] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if DCS indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [76] CBM Content of Message in text mode responses; format: • if DCS indicates that 3GPP TS 23.038 [74] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number if DCS indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [75])
<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 [76] CBM Page Parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [76] 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

11.12.4 Notes

LARA-R6

- When parameter <stat> is omitted, the default value will be 0 (if PDU mode is active) or "REC UNREAD" (if text mode is active).
- The <stat> parameter is blank in **SMS-STATUS-report** displaying case.

11.13 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

11.13.1 Description

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

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

11.13.2 Syntax

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

11.13.3 Defined values

Parameter	Type	Description
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<text>	String	SMS String
<mr>	Number	Message reference
<length>	Number	Two meanings: • in text mode: number of characters • in PDU mode: PDU's length in octets without the Service Center's address. In example 0391214301000381 66F6000004E374F80D: is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length>=13.
<PDU>	String	Protocol Data Unit: each 8-bit octet of the PDU must be written as two IRA character long hexadecimal numbers, e.g. octet with integer value 42 must be written as two characters 2A (IRA 50 and 65)
<ackpdu>	String	See the 3GPP TS 23.040 [75] RP-User-Data element of RP-ACK PDU; the format is same as for <PDU> in case of SMS

11.13.4 Notes

LARA-R6

- The <ackpdu> parameter is not supported.

11.14 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

11.14.1 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.

11.14.2 Syntax

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

11.14.3 Defined values

Parameter	Type	Description
<da>	String	TP-Destination-Address Address-Value field (see the 3GPP TS 23.040 [75]); 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 [75]); 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 [80]); see the <toda> parameter for the default value
<toda>	Number	TP-Destination-Address Type-of-Address octet (see the 3GPP TS 24.011 [80]); when the first character of <da> is + (IRA 43) the default value is 145, otherwise it is 129)
<stat>	Number or String	Number type in PDU mode (default value: 2), or string type in text mode (default value: "STO UNSENT"); it indicates the message status in memory: • 0: in PDU mode or "REC UNREAD" in text mode: received unread SMS messages • 1: in PDU mode or "REC READ" in text mode: received read SMS messages • 2: in PDU mode or "STO UNSENT" in text mode: stored unsent SMS messages • 3: in PDU mode or "STO SENT" in text mode: stored sent SMS messages
<text>	String	SMS string
<index>	Number	Storage position
<length>	Number	The parameter meaning depends on the message format: • In text mode: number of characters • In PDU mode: PDU's length in octets without the Service Center's address. In example: 039121430100038166F6000004E374F80D is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length>=13.

Parameter	Type	Description
<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)

11.15 Send message from storage +CMSS

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

11.15.1 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.

11.15.2 Syntax

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

11.15.3 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

11.16 Set text mode parameters +CSMP

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

11.16.1 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 [74] and the 3GPP TS 23.040 [75].

11.16.2 Syntax

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

Type	Syntax	Response	Example
Test	AT+CSMP=?	OK	

11.16.3 Defined values

Parameter	Type	Description
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [75])
<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 [75]

<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 [75]); 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 [75]
<dcs>	Number	Data Coding Scheme. The default value is 0

11.17 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

11.17.1 Description

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

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

LARA-R6
When deleting a message from an empty location, the module returns the "+CMS ERROR: Invalid memory index" error result code.

11.17.2 Syntax

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

11.17.3 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

11.18 Service center address +CSCA

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

11.18.1 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.

LARA-R6
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.

11.18.2 Syntax

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

11.18.3 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 [79]); the default value is 145 when string includes '+', otherwise the default is 129.

11.19 Select cell broadcast message types +CSCB

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

11.19.1 Description

Selects which types of CBM's are to be received by the MT.

11.19.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSCB=[<mode>[,<mids>[,<dcss>]]]	OK	AT+CSCB=0,"1,5,10-11,40","" OK
Read	AT+CSCB?	+CSCB: <mode>,<mids>,<dcss> OK	+CSCB: 0,"",""" OK
Test	AT+CSCB=?	+CSCB: (list of supported <mode>s) OK	+CSCB: (0-1) OK

11.19.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 0 (default value and factory-programmed value): message types specified in <mids> and <dcss> accepted • 1: message types specified in <mids> and <dcss> not accepted
<mids>	String	Contains all possible combinations of CBM message identifiers (<mid>). See the 3GPP TS 23.041 [76], chapter 9.4. When RAT is UMTS up to 2048 message identifiers can be set; defining an exceeding combination will not cause an error result code and exceeding values will be ignored.
<dcss>	String	Contains all possible combinations of CBM data coding schemes (<dcs>). See the 3GPP TS 23.038 [74], chapter 5.

11.19.4 Notes

- If <mode>=0 and <mids> is an empty string, receiving of CB SMS is stopped.

LARA-R6

- The <mode> parameter is mandatory in the set command.

11.20 Read concatenated message +UCMGR

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

11.20.1 Description

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

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

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

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

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

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

11.20.2 Syntax

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

11.20.3 Defined values

Parameter	Type	Description
<index>	Number	Storage position
<stat>	String	Indicates the status of message in memory: • "REC UNREAD": received unread SMS • "REC READ": received read SMS • "STO UNSENT": stored unsent SMS • "STO SENT": stored sent SMS
<oa>	String	Originator address
<alpha>	String	Alphanumeric representation of <da> or <oa> corresponding to the entry found in the phonebook 3GPP TS 24.008 [79]. The parameter is not managed.
<scts>	String	Service center time stamp in time-string format, refer to <dt>
<tooa>	Number	Type of address of <oa> - octet
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [75])
<pid>	Number	TP-Protocol-Identifier (default 0); see 3GPP TS 23.040 [75]
<dcs>	Number	Data Coding Scheme
<sca>	String	Service center address field
<tosca>	Number	Type of address of <sca> - octet in Number format (for more details see 3GPP TS 24.008 [79]); default 145 when string includes '+', otherwise default 129
<length>	Number	Number of characters
<seq>	Number	Sequence number of the current short message (1-255)
<max>	Number	Maximum number of short messages in the concatenated short message (1-255)
<iei>	Number	Information Element Identifier, the possible values are the following: • 0: Concatenated short messages, 8-bit reference number

Parameter	Type	Description
		• 8: Concatenated short messages, 16-bit reference number
<ref>	Number	Concatenated short message reference number: • 0-255: concatenated short messages, 8-bit reference number case • 0-65535: concatenated short messages, 16-bit reference number case
<data>	String	In the case of SMS: 3GPP TS 23.040 [75] TP-User-Data in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [74] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of 3GPP TS 27.005 [81] Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [76] CBM Content of Message in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [74] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of 3GPP TS 27.005 [81] Annex A o if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet
<vp>	Number	Format depending of the <fo> setting: • Relative format: validity period starting from when the SMS is received by the SMSC, in range 0-255 (default value 167); for more details see 3GPP TS 23.040 [75] • Absolute format: absolute time of the validity period termination in string format ("yy/MM/dd,hh:mm:ss+zz") (refer to 3GPP TS 23.040 [75]); the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<mr>	Number	Message reference
<ra>	String	Recipient address field
<tora>	Number	Type of address of <ra> - octet
<scts>	String	Service center time stamp in time-string format, refer to <dt>
<dt>	String	Discharge time in format "yy/MM/dd,hh:mm:ss+zz"; the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56
<st>	Number	Status of an SMS STATUS-REPORT
<ct>	Number	TP-Command-Type (default 0)
<mn>	Number	3GPP TS 23.040 [75] TP-Message-Number in integer format
<mid>	Number	CBM message identifier
<cdata>	String	TP-Command-Data in text mode responses
<sn>	Number	CBM serial number
<page>	Number	3GPP TS 23.041 [76] CBM page parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [76] CBM page parameter bits 0-3 in integer format

<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

11.20.4 Notes

LARA-R6

- The <stat> parameter is blank in **SMS-STATUS-report** displaying case.

11.21 List concatenated message +UCMGL

+UCMGL						
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

11.21.1 Description

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

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

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

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

11.21.2 Syntax

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

Type	Syntax	Response	Example
		CBM storage: +UCMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages><data> [+UCMGL: <index>,<stat>,<sn>,<mid>,<page>,<pages>,<data>[...]] OK	
Test	AT+UCMGL=?	+UCMGL: (list of supported <stat>s) OK	+UCMGL: ("REC UNREAD","REC READ","STO UNSENT","STO SENT", "ALL ") OK

11.21.3 Defined values

Parameter	Type	Description
<stat>	String	Indicates the status of message in memory: • "REC UNREAD": received unread SMS messages • "REC READ": received read SMS messages • "STO UNSENT": stored unsent SMS messages • "STO SENT": stored sent SMS messages • "ALL": all SMS messages (default value)
<index>	Number	Storage position
<oa>	String	Originator address
<alpha>	String	Alphanumeric representation of <da> or <oa> corresponding to the entry found in the phonebook 3GPP TS 24.008 [79]. The parameter is not managed.
<scts>	String	Service center time stamp in time-string format; refer to <dt>
<tooa>	Number	Type of address of <oa> - octet
<length>	Number	Number of characters
<seq>	Number	Sequence number of the current short message (1-255)
<max>	Number	Maximum number of short messages in the concatenated short message (1-255)
<iei>	Number	Information Element Identifier, the possible values are the following: • 0: concatenated short messages, 8-bit reference number • 8: concatenated short messages, 16-bit reference number
<ref>	Number	Concatenated short message reference number: • 0-255: concatenated short messages, 8-bit reference number case • 0-65535: concatenated short messages, 16-bit reference number case
<data>	String	In the case of SMS: 3GPP TS 23.040 [75] TP-User-Data in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [74] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of 3GPP TS 27.005 Annex A [81] o if TE character set is "HEX": ME/TA converts each 7-bit character of GSM 7 bit default alphabet into two IRA character long hexadecimal number (e.g. character Æ (GSM 7 bit default alphabet 28) is presented as 1C (IRA 49 and 67)) • if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number (e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65)) In the case of CBS: 3GPP TS 23.041 [76] CBM Content of Message in text mode responses; format: • if <dcs> indicates that 3GPP TS 23.038 [74] GSM 7 bit default alphabet is used: o if TE character set other than "HEX" (see the +CSCS AT command description): ME/TA converts GSM alphabet into current TE character set according to rules of 3GPP TS 27.005 [81] Annex A • if TE character set is "HEX": ME/TA converts each 7-bit character of the GSM 7 bit default alphabet into two IRA character long hexadecimal number if <dcs> indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number
<da>	String	Destination address

Parameter	Type	Description
<toda>	Number	Type of address of <da> - octet
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [75])
<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 [76] CBM Page Parameter bits 4-7 in integer format
<pages>	Number	3GPP TS 23.041 [76] CBM Page Parameter bits 0-3 in integer format
<dcs>	Number	Data Coding Scheme

11.21.4 Notes

LARA-R6

- When parameter <stat> is omitted, the default value will be 0 (if PDU mode is active) or "REC UNREAD" (if text mode is active).
- The <stat> parameter is blank in **SMS-STATUS-report** displaying case.

11.22 Send concatenated message +UCMGS

+UCMGS						
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

11.22.1 Description

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

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

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

11.22.2 Syntax

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

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

11.22.3 Defined values

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

11.23 Write concatenated message to memory +UCMGW

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

11.23.1 Description

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

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

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

11.23.2 Syntax

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

11.23.3 Defined values

Parameter	Type	Description
<da>	String	3GPP TS 23.040 [75] TP-Destination-Address Address-Value field in string format; BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters of the currently selected TE character set (refer command +CSCS in 3GPP TS 27.007 [70]; type of address given by <toda>
<oa>	String	3GPP TS 23.040 [75] TP-Originating-Address Address-Value field in string format; BCD numbers (or GSM 7 bit default alphabet characters) are converted to characters of the currently selected TE character set (refer command +CSCS chapter Chapter 4.10); type of address given by <tooa>
<tooa>	Number	3GPP TS 24.011 [80] TP-Originating-Address Type-of-Address octet in integer format (default refer <toda>)
<toda>	Number	3GPP TS 24.011 [80] TP-Destination-Address Type-of-Address octet in integer format (when first character of <da> is + (IRA 43) default is 145, otherwise default is 129)
<stat>	String	Indicates the status of message in memory: • "REC UNREAD": received unread SMS messages • "REC READ": received read SMS messages • "STO UNSENT": stored unsent SMS messages • "STO SENT": stored sent SMS messages (default value)
<seq>	Number	Sequence number of the current short message (1-255)
<max>	Number	Maximum number of short messages in the concatenated short message (1-255)
<iei>	Number	Information Element Identifier, the possible values are the following: • 0: Concatenated short messages, 8-bit reference number • 8: Concatenated short messages, 16-bit reference number
<ref>	Number	Concatenated short message reference number: • 0-255: Concatenated short messages, 8-bit reference number case • 0-65535: Concatenated short messages, 16-bit reference number case
<text>	String	SMS String
<index>	Number	Storage position

11.24 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

11.24.1 Description

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

11.24.2 Syntax

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

11.24.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 0 (default value): disabled

Parameter	Type	Description
		• 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

11.24.4 Notes

LARA-R6

- The <mode> parameter is mandatory in the set command.

11.25 Peek message +UCMGP

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

11.25.1 Description

Returns the message with location value <index> from message storage <mem1> to the DTE, the same as +CMGR does.

The SMS message is only 'peeked', i.e. its status is not forced to "received read SMS mode" after reading.

The syntax, defined values and remarks are the same as described for +CMGR.

☞ The PIN verification is not required when the preferred memory storage is "ME".

11.25.2 Syntax

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

Type	Syntax	Response	Example
		OK	
	PDU mode (+CMGF=0): AT+UCMGP=<index>	+UCMGP: <stat>,[<alpha>],<length> <pdu> OK	AT+UCMGP=1 +UCMGP: 0,,40 07919343290020000 40C9193230982 66140000807032804521801 8D4F29CF E06B5CBF379F87C4EBF41E434082E7F DBC3 OK
Test	AT+UCMGP=?	OK	

11.25.3 Defined values

Parameter	Type	Description
<index>	Number	Storage position

11.25.4 Notes

LARA-R6

- The <stat> parameter is blank in **SMS-STATUS-report** displaying case.

11.26 Send SMS command +CMGC

+CMGC						
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

11.26.1 Description

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

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

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

11.26.2 Syntax

Type	Syntax	Response	Example
Set	**Text mode (+CMGF=1):** AT+CMGC=<fo>,<ct>[,<pid>[,<mn>[,<da>[,<toda>]]]]<CR> > text is entered<Ctrl-Z/ESC>	+CMGC: <mr>[,<scts>] OK	AT+CMGC=17,0<CR> > This is the text<Ctrl-Z> +CMGC: 20 OK
	PDU mode (+CMGF=0): AT+CMGC=<length><CR> > <PDU> is given<Ctrl-Z/ESC>	+CMGC: <mr>[,<ackpdu>] OK	AT+CMGC=13<CR> > 0391214301000381 66F6000004E374F80D<Ctrl-Z> +CMGC: 2 OK

Type	Syntax	Response	Example
Test	AT+CMGC=?	OK	
URC		+CMT: [<alpha>], <length><CR><LF><pdu>	

11.26.3 Defined values

Parameter	Type	Description
<mr>	Number	Message reference
<length>	Number	PDU's length in octets without the Service Center's address. In example 039121430 100038166F6000004E374F80D: is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length>=13.
<PDU>	String	Protocol Data Unit: each 8-bit octet of the PDU must be written as two IRA character long hexadecimal numbers, e.g. octet with integer value 42 must be written as two characters 2A (IRA 50 and 65).
<ackpdu>	String	See the 3GPP TS 23.040 [75] RP-User-Data element of RP-ACK PDU; format is same as for <PDU> in case of SMS.
<alpha>	String	Alphanumeric representation of destination or originating address. See the 3GPP TS 27.005 [81].
<fo>	Number	First octet of the SMS TPDU (see 3GPP TS 23.040 [75])
<ct>	Number	TP-Command-Type (default value: 0)
<pid>	Number	TP-Protocol-Identifier (default value: 0); see the 3GPP TS 23.040 [75]
<mn>	Number	See the 3GPP TS 23.040 [75] TP-Message-Number in integer format
<da>	String	Destination address
<toda>	Number	Type of address of <da> - octet

12 Supplementary services

12.1 Introduction

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

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

12.2 Call forwarding +CCFC

+CCFC						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 3 min	+CME Error

12.2.1 Description

Controls the call forwarding supplementary service. Registration, erasure, activation, deactivation and status query are supported.

12.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+CCFC=<reason>,<mode>[,<number>[,<type>[,<class>[,<subaddr>[,<satype>[,<time>]]]]]]	OK or when <mode>=2 +CCFC: <status>,<class1>[,<number>,<type> [,<subaddr>,<satype>[,<time>]]] [+CCFC: <status>,<class2> [,<number>, <type>[,<subaddr>,<satype>[,<time>]]]] OK	**Registration:** AT+CCFC=0,3,"01711234" OK **Query status:** AT+CCFC=2,2 +CCFC: 1,1,"+3945112",145,"",,60 OK
Test	AT+CCFC=?	+CCFC: (list of supported <reason>s) OK	+CCFC: (0-5) OK

12.2.3 Defined values

Parameter	Type	Description
<reason>	Number	• 0: unconditional • 1: mobile busy • 2: no reply • 3: not reachable • 4: all call forwarding • 5: all conditional call forwarding

Parameter	Type	Description
<mode>	Number	• 0: disable • 1: enable • 2: query status • 3: registration • 4: erasure
<number>	String	Phone number of forwarding address in <type> format
<type>	Number	Type of address; default 145 when dialling string includes '+', otherwise 129
<subaddr>	String	Subaddress; parameter currently ignored after syntax check
<satype>	Number	Type of subaddress; default 128 (TON/NPI unknown); parameter currently ignored after syntax check
<classx>	Number	Sum of Numbers each representing a class of information (default 7 - voice (1), data (2) and FAX (4) - or interpreted by network if not explicitly entered): • 1: voice • 2: data • 4: FAX • 8: SMS • 16: data circuit sync • 32: data circuit async • 64: dedicated packet access • 128: dedicated PAD access
<time>	Number	Time in seconds to wait before call is forwarded (default 60), but only when <reason>=2 (no reply) is enabled; the range goes from 5 to 30 s
<status>	Number	• 0: not active • 1: active

12.2.4 Notes

- When querying the status of a network service (<mode>=2) the response line for "not active" case (<status>=0) is returned only if the service is not active for any <class>. Hence when querying the status of a network service (<mode>=2) asking for a specific <class>, the DUT sends a generic request instead.

12.3 Call waiting +CCWA

+CCWA						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	Yes	Up to 3 min	+CME Error

12.3.1 Description

Controls the Call Waiting supplementary service according to 3GPP TS 22.083 [89]. The activation, deactivation and status query are supported. When querying the status of a network service (<mode>=2) the information text response for 'not active' case (<status>=0) should be 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.

It is possible to abort the status query sending a character to the DCE during the command execution. If enabled by <n> a URC is presented on TE when a call is signalled.

12.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+CCWA=[<n>[,<mode>[,<class>]]]	OK	AT+CCWA=1,1,32 OK
	AT+CCWA=[<n>[,<mode>]]	+CCWA: <status>,<class1> [+CCWA: <status>,<class2> [...]] OK	AT+CCWA=1,2 +CCWA: 1,1 +CCWA: 1,4 +CCWA: 1,16

Type	Syntax	Response	Example
			+CCWA: 1,32 OK
Read	AT+CCWA?	+CCWA: <n> OK	+CCWA: 0 OK
Test	AT+CCWA=?	+CCWA: (list of supported <n>s) OK	+CCWA: (0-1) OK
URC		+CCWA: <number>,<type>,<class>,[<alpha>][,<CLI validity>[,<subaddr>,<satype>[,<priority>]]]	+CCWA: "+393290286612",145,1,,0

12.3.3 Defined values

Parameter	Type	Description
<n>	Number	URC configuration: • 0 (default value): disabled • 1: enabled
<mode>	Number	If <mode> is not set, no request is sent to the network: • 0: disabled • 1 (default value): enabled • 2: query status
<classx>	Number	Sum of numbers each representing an information class: • 1: voice • 2: data; it comprises all those <classx> values between 16 and 128, that are supported both by the network and the MS. This means, a setting made for <classx> to 2 applies to all remaining data classes (if supported). In addition, it is possible to assign a different setting to a specific class. For example, call waiting can be deactivated only for a specific data class. To understand which classes were actually activated AT+CCWA=1,2 command should be executed • 4: FAX • 8: SMS • 16: data circuit sync • 32: data circuit async • 64: dedicated packet access • 128: dedicated PAD access If <classx> is not set and <mode> is 0 or 1 the default value is 3 The default value is 255 if <classx> is not set and <mode> is 2 e.g. it reports all active classes if any. If no class is active only classes 1 and 2 are reported as inactive: • +CCWA: 0,1 • +CCWA: 0,2
<status>	Number	Allowed values: • 0: not active • 1: active
<number>	String	Phone number of calling address in format specified by <type>
<type>	Number	Type of address
<alpha>	String	Optional string type alphanumeric representation of <number> corresponding to the entry found in phonebook; this parameter is not managed
<CLI validity>	Number	Allowed values: • 0: CLI valid • 1: CLI has been withheld by the originator • 2: CLI is not available
<subaddr>	String	Subaddress of format specified by <satype>
<satype>	Number	Subaddress octet (see the 3GPP TS 24.008 [79] subclause 10.5.4.8)
<priority>	Number	Optional digit type parameter indicating that the eMLPP priority level of the incoming call. The priority level values are as defined in eMLPP specification 3GPP TS 22.067 [103].

12.3.4 Notes

- The call waiting is not handled in uniform mode among all the networks, even if the 3GPP TS 22.004 [71] describes all needed specification: "The applicability of call waiting refers to the telecommunication service of the active call and not of the waiting call. The incoming, waiting, call may be of any kind." Nevertheless, the actual implementation of the service on the networks is different.
- If a sum class is provided in the <classx> parameter the classes will be activated or deactivated in cardinal order (minimum to maximum). If a class is not supported then the procedure ends and any remaining class is not processed. To check which classes were actually activated AT+CCWA=1,2 command should be done.

LARA-R6

- The <alpha>, <CLI validity>, <subaddr>, <satype>, <priority> parameters are not supported.

12.4 Calling line identification restriction +CLIR

+CLIR						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	NVM	Yes	Up to 3 min (<1 s for prompt ">" when present)	+CME Error

12.4.1 Description

Controls the Calling Line Identification Restriction (CLIR) supplementary service (3GPP TS 22.081 [90]). The CLIR subscription, when the temporary mode is provisioned by the network, is overidden as a default adjustment for all following outgoing calls (3GPP TS 22.081 [90] specifies how the network will act).

12.4.2 Syntax

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

12.4.3 Defined values

Parameter	Type	Description
<n>	Number	Sets the adjustment for outgoing calls: • 0 (factory-programmed value): presentation indicator is used according to the subscription of the CLIR service • 1: CLIR invocation • 2: CLIR suppression
<m>	Number	Shows the subscriber CLIR status in the network: • 0: CLIR not provisioned • 1: CLIR provisioned in permanent mode • 2: unknown • 3: CLIR temporary mode presentation restricted • 4: CLIR temporary mode presentation allowed

12.5 Calling line identification presentation +CLIP

+CLIP						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 3 min (<1 s for prompt ">" when present)	+CME Error

12.5.1 Description

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

12.5.2 Syntax

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

12.5.3 Defined values

Parameter	Type	Description
<n>	Number	Optional parameter sets/shows the result code presentation in the TA: • 0 (default value): disable • 1: enable
<m>	Number	Shows the subscriber CLIP service status in the network • 0: CLIP not provisioned • 1: CLIP provisioned • 2: unknown
<number>	String	Phone number of calling address in format specified by <type>.
<type>	Number	Type of address octet.
<subaddr>	String	Subaddress of format specified by <satype>.
<satype>	Number	Type of subaddress octet.
<alpha>	String	Optional string type alphanumeric representation of <number> corresponding to the entry found in phonebook; the parameter is not managed.
<CLI validity>	Number	• 0: CLI valid • 1: CLI has been withheld by the originator • 2: CLI is not available

12.5.4 Notes

- When CLI is not available (<CLI validity>=2), the <number> parameter shall be an empty string ("") and <type> value will not be significant. Nevertheless, the TA may return the recommended value 128 for <type> (TON/NPI unknown). When CLI has been withheld by the originator, (<CLI validity>=1) and the CLIP is provisioned with the "override category" option (see the 3GPP TS 22.081 [90] and 3GPP TS 23.081 [91]), <number> and <type> is provided. Otherwise, TA shall return the same setting for <number> and <type> as if the CLI was not available.

12.6 Connected line identification presentation +COLP

+COLP						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	< 20 s	+CME Error

12.6.1 Description

Controls the COnnected Line identification Presentation (COLP) supplementary service (see the 3GPP TS 22.081 [90]), useful in case of call forwarding of the connected line. It enables a calling subscriber to get the connected line identity (COL) of the called party, after setting up a mobile originated call. The command enables or disables the presentation of the COL at the TE. It has no effect on the execution of the supplementary service COLR in the network.

When enabled (and called subscriber allows), the IRC is sent from TA to TE before any +CR or V.25ter responses.

The read command provides the <n> status, and also triggers an interrogation of the provision status of the COLP service according 3GPP TS 22.081 [90] (given in <m>).

12.6.2 Syntax

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

12.6.3 Defined values

Parameter	Type	Description
<n>	Number	Optional parameter sets/shows the result code presentation status to the TE: • 0 (default value): disable • 1: enable
<m>	Number	Shows the subscriber COLP status in the network: • 0: COLP not provisioned • 1: COLP provisioned • 2: unknown (e.g. no network, etc.)
<number>, <type>, <subaddr>, <satype>, <alpha>		See +CLIP.

12.7 Advice of charge +CAOC

+CAOC						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 10 s	+CME Error

12.7.1 Description

Allows the subscriber to get the information about the call costs in home units using the advice of charge supplementary service (3GPP TS 22.024 [93] and 3GPP TS 22.086 [92]). If it is enabled, the TE periodically receives the URC containing the corresponding information.

12.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+CAOC[=<mode>]	[+CAOC: <ccm>]	AT+CAOC=0
		OK	OK
Read	AT+CAOC?	+CAOC: <mode>	+CAOC: 1
		OK	OK
Test	AT+CAOC=?	+CAOC: (list of supported <mode>s)	+CAOC: (0-2)
		OK	OK
URC		+CCCM: <ccm>	

12.7.3 Defined values

Parameter	Type	Description
<mode>	Number	• 0: queries the CCM value • 1: deactivates the unsolicited reporting of CCM value • 2: activates the unsolicited reporting of CCM value
<ccm>	Number	Current call meter indicated as a string in hexadecimal format

12.8 Accumulated call meter +CACM

+CACM						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

12.8.1 Description

Resets the advice of charge related accumulated call meter value in the SIM file EF_{ACM}. The ACM contains the total number of home units for both the current and preceding calls. The SIM PIN2 is required to reset the value.

☞ If the EF is not available, the read command returns +CME ERROR: SIM failure (verbose result code).

12.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+CACM=[<passwd>]	OK	AT+CACM="0933"
			OK
Read	AT+CACM?	+CACM: <acm>	+CACM: "000000"
		OK	OK
Test	AT+CACM=?	OK	

12.8.3 Defined values

Parameter	Type	Description
<passwd>	String	SIM PIN2 as string type
<acm>	String	Accumulated call meter value similarly coded as <ccm> under +CAOC

12.8.4 Notes

- The command needs the SIM module to work correctly

12.9 Accumulated call meter maximum +CAMM

+CAMM						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

12.9.1 Description

Sets the advice of charge related accumulated call meter maximum value in the SIM file EF_{ACMmax}. The ACMmax contains the maximum number of home units allowed to be consumed by the subscriber. When the ACM reaches ACMmax, the calls are prohibited. The SIM PIN2 is required to set the value.

☞ If the EF is not available, the read command returns +CME ERROR: SIM failure (verbose result code).

12.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+CAMM=[<acmmax>[,<passwd>]]	OK	AT+CAMM="000300","0933" OK
Read	AT+CAMM?	+CAMM: <acmmax> OK	+CAMM: "000300" OK
Test	AT+CAMM=?	OK	

12.9.3 Defined values

Parameter	Type	Description
<acmmax>	String	Contains the accumulated call meter maximum value similarly coded as <ccm> under +CAOC; value zero disables the ACMmax feature
<passwd>	String	Contains SIM PIN2

12.9.4 Notes

- The command needs the SIM module to work correctly

12.10 Price per unit and currency table +CPUC

+CPUC						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 10 s	+CME Error

12.10.1 Description

Sets the parameters of advice of charge related price per unit and the currency table in the SIM file EF_{PUCT}. The PUCT information can be used to convert the home units into the currency units. The PIN2 is required to set the parameters.

☞ If the EF is not available, the read command returns +CME ERROR: SIM failure (verbose result code).

12.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+CPUC=<currency>,<ppu>[,<passwd>]	OK	AT+CPUC="USD","0.20","0933" OK
Read	AT+CPUC?	+CPUC: <currency>,<ppu> OK	+CPUC: "USD","0.20" OK
Test	AT+CPUC=?	OK	

12.10.3 Defined values

Parameter	Type	Description
<currency>	String	Contains the three-character currency code (e.g. "GBP", "EUR")
<ppu>	String	Contains the price per unit; the dot is used as a decimal separator
<passwd>	String	Contains SIM PIN2

12.11 Call related supplementary services +CHLD

+CHLD						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 20 s	+CME Error

12.11.1 Description

Call hold and multiparty conversation (conference call). The calls can be put on hold, recovered, released or added to the conversation.

The expected response time depends on the number of calls manipulated by the command (the current value refers to the manipulation of one call): in case of poor radio quality, disconnect, hold and retrieve procedures triggered by the command might require several retransmissions at radio level, thus the expected response time shall be extended accordingly.

12.11.2 Syntax

Type	Syntax	Response	Example
Set	AT+CHLD=[<n>]	OK	AT+CHLD=2 OK
Test	AT+CHLD=?	+CHLD: (list of supported <n>s) OK	+CHLD: (0,1,1x,2,2x,3,4,4*,6,7,8) OK

12.11.3 Defined values

Parameter	Type	Description
<n>	Number	• 0: release all the held calls or set User Determined User Busy for a waiting call; if both exists then only the waiting call will be rejected • 1: release all the active calls and accepts the other (held or waiting) • 1x: release a specific call (x specific call number as indicated by +CLCC) • 2: place all the active calls (if exist) on hold and accepts the other call (held or waiting, if exist) • 2x: place all the active calls on hold except the call x with which communication is supported • 3: adds a held call to the conversation • 4: connects the two calls and disconnects the subscriber from both calls (Explicit Call Transfer) • 4*: call deflection (proprietary feature) • 5: call completion of busy subscriber; this command syntax will be interpreted as an activation request, if the network has previously offered the possibility to activate this function • 6: puts an active call on hold or an held call to active • 7: disconnect the users in multiparty without accepting incoming call • 8: release all the calls (active and held)

12.12 Call deflection +CTFR

+CTFR						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	Up to 3 min	+CME Error

12.12.1 Description

Allows the MT user to respond to an incoming call offered by the network by requesting call deflection, i.e. redirection of this call to another number specified in the response. The call deflection is a supplementary service applicable only to voice calls (teleservice 11).

12.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+CTFR=<number>[,<type>[,<subaddr>[,<satype>]]]	OK	AT+CTFR="09113788" OK
Test	AT+CTFR=?	OK	

12.12.3 Defined values

Parameter	Type	Description
<number>	String	Phone number
<type>	Number	Type of address; default 145 when dialling string includes '+', otherwise 129
<subaddr>	String	Subaddress; parameter currently ignored after syntax check
<satype>	Number	Type of subaddress; default 128 (TON/NPI unknown); parameter currently ignored after syntax check

12.13 Supplementary service notifications +CSSN

+CSSN						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

12.13.1 Description

Refers to supplementary service related network initiated notifications. When <n>=1 and a supplementary service notification is received after a mobile originated call setup, the IRC is sent before any other Mobile Originated call setup result codes. When <m>=1 and a supplementary service notification is received during a call, the URC is sent.

12.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+CSSN=[<n>[,<m>]]	OK	AT+CSSN=0,0 OK
Read	AT+CSSN?	+CSSN: <n>,<m> OK	+CSSN: 0,0 OK
Test	AT+CSSN=?	+CSSN: (list of supported <n>s),(list of supported <m>s) OK	+CSSN: (0-1),(0-1) OK
IRC		+CSSI: <code1>[,<index>]	+CSSI: 4,1
URC		+CSSU: <code2>[,<index>[,<number>,<type>[,<subaddr>,<satype>]]]	+CSSU: 0

12.13.3 Defined values

Parameter	Type	Description
<n>	Number	Sets/shows the +CSSI result code presentation status • 0: disabled (default value) • 1: enabled
<m>	Number	Sets/shows the +CSSU result code presentation status • 0: disabled (default value) • 1: enabled
<code1>	Number	• 0: unconditional call forwarding is active • 1: some of the conditional call forwardings are active • 2: call has been forwarded • 3: call is waiting • 4: this is a CUG call (<index> parameter is provided) • 5: outgoing calls are barred • 6: incoming calls are barred • 7: CLIR suppression rejected • 8: calls has been deflected
<index>	Number	Refer +CCUG (Chapter 12.15)
<code2>	Number	• 0: this is a forwarded call (MT call setup) • 1: this is a CUG call (<index> parameter is provided) (MT call setup) • 2: call has been put on hold (during a voice call) • 3: call has been retrieved (during a voice call) • 4: multiparty call entered (during a voice call) • 5: call on hold has been released - this is not an SS notification - (during a voice call) • 6: forward check SS message received (can be received whenever) • 7: call is being connected (alerting) with the remote party in alerting state in explicit call transfer operation (during a voice call) • 8: call has been connected with the other remote party in explicit call transfer operation (during a voice call or MT call setup) • 9: this is a deflected call (MT call setup) • 10: additional incoming call forwarded
<number>	String	Phone number, format specified by <type>
<type>	Number	Type of address octet
<subaddr>, <satype>	String	Not used

12.14 Unstructured supplementary service data +CUSD

+CUSD						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	Yes	Up to 3 min	+CME Error

12.14.1 Description

Control of Unstructured Supplementary Service Data (USSD) is according to 3GPP TS 22.090 [73]. Both network and mobile initiated operations are supported. The parameter <n> disables/enables the URC presentation. Value <n>=2 is used to cancel an ongoing USSD session. When <str> is given, a mobile initiated USSD-string or a response USSD-string to a network initiated operation is sent to the network. The response USSD-string from the network is returned in the URC +CUSD indicated above.

12.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+CUSD=[<n>[,<str>[,<dcs>]]]	[+CUSD: <m>[,<str>,<dcs>]] OK	AT+CUSD=1,"*100#",15 +CUSD: 2,"Residual credit: 7,87 Euro",15 OK

Type	Syntax	Response	Example
Read	AT+CUSD?	+CUSD: <n>	+CUSD: 0
		OK	OK
Test	AT+CUSD=?	+CUSD: (list of supported <n>s)	+CUSD: (0-2)
		OK	OK
URC		+CUSD: <m>[,<str>,<dcs>]	

12.14.3 Defined values

Parameter	Type	Description
<n>	Number	• 0 (default value): result code presentation disabled • 1: result code presentation enabled • 2: session cancelled (not applicable to the read command response)
<str>	String	USSD-string converted in the current character set in use (see the +CSCS command)
<dcs>	Number	Data coding scheme (see 3GPP TS 23.038 [74]) used for sending the USSD string. 1 byte in decimal format; valid values are 0-255. The default value is 15.
<m>	Number	• 0: no further user action required • 1: further user action required • 2: USSD termination by network • 4: operation not supported • 5: network time out

12.14.4 Notes

- Aborting the command is equivalent to send AT+CUSD=2, that ends the current USSD session.
- When issuing a set command with <n>=1, the module waits for SS transaction to finish before issuing the final result code (e.g. "OK").
- After having sent a +CUSD request, it is recommended to refrain from sending another +CUSD request until the URC of the first one has been received.

12.15 Closed user group +CCUG

+CCUG						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	No	No	-	+CME Error

12.15.1 Description

Enables subscribers to form closed user groups to and from which access is restricted (refer to 3GPP TS 22.085 [38]). The command can be used to:

- Activate/deactivate the control of the CUG information for all following calls
- Select a CUG index
- Suppress the outgoing access (OA). The OA allows a member of a CUG to place calls outside the CUG
- Suppress the preferential CUG

12.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+CCUG=[<n>[,<index>[,<info>]]]	OK	AT+CCUG=1,2,1
			OK
Read	AT+CCUG?	+CCUG: <n>,<index>,<info>	+CCUG: 0,0,0
		OK	OK
Test	AT+CCUG=?	[+CCUG: (list of supported <n>s), (list of supported <index>s),(list of supported <info>s)]	+CCUG: (0-1),(0-10),(0-3)
			OK
		OK	

12.15.3 Defined values

Parameter	Type	Description
<n>	Number	Allowed values: • 0 (default value): CUG temporary disabled • 1: CUG temporary enabled
<index>	Number	Allowed values: • 0..9: CUG index, (0 default value) • 10: no index (preferred CUG taken from subscriber data)
<info>	Number	Allowed values: • 0: no information (default value) • 1: suppress OA • 2: suppress preferential CUG • 3: suppress OA and preferential CUG

12.15.4 Notes

LARA-R6

- The test command returns only the "OK" final result code.

13 Circuit switched data services

13.1 Introduction

For CSD services, it is advised to enable the XID negotiation using the configuration AT+CRLP=61,61,48,7.

13.2 Cellular result codes +CRC

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

13.2.1 Description

Enables the detailed ring indication for the incoming calls. Instead of RING, the **+CRING: <type>** URC is displayed.

13.2.2 Syntax

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

13.2.3 Defined values

Parameter	Type	Description
<mode>	Number	• 0 (default value and factory-programmed setting): extended format disabled • 1: extended format enabled
<type>	String	Ring indication description: • ASYNC: asynchronous transparent • REL ASYNC: asynchronous non-transparent (reliable) • SYNC: synchronous transparent • REL SYNC: synchronous non-transparent (reliable) • FAX: facsimile (TS62) • VOICE: normal voice (TS11) • ALT VOICE / FAX: alternating voice/FAX, voice first (TS61) • ALT FAX / VOICE: alternating voice/FAX, FAX first (TS61) • GPRS <PDP_type>,<PDP_addr>,<L2P>,<APN>: GPRS network request for the PDP context activation

13.2.4 Notes

LARA-R6

- The command setting is not stored in the personal profile and therefore are volatile.
- <type>="ASYNC", "REL ASYNC", "SYNC", "REL SYNC", FAX", "ALT VOICE / FAX", "ALT FAX / VOICE" are not supported.

14 V24 control and V25ter

14.1 Introduction

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

14.2 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

14.2.1 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.

LARA-R6
On the AUX UART interface the command is not effective.

LARA-R6
Setting a 5-wire UART configuration (see the +USIO AT command), the command is not effective.

14.2.2 Syntax

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

14.2.3 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

14.2.4 Notes

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

LARA-R6

- The command setting is not stored in the personal profile.

14.3 Circuit 108/2 and escape sequence behavior &D

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

14.3.1 Description

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

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

14.3.2 Syntax

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

14.3.3 Defined values

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

14.3.4 +++ behavior

- A special meaning of the &D value is provided for the +++ sequence during a PS data transfer with PPP L2 protocol (this is outside the ITU-T V.25ter recommendation [198] scope). Upon +++ sequence the PS data transfer is escaped and the system returns in the on-line command state.
- The ATO command is used to resume the PS data transfer session.
- If the module has a DUN/PPP activated and is in OLCM, the ATH command deactivates the PPP and the associated PDP context (if possible).

☞ For more details, see the ITU-T recommendation V250 [197], ITU-T V.25ter recommendation [198] and ITU-T V.32 recommendation [199].

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

14.3.5 DTR, +++ behavior

PS data mode (PPP L2 protocol case)		
Event	**DTE sends +++**	**DTR ON-to-OFF transition**
&D0	DCE enters online command mode	Context deactivation
&D1	DCE enters online command mode	DCE enters online command mode
&D2	DCE enters online command mode	Context deactivation

Table 12: PS data mode

Direct Link 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	DCE enters command mode
&D2	DCE enters command mode	DCE enters command mode

Table 13: Direct Link mode

14.3.6 Notes

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

LARA-R6

- The command setting is not stored in the personal profile.
- On the AUX UART interface, the DTR line is always considered to ON state (even if the AUX UART interface does not support the DTR line).
- Setting a 5-wire UART configuration (for mode details, see the +USIO AT command), on the UART interface the DTR line is always considered to ON state (even if the UART interface does not support the DTR line).

14.4 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

14.4.1 Description

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

☞ LARA-R6
On the AUX UART interface the command is not effective.

☞ LARA-R6
Setting a 5-wire UART configuration (see the +USIO AT command), the command is not effective.

14.4.2 Syntax

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

14.4.3 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

14.4.4 Notes

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

LARA-R6

- The command setting is not stored in the personal profile.

14.5 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

14.5.1 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

14.5.2 Syntax

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

14.5.3 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

Parameter	Type	Description
		• 5: enable the XON/XOFF DTE flow control • 6: enable the XON/XOFF DTE flow control

14.5.4 Notes

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

LARA-R6

- The primary UART interface baud rate configuration is stored in the NVM, while the AUX UART interface baud rate configuration is volatile.
- The command is not supported on the multiplexer channels. For more details, see the +CMUX AT command.
- The SW flow control is not supported (<value>=4, 5 and 6 are not allowed).
- The HW flow control cannot be changed when +USIO: 1 and +UPSV: 1; for more details, see the +UPSV AT command..

14.6 DTE-DCE character framing +ICF

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

14.6.1 Description

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

☞ The following restrictions must be reminded:

- If a data frame format refers to a frame without parity (ex. <format>=3), the command is accepted, but the parity value is ignored; it is returned by the +ICF read command (and displayed 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

14.6.2 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

14.6.3 Defined values

Parameter	Type	Description
<format>	Number	• 0: auto detect • 1: 8 data 2 stop • 2: 8 data 1 parity 1 stop • 3: 8 data 1 stop • 4: 7 data 2 stops • 5: 7 bit, 1 parity, 1 stop • 6: 7 bit, 1 stop Allowed values: • LARA-R6 - 3 (default and factory-programmed value)
<parity>	Number	• 0: odd

Parameter	Type	Description
		• 1: even Allowed values: • LARA-R6 - The parameter is not supported

14.6.4 Notes

LARA-R6

- The command setting is not stored in the personal profile.

14.7 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

14.7.1 Description

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

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

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

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

14.7.2 Syntax

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

14.7.3 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)

14.7.4 Notes

LARA-R6

- This command has no effect. To change UART flow control settings use AT&K command.

14.8 UART data rate configuration +IPR

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

14.8.1 Description

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

☞ LARA-R6
The command is not applicable on the USB interface and the DCE returns an error result code if the command is issued.

14.8.2 Syntax

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

14.8.3 Defined values

Parameter	Type	Description
<rate>	Number	Allowed baud rates expressed in b/s (0, if present, means autobauding): • LARA-R6 - 115200 (default and factory-programmed value), 230400, 460800, 921600, 3000000

14.8.4 Notes

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

LARA-R6

- The primary UART interface baud rate configuration is stored in the NVM, while the AUX UART interface baud rate configuration is volatile.
- This command is not supported in the multiplexer mode. See the +CMUX AT command for more details.
- The <rate> parameter is mandatory.
- Baud rate changes using +IPR may occur asynchronously to the final result code.

14.9 Return to on-line data state O

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

14.9.1 Description

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

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

LARA-R6
It allows the DCE to return to online data state, after an ON-to-OFF transition of circuit 108/2 or escape sequence that has caused the DCE to enter in command mode (see &D).

14.9.2 Syntax

Type	Syntax	Response	Example
Action	ATO	<response>	ATO CONNECT

14.9.3 Defined values

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

14.9.4 Notes

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

14.10 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

14.10.1 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. "+++".

14.10.2 Syntax

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

14.10.3 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 '+').

14.10.4 Notes

LARA-R6

- The command has no effect.

14.11 Command line termination character S3

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

14.11.1 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.

14.11.2 Syntax

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

14.11.3 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)).

14.11.4 Notes

LARA-R6

- The command setting is not stored in the personal profile.

14.12 Response formatting character S4

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

14.12.1 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.

14.12.2 Syntax

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

14.12.3 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)).

14.12.4 Notes

LARA-R6

- The command setting is not stored in the personal profile.

14.13 Command line editing character S5

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

14.13.1 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.

14.13.2 Syntax

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

14.13.3 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)).

14.13.4 Notes

LARA-R6

- The command setting is not stored in the personal profile.

14.14 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

14.14.1 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.

14.14.2 Syntax

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

14.14.3 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.

14.14.4 Notes

LARA-R6

- The command has no effect.

14.15 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

14.15.1 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.

14.15.2 Syntax

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

14.15.3 Defined values

Parameter	Type	Description
<value>	Number	Range 1 - 255. The answer to the read command is in "xxx" format. • LARA-R6 - The default value is 0

14.15.4 Notes

LARA-R6

- The command has no effect.

14.16 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

14.16.1 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.

14.16.2 Syntax

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

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

14.16.3 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.

14.17 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

14.17.1 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.

14.17.2 Syntax

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

14.17.3 Defined values

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

14.17.4 Notes

LARA-R6

- The command has no effect.

14.18 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

14.18.1 Description

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

14.18.2 Syntax

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

14.18.3 Defined values

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

14.18.4 Notes

LARA-R6

- The command setting is stored in the NVM.

14.19 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

14.19.1 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.

14.19.2 Syntax

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

14.19.3 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

14.19.4 Notes

LARA-R6

- The command setting is not stored in the personal profile.

14.20 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

14.20.1 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.

14.20.2 Syntax

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

14.20.3 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

14.20.4 Notes

LARA-R6

- The command setting is not stored in the personal profile.

14.21 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	Yes	Profile	No	-	+CME Error

14.21.1 Description

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

14.21.2 Syntax

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

14.21.3 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; The default and factory-programmed value is: • LARA-R6 - 0
<speed>	Number	Transfer speed for CSD calls configured via the +CBST AT command

14.21.4 Notes

LARA-R6

- The command setting is stored in the NVM.

14.22 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

14.22.1 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.

14.22.2 Syntax

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

14.22.3 Defined values

Parameter	Type	Description
<value>	Number	Profile index, optional parameter. Allowed values: • LARA-R6 - 0 (default value)

15 SIM management

15.1 Generic SIM access +CSIM

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

15.1.1 Description

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

☞ The command needs the SIM module to work correctly.

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

☞ LARA-R6
Operations linked to USIM application can be performed after the ADF USIM selection: issue the AT +CSIM=14,"00A40004027FFF" command to avoid ambiguous behavior.

☞ LARA-R6
The PIN insertion is not mandatory before the command execution.

15.1.2 Syntax

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

15.1.3 Defined values

Parameter	Type	Description
<length>	Number	Length of the characters sent to the TE in <command> or <response> parameters
<command>	String	Command passed on by MT to SIM in hex format; see the 3GPP TS 51.011 [83] and ETSI TS 102 221 [162]
<response>	String	Response to the command passed on by the SIM to the MT (3GPP TS 51.011 [83] and ETSI TS 102 221 [162])

15.2 Restricted SIM access +CRSM

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

15.2.1 Description

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

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

☞ The command needs the SIM module to work correctly.

☞ LARA-R6
The PIN insertion is not mandatory before the command execution.

15.2.2 Syntax

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

15.2.3 Defined values

Parameter	Type	Description
<command>	Number	Allowed values: • 176: read binary • 178: read record • 192: get response • 214: update binary • 220: update record • 242: status • 203: retrieve data • 219: set data
<fileid>	Number	Identifies an elementary datafile on SIM. Mandatory for each command except STATUS (e.g. 28423: meaning IMSI file (6F07)). For a complete description of Elementary Files (EF), see 3GPP TS 31.102 [84].
<P1>, <P2>, <P3>	Number	Defines the request. These parameters are mandatory for each command, except GET RESPONSE and STATUS. The values are described in 3GPP TS 51.011 [83] and ETSI TS 102 221 [162].
<data>	String	Information which shall be written to the SIM (hexadecimal character format; see the +CSCS - string containing hexadecimal characters)
<pathid>	String	Contains the path of an elementary file on the SIM/UICC in hexadecimal format as defined in ETSI TS 102 221 [162] (e.g. "7F205F70" in SIM and UICC case). The <pathid> shall only be used in the mode "select by path from MF" as defined in ETSI TS 102 221 [162].
<sw1>, <sw2>	Number	Contains SIM information about the execution of the actual command and can be (more details in 3GPP TS 51.011 [83] and ETSI TS 102 221 [162]). Status words examples for 2G SIM cards: • 0x90 0x00: normal ending of the command • 0x9F 0xXX: length XX of the response data • 0x92 0x0X: command successful but after using an internal retry routine X times • 0x92 0x40: memory problem • 0x94 0x00: no EF selected • 0x94 0x02: out of range (invalid address) • 0x94 0x04: file ID not found; pattern not found • 0x94 0x08: file is inconsistent with the command • 0x98 0x02: no CHV initialized • 0x98 0x04: access condition not fullfiled / unsucc. CHV verify / authent.failed • 0x98 0x08: in contradiction with CHV status • 0x98 0x10: in contradiction with invalidation status • 0x98 0x40: unsucc. CHV-verif. or UNBLOCK CHV-verif. / CHV blocked / UNBL.blocked • 0x67 0xXX: incorrect parameter P3 • 0x6A 0x81: function not supported • 0x6A 0x82: file not found • 0x6B 0xXX: incorrect parameter P1 or P2 • 0x6D 0xXX: unknown instruction code given in the command

Parameter	Type	Description
		• 0x6E 0xXX: wrong instruction class given in the command • 0x6F 0xXX: technical problem with no diagnostic given Status words examples for 3G SIM cards: • 0x90 0x00: normal ending of the command • 0x91 0xXX: length XX of the response data • 0x63 0xCX: command successful but after using an internal retry routine X times • 0x62 0x00: no information given, state of non volatile memory unchanged • 0x64 0x00: no information given, state of non-volatile memory unchanged • 0x65 0x00: no information given, state of non-volatile memory changed • 0x65 0x81: memory problem • 0x67 0x00: wrong length • 0x69 0x85: conditions of use not satisfied • 0x69 0x86: command not allowed (no EF selected) • 0x69 0x82: security status not satisfied • 0x62 0x81: part of returned data may be corrupted • 0x6A 0x81: function not supported • 0x6A 0x82: file not found • 0x6A 0x83: record not found • 0x6B 0x00: wrong parameter(s) P1, P2 • 0x6D 0x00: instruction code not supported or invalid • 0x6E 0x00: instruction code not supported or invalid • 0x6F 0x00: technical problem, no precise diagnosis
<response>	String	The response of successful completion of the command previously issued (hexadecimal character format; see the +CSCS). STATUS and GET RESPONSE return data, which gives information about the current elementary datafield. This information includes the type of file and its size (see the 3GPP TS 51.011 [83] and the ETSI TS 102 221 [162]). After READ BINARY or READ RECORD command the requested data will be returned. <response> is not returned after a successful UPDATE BINARY or UPDATE RECORD command.

15.2.4 Notes

LARA-R6

- <command>=203 and 219 are not supported.
- The following set command syntax is also allowed: AT+CRSM=<command>,<fileid>,<P1>,<P2>,<P3>,[<data>],<pathid>.

15.3 Read the SIM language +CLAN

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

15.3.1 Description

Reads the language from the SIM.

The read syntax will display the most preferred language from the preferred language list in:

- LARA-R6 - the EF_{LI} (6F05) file. If the EF_{LI} file does not exist, the preferred language is read from EF_{PL} (2F05) file.

15.3.2 Syntax

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

Type	Syntax	Response	Example
Test	AT+CLAN=?	OK	

15.3.3 Defined values

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

15.3.4 Notes

LARA-R6

- The set command is not supported.

15.4 Check for UICC card +UUICC

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

15.4.1 Description

Returns the type of application which is present on the ICC or UICC.

LARA-R6
The command needs the SIM module to work correctly.

15.4.2 Syntax

Type	Syntax	Response	Example
Read	AT+UUICC?	+UUICC: <state> OK	+UUICC: 1 OK

15.4.3 Defined values

Parameter	Type	Description
<state>	Number	• 0: 2G SIM (SIM application present) • 1: 3G SIM (USIM application present) • 2: 4G SIM (USIM and ISIM applications present)

15.5 SIM hot insertion configuration +UDCONF=50

+UDCONF=50						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

15.5.1 Description

Configures the SIM hot insertion feature. The feature enables the SIM interface upon detection of external SIM card physical insertion / removal and behaves accordingly, triggering registration and deregistration.

The +CIEV URC (see +CMER AT command) and +CIND AT command notify the SIM card detection status.

The command setting is saved in NVM and will be effective at the next power on.

15.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=50,<sim_hot_insertion>	OK	AT+UDCONF=50,1

Type	Syntax	Response	Example
			OK
Read	AT+UDCONF=50	+UDCONF: 50,<sim_hot_insertion> OK	AT+UDCONF=50 +UDCONF: 50,1 OK

15.5.3 Defined values

Parameter	Type	Description
<sim_hot_insertion>	Number	SIM hot insertion setting. Allowed values: • 0 (factory-programmed value): SIM hot insertion disabled • 1: SIM hot insertion enabled

15.5.4 Notes

LARA-R6

- For the correct behavior of the SIM hot insertion feature, the "SIM card detection" feature (configurable by means of the +UGPIOC AT command) must be enabled too.
- Beware that the SIM will be in a not-ready state if the SIM hot insertion feature is enabled and the "SIM card detection" feature is disabled.
- The SIM card detection status is notified by means of +CIEV URC (see +CMER AT command) and +CIND AT command only if a GPIO pin is configured as "SIM card detection" (see +UGPIOC AT command, <gpio_mode>=7).

15.6 UICC application discovery +CUAD

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

15.6.1 Description

Asks the MT to discover what applications are available for selection on the UICC. According to ETSI TS 102.221 [162], the ME shall access and read the EF_{DIR} file in the UICC and return the values that are stored in its records. Each record contains the AID and optionally application parameters of one of the applications available on the UICC.

If the optional parameter(s) are requested and the EF_{DIR} file is not present in the UICC, the <response> parameter shall be empty.

15.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+CUAD[=<option>] OK	+CUAD: <response>[,<active_application>[,<AID>]] OK	AT+CUAD=1 +CUAD: 61124F10A0000000871002FFFFFFFF89060400FFFFFFFFFFFFFFFFFFFFFFFFFF9000,2,A0000000871002FFFFFFFF89060400FF OK
Test	AT+CUAD=?	+CUAD: (list of supported <option>s) OK	+CUAD: (0,1) OK

15.6.3 Defined values

Parameter	Type	Description
<option>	Number	• 0 (default value): no parameters requested in addition to <response> • 1: include <active_application>

Parameter	Type	Description
<response>	String	Content of the EF_{DIR} in hexadecimal format
<active_application>	Number	Active application: • 0: no SIM or USIM active • 1: active application is SIM • 2: active application is USIM, followed by <AID> • 3: active application is ISIM, followed by <AID>
<AID>	String	AID of active USIM in hexadecimal format

15.6.4 Notes

LARA-R6

- The <option> parameter is not supported, therefore the module returns only the <response> parameter in the information text response to the set command.
- The test command is not supported.
- Each EF_{DIR} file record is returned within quotation marks; e.g:

```
+CUAD: "61204F10A0000000871002FF33FFFF8906030100500C47454E45524943205553494DFFFFFFFF""61194F0CA000000063504B43532D313550094D49445066696C6573FFFFFFFFFFFFFFFFFFFFFF"
```

15.7 SIM states reporting +USIMSTAT

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

15.7.1 Description

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

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

15.7.2 Syntax

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

15.7.3 Defined values

Parameter	Type	Description
<mode>	Number	Bitmask representing which indications the +UUSIMSTAT URC is allowed to report. See Table 14 for the meaning of each bit. The factory-programmed value is 0.
<state>	Number	Indicates the SIM card initialization status, the phonebook initialization status and the REFRESH proactive command execution result: • 0: SIM card not present • 1: PIN needed • 2: PIN blocked • 3: PUK blocked • 4: (U)SIM not operational

Parameter	Type	Description
		• 5: (U)SIM in restricted use (FDN or BDN active) • 6: (U)SIM operational (registration may be initiated) • 7: SIM phonebook ready to be used (when the SIM application is active) • 8: USIM phonebook ready to be used (when the USIM application is active) • 9: (U)SIM toolkit REFRESH proactive command successfully concluded • 10: (U)SIM toolkit REFRESH proactive command unsuccessfully concluded • 11: PPP connection active, (U)SIM toolkit REFRESH proactive command delayed till PPP deactivation • 12: voice call active, (U)SIM toolkit REFRESH proactive command delayed till call release • 13: CSD call active, (U)SIM toolkit REFRESH proactive command delayed till call release Allowed values: • LARA-R6 - 9, 10

15.7.4 Notes

- <state>=9 and 10 will not be reported when dedicated (+CFUN: 6) or raw (+CFUN: 9) mode is active.
- Table 14 provides the meaning of each bit with the corresponding state:

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

Table 14: <mode> bitmask meaning

LARA-R6

- Only <mode>=4 is supported and its factory-programmed value. By factory-programmed configuration the +USIMSTAT URCs are disabled: for more details on enabling / disabling the +USIMSTAT URCs, see the +UCUSATA AT command.

16 SIM toolkit

16.1 Introduction

SIM Application Toolkit (STK) is the 3GPP standard feature that allows the Subscriber Identity Module (SIM) to handle the DCE, by issuing commands such as sending SMS to the network, or triggering a SIM refresh, or asking for local information (e.g. Location, IMEI), and monitor its access to the cellular network, by configuring notifications for relevant events (envelopes).

The processing of SIM Application toolkit commands can be seamlessly performed by the DCE, or can be done by the host application by activating the SIM toolkit AT interface either in dedicated or in raw mode. In dedicated mode, the DTE is notified of STK commands and events after decoding; in raw mode the DTE is notified with the raw data as received from the SIM. Only one mode can be enabled and function at a time.

The commands in this section (with the exception of the +UBIP, +UCATPROF and +STKPROF AT commands, where supported) properly work only if the SIM toolkit interface has been activated by the DTE. Otherwise the SIM toolkit processing will be blocked.

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

For more details on the command description and parameters, see 3GPP TS 51.014 [98] and ETSI TS 102.223 [161].

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

The SIM card can establish data sessions with a SIM OTA server using the the module's cellular connectivity by means of the Bearer Independent Protocol (BIP) feature.

The STK commands related to the Bearer Independent Protocol, i.e. Open Channel, Close Channel, Receive Data, Send Data, Get Channel Status and the events Data Available and Channel Status, are autonomously managed by the device without the intervention from the TE, unless the dedicated mode is supported and actived and the Open Channel command requires the user intervention (see ETSI TS 102 223 [161]).

16.2 Bearer Independent Protocol status indication +UBIP

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

16.2.1 Description

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

☞ The channel status event provides information about the link status and its drop, therefore it is advisable to enable it where available.

16.2.2 Syntax

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

16.2.3 Defined values

Parameter	Type	Description
<mode>	Number	Indicates whether the +UUBIP URC is enabled or not: • 0 (factory-programmed value): BIP status indication disabled • 1: BIP status indication enabled • 2: OPEN CHANNEL, CLOSE CHANNEL and CHANNEL STATUS EVENT status indications enabled Allowed values: • LARA-R6 - 0, 1
<ev_cmd>	Number	Indicates the event download's tag or proactive command's tag. Allowed values: • 10: Channel status event • 64: Open channel proactive command • 65: Close channel proactive command • 66: Receive data proactive command • 67: Send data proactive command
<val>	Number	Indicates the channel status (in case of the event download channel status) or result in case of a proactive command (see ETSI TS 102 223 [161])

16.3 Read the USAT profile +CUSATR

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

16.3.1 Description

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

16.3.2 Syntax

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

16.3.3 Defined values

Parameter	Type	Description
<profile_storage>	Number	Allowed values: • 0: the TE profile that can be set with the +CUSATW AT command • 1: the MT profile that can be set with the +CUSATW AT command • 2: MT default profile that reflects the inherent, default supported facilities of the MT • 3: UICC profile that reflects the currently active UICC profile that was sent to the UICC in the last TERMINAL PROFILE command • 4: UICC EF_{UST}. It represents the elementary file that indicates services available in the USIM • 5: list of MT only facilities (facilities that are not allowed to be assigned to the TE, see 3GPP TS 31.111 [137])

Parameter	Type	Description
<profile>	String	The profile in hexadecimal character format describing the supported facilities of the referenced <profile_storage> as specified for the Terminal Profile in 3GPP TS 31.111 [137] or for the related EF in 3GPP TS 31.102 [84].

16.4 Write the USAT profile +CUSATW

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

16.4.1 Description

Writes a USAT terminal profile to the profile storage location. If the profile storage parameter is omitted in the set command, it resets the profiles for all the supported profile storage values to factory-programmed setting. If only the profile parameter is omitted, it will reset the given profile storage to factory-programmed setting.

16.4.2 Syntax

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

16.4.3 Defined values

Parameter	Type	Description
<profile_storage>	Number	Allowed values: • 0: TE. It refers to the profile storage for the facilities supported by the TE. The default value is a blank profile with all bits set to zero. This value is applicable both in the execution command and in the information text response. • 1: MT. It refers to the profile storage for the facilities to be supported by the MT, which can be a subset of the default MT facilities. The TE can choose to register a subset of the MT default profile, typically omitting facilities also supported by the TE profile. The default value is the MT default profile. This value is applicable both in the execution command and in the information text response.
<profile>	String	The profile in hexadecimal character format describing the supported facilities of the referenced <profile_storage> as specified for the Terminal Profile in 3GPP TS 31.111 [137] or for the related EF in 3GPP TS 31.102 [84].

16.5 Enable USAT terminal URCs +UCUSATA

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

16.5.1 Description

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

16.5.2 Syntax

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

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

16.5.3 Defined values

Parameter	Type	Description
<active_URC>	Number	Bitmask representing which URCs are activated. See Table 15 for the meaning of each bit. The factory-programmed value is 0.
<proactive_command>	String	Command in hexadecimal character format. Proactive command as defined in 3GPP TS 31.111 [137], consisting of the full BER-TLV data object.

16.5.4 Notes

- The MT issues the +CUSATP URC to forward to the TE proactive commands issued by the UICC.
- The MT issues the +CUSATEND URC when the UICC indicates that the proactive command session is terminated.
- Table 15 provides the meaning of each bit with the corresponding state:

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

Table 15: <mode> bitmask meaning

17 Packet switched data services

17.1 PDP contexts and parameter definition

17.1.1 Primary and secondary PDP contexts

A PDP context can be either **primary** or **secondary**. In LTE, PS data connections are referred to as EPS bearers: EPS bearers are conceptually equivalent to the legacy PDP contexts, which are often referred to for sake of simplicity. Similarly to a PDP context, the EPS bearer can be a default (primary) or dedicated (secondary) one. The initial EPS bearer established during LTE attach procedure is actually a default EPS bearer. A secondary PDP context uses the same IP address of a primary PDP context (the usual PDP context activated e.g. via dial-up). The Traffic Flow Filters for such secondary contexts shall be specified according to 3GPP TS 23.060 [77].

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.

☞ LARA-R6
At most 7 secondary PDP contexts may be associated to a primary PDP context; the maximum number of primary PDP contexts that can be activated are 5, while the total number of PDP contexts, both primary and secondary, that can be activated are 8.

17.1.2 Multiple PDP contexts

Two PDP context types are defined:

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

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

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

17.1.3 Parameter definition

17.1.3.1 <APN>

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

The maximum length of the parameter is:

- LARA-R6 - 62 characters

17.1.3.2 <cid>

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

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

Product	Max number of definable PDP contexts	Max number of active PDP contexts
LARA-R6	24	8

17.1.3.3 <PDP_addr>

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

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

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

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

17.1.3.4 <PDP_type>

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

- "IP": Internet Protocol (IETF STD 5)
- "NONIP": Non IP
- "IPV4V6": virtual <PDP_type> introduced to handle dual IP stack UE capability (see the 3GPP TS 24.301 [114])
- "IPV6": Internet Protocol, version 6 (see RFC 2460 [171])

LARA-R6
<PDP_type>="NONIP" is not supported.

17.2 PPP LCP handshake behavior

When a data call is initiated by means of D* AT command, the module switches to PPP mode just after the CONNECT intermediate result code. The first step of the PPP procedure is the LCP handshake, in this phase the behavior of module series differ between them.

LARA-R6
The data call can be initiated also by the +CGDATA AT command setting "PPP" as <L2P> protocol.

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

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

LARA-R6
By default the module starts PPP in silent mode, waiting for the first LCP packet coming from the TE. If a valid LCP packet is received the module continues the LCP handshake by its side, otherwise it remains in wait state. If the module is in wait state, it is possible to make it switch back to:

- the AT command mode by toggling the DTR line (see the &D AT command).
- the online command mode by sending escape sequence "+++" or by toggling the DTR line (see the &D AT command).

17.3 Printing IP address format +CGPIAF

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

17.3.1 Description

Defines the printing format of IPv6 address parameters of the other AT commands. See RFC 4291 [176] for details of the IPv6 address format.

LARA-R6
The affected parameters are:

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

17.3.2 Syntax

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

17.3.3 Defined values

Parameter	Type	Description
<IPv6_AddressFormat>	Number	Defines the IPv6 address format: • 0 (default value): IPv4-like dot-notation used. IP address and subnetwork mask if applicable, are dot-separated • 1: IPv6-like colon-notation used. IP address and subnetwork mask if applicable and when given explicitly, are separated by a space
<IPv6_SubnetNotation>	Number	Defines the subnet-notation for <remote_address_and_subnet_mask>. The setting does not apply if <IPv6_AddressFormat>=0: • 0 (default value): both IP address and subnet mask are explicitly stated, separated by a space

Parameter	Type	Description
		• 1: the printout format is applying / (forward slash) subnet-prefix Classless Inter-Domain Routing (CIDR)
<IPv6_ LeadingZeros>	Number	Defines whether leading zeros are omitted or not. The setting does not apply if <IPv6_ AddressFormat>=0: • 0 (default value): leading zeros omitted • 1: leading zeros included
<IPv6_ CompressZeros>	Number	Defines whether 1-n instances of 16-bit-zero-values are replaced by only "::". This applies only once. The setting does not apply if <IPv6_AddressFormat>=0: • 0 (default value): no zero compression • 1: use zero compression

17.4 PDP context definition +CGDCONT

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

17.4.1 Description

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

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

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

Usage of static i.e. user defined IP address is possible in UTRAN and GERAN but not in EUTRAN; to prevent inconsistent addressing methods across various RATs, static IP addressing is not recommended for LTE modules: 3GPP TS 23.060 [77] Rel.8 and later releases specify that a UE with EUTRAN/UTRAN/GERAN capabilities shall not include a static PDP address in PDP context activation requests.

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

☞ LARA-R6
After the PDP context activation, the information text response to the read command provides the configuration negotiated with the network (similarly to +CGCONTRDP AT command).

17.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGDCONT=[<cid>[,<PDP_ type>[,<APN>[,<PDP_addr>[, <d_comp>[,<h_comp>[, <IPv4AddrAlloc>[,<emergency_ indication>[,<P-CSCF_discovery>[, <IM_CN_Signalling_Flag_Ind>[, <NSLPI>]]]]]]]]]]	OK	**IPv4 example** AT+CGDCONT=1,"IP","APN_name", "1.2.3.4",0,0 OK **IPv4v6 example** AT+CGDCONT=1,"IPV4V6","APN","0 .0.0.0 0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 ",0,0 OK **IPv6 example** AT+CGDCONT=1,"IPV6","APN","0.0.0 .0.0.0.0.0.0.0.0.0.0.0.0.0",0,0 OK
Read	AT+CGDCONT?	+CGDCONT: <cid>,<PDP_type>, <APN>,<PDP_addr>,<d_comp>, <h_comp>[,<IPv4AddrAlloc>, <emergency_indication>[,<P-CSCF_	+CGDCONT: 1,"IP","web.omnitel.it", "91.80.140.199",0,0,0 OK

Type	Syntax	Response	Example
		discovery>,<IM_CN_Signalling_Flag_Ind>[,<NSLPI>]]] [+CGDCONT: <cid>,<PDP_type>,<APN>,<PDP_addr>,<d_comp>,<h_comp>[,<IPv4AddrAlloc>,<emergency_indication>[,<P-CSCF_discovery>,<IM_CN_Signalling_Flag_Ind>[,<NSLPI>]]]] OK	
Test	AT+CGDCONT=?	+CGDCONT: (list of supported <cid>s),<PDP_type>,,,(list of supported <d_comp>s),(list of supported <h_comp>s)[,(list of supported <IPv4AllocAddr>s),(list of supported <emergency_indication>s)[,(list of supported <P-CSCF_discovery>s),(list of supported <IM_CN_Signalling_Flag_Ind>s)[,(list of supported <NSLPI>s)]]] [+CGDCONT: (list of supported <cid>s),<PDP_type>,,,(list of supported <d_comp>s),(list of supported <h_comp>s)[,(list of supported <IPv4AllocAddr>s),(list of supported <emergency_indication>s)[,(list of supported <P-CSCF_discovery>s),(list of supported <IM_CN_Signalling_Flag_Ind>s)[,(list of supported <NSLPI>s)]]]] OK	+CGDCONT: (1-3),"IP",,,(0-2),(0-4) +CGDCONT: (1-3),"IPV6",,,(0-2),(0-4) OK

17.4.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>. The default value is 1.
<PDP_type>	String	See <PDP_type>. The default value is "IP".
<APN>	String	See <APN>. The default value is "" (blank APN).
<PDP_addr>	Number	See <PDP_addr>. The default value is "0.0.0.0"
<d_comp>	Number	PDP data compression; it can have the values: • 0 (default value): off • 1: on (predefined compression type i.e. V.42bis data compression) • 2: V.42bis data compression • 3: V.44
<h_comp>	Number	PDP header compression; it can have the values: • 0 (default value): off • 1: on (predefined compression type, i.e. RFC1144) • 2: RFC1144 • 3: RFC2507 • 4: RFC3095 ☞ <h_comp>: the available head-compressions are dependent on configuration of the stack (configured via features in the stack)
<IPv4AddrAlloc>	Number	Controls how the MT/TA requests to get the IPv4 address information: • 0 (default value): IPv4 Address Allocation through NAS Signalling • 1: IPv4 Address Allocated through DHCP
<emergency_indication>	Number	Indicates whether the PDP context is for emergency bearer services or not: • 0 (default value): PDP context is not for emergency bearer services • 1: PDP context is for emergency bearer services
<request_type>	Number	Indicates the type of PDP context activation request for the PDP context:

Parameter	Type	Description
		• 0: PDP context is for new PDP context establishment or for handover from a non-3GPP access network (how the MT decides whether the PDP context is for new PDP context establishment or for handover is implementation specific) • 1: PDP context is for emergency bearer services • 2 (default value): PDP context is for new PDP context establishment • 3: PDP context is for handover from a non-3GPP access network
<P-CSCF_discovery>	Number	Influences how the MT/TA requests to get the P-CSCF address, see 3GPP TS 24.229 [125] annex B and annex L: • 0 (default value): preference of P-CSCF address discovery not influenced by +CGDCONT • 1: preference of P-CSCF address discovery through NAS Signalling • 2: preference of P-CSCF address discovery through DHCP
<IM_CN_Signalling_Flag_Ind>	Number	Shows whether the PDP context is for IM CN subsystem-related signalling only or not: • 0: PDP context is not for IM CN subsystem-related signalling only • 1: PDP context is for IM CN subsystem-related signalling only
<NSLPI>	Number	Indicates the NAS signalling priority requested for the corresponding PDP context: • 0 (default value): indicates that the PDP context has to be activated with the value for the low priority indicator configured in the MT. • 1: indicates that the PDP context has to be activated with the value for the low priority indicator set to "MS is not configured for NAS signalling low priority". The MT utilises the NSLPI information provided as specified in 3GPP TS 24.301 [114] and 3GPP TS 24.008 [79].
<secure_PCO>	Number	Specifies if security protected transmission of PCO is requested or not (applicable for EPS only): • 0 (default value): Security protected transmission of PCO is not requested. • 1: Security protected transmission of PCO is requested.
<IPv4_MTU_discovery>	Number	Influences how the MT/TA requests to get the IPv4 MTU size: • 0 (default value): Preference of IPv4 MTU size discovery not influenced by +CGDCONT. • 1: Preference of IPv4 MTU size discovery through NAS signalling.
<Local_Addr_Ind>	Number	Indicates to the network whether or not the MS supports local IP address in TFTs: • 0 (default value): indicates that the MS does not support local IP address in TFTs. • 1: indicates that the MS supports local IP address in TFTs.
<Non_IP_MTU_discovery>	Number	Influences how the MT/TA requests to get the Non-IP MTU size (for more details, see 3GPP TS 24.008 [79]): • 0 (default value): preference of Non-IP MTU size discovery not influenced by +CGDCONT. • 1: preference of Non-IP MTU size discovery through NAS signalling.

17.4.4 Notes

Additional examples:

Command	Response	Description
		Configure the error result code format by means of the +CMEE AT command
AT+CGDCONT=?	+CGDCONT: (1-3),"IP",,,(0),(0-1) OK	Test command
AT+CGDCONT=4,"IP","internet"	+CME ERROR: operation not allowed	Define out of range PDP contexts
AT+CGDCONT=2,"IP","internet"	OK	Define allowed PDP contexts
AT+CGDCONT=1,"IP","STATREAL"	OK	Define allowed PDP contexts
AT+CGDCONT=3,"IP","tim.ibox.it"	OK	Define allowed PDP contexts
AT+CGDCONT=253,"IP","internet"	+CME ERROR: operation not allowed	Define out of range PDP contexts
AT+CGDCONT?	+CGDCONT: 2,"IP","internet","0.0.0.0",0,0 +CGDCONT: 1,"IP","STATREAL","0.0.0.0",0,0 +CGDCONT: 3,"IP","tim.ibox.it","0.0.0.0",0,0 OK	Read command

LARA-R6

- The factory-programmed settings of the initial default EPS bearer mapped to <cid>=1 are:
  - <APN> see Mobile Network Operator profiles.
  - <PDP_addr>="0.0.0.0 0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0"
  - <PDP_type>="IPV4V6"
- If <PDP_type>="IPV6", the <PDP_addr> parameter is mandatory and the allowed values are "" (blank) or a full 8 octets with colon separated format address.
- <d_comp>=1, 2, 3 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.
- <h_comp>=1, 2, 3 and 4 are not supported.
- If <PDP_addr> is not assigned or set to all zeros and <PDP_type>="IPV4V6", the read command will only return the all zeros IPV6 address.

LARA-R6

- The <emergency_indication>, <P-CSCF_discovery> and <IM_CN_Signalling_Flag_Ind> parameters are not supported.
- It is possible to undefine active PDP contexts, even mapped to <cid>=1. The undefined PDP contexts will not be reported by the +CGDCONT read command but they are not deactivated; the undefined active PDP contexts can be restored by re-defining them with their current <APN> and <PDP_type>.
- Undefining the PDP context associated to <cid>=1 is allowed; if done in deregistered state, it will prevent the LTE registration. In this configuration, in order to trigger LTE registration, the PDP context associated to <cid>=1 shall be re-defined and a registration cycle shall be triggered via e.g. AT+CFUN=0/AT+CFUN=1.

17.5 Default PDP and preferred protocol type configuration +UDCONF=19

+UDCONF=19						
Modules	LARA-R6001 LARA-R6401 LARA-R6401D LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	Yes	NVM	No	-	+CME Error

17.5.1 Description

Configures the default internal PDP context and the preferred IP type to use by AT commands that require connectivity and for which these parameters are not explicitly specified.

☞ The read command reports the current effective setting. Reboot the module (e.g. by means of the AT+CFUN=15/AT+CFUN=16 command) to make the change effective.

17.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=19,<cid>,<preferred_protocol_type>	OK	AT+UDCONF=19,1,0 OK
Read	AT+UDCONF=19	+UDCONF: 19,<cid>,<preferred_protocol_type> OK	AT+UDCONF=19 +UDCONF: 19,2,1 OK

17.5.3 Defined values

Parameter	Type	Description
<cid>	Number	Internal PDP context identifier used by default by AT commands. For the parameter allowed range, see <cid>. The factory-programmed value is 1.
<preferred_protocol_type>	Number	Preferred protocol type to be specified when the <cid> protocol type is IPv4v6. Allowed values:

Parameter	Type	Description
		• 0 (factory-programmed value): IPv4 • 1: IPv6

17.6 Quality of service profile (requested) +CGQREQ

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

17.6.1 Description

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

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

☞ If not specified the following values are assumed:

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

17.6.2 Syntax

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

17.6.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<PDP_type>	String	See <PDP_type>
<precedence>	Number	Precedence class (for the description see the +UPSD command description), it can assume the values:

Parameter	Type	Description
		• 0: network subscribed • 1: high priority • 2: normal priority • 3: low priority
<delay>	Number	Delay class according to 3GPP TS 24.008 [79] (QoS) (for the description see the +UPSD command description).
<reliability>	Number	Reliability class (see the +UPSD command description).
<peak>	Number	Peak throughput class (for the description see the +UPSD command description).
<mean>	Number	Mean throughput class (for the description see the +UPSD command description).

17.7 Quality of service profile (minimum acceptable) +CGQMIN

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

17.7.1 Description

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

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

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

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

17.7.2 Syntax

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

Type	Syntax	Response	Example
		[...]] OK	

17.7.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<PDP_type>	String	See <PDP_type>
<precedence>	Number	Precedence class (for the description see the +UPSD command description), it can assume the values: • 0: network subscribed • 1: high priority • 2: normal priority • 3: low priority
<delay>	Number	Delay class according to 3GPP TS 24.008 [79] (QoS) (for the description see the +UPSD command description).
<reliability>	Number	Reliability class (see the +UPSD command description).
<peak>	Number	Peak throughput class (for the description see the +UPSD command description).
<mean>	Number	Mean throughput class (for the description see the +UPSD command description).

17.8 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

17.8.1 Description

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

☞ The user should not enter colliding requests (e.g. AT+CGATT=1 and AT+CGATT=0) on different communication ports, because this might cause interoperability issues if overlapping attach and detach requests are not handled by the network, and could result in an unpredictable registration state. Similarly, when notified of a mobile terminated GPRS detach event (e.g. via +CGEV URC), it is recommended to wait a few seconds before entering AT+CGATT=0 in order to let the pending attach procedure (automatically triggered by the module in most cases) successfully end.

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

17.8.2 Syntax

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

17.8.3 Defined values

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

Parameter	Type	Description
		• 0: detached • 1 (default value): attached

17.9 PDP context activate or deactivate +CGACT

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

17.9.1 Description

Activates or deactivates the specified PDP context. After the command, the MT remains in AT command mode. If any context is already in the requested state, the state for the context remains unchanged. If the required action cannot succeed, an error result code is returned. If the MT is not GPRS attached when the activation of a PDP context is required, the MT first performs a GPRS attach and then attempts to activate the specified context.

The maximum expected response time is different whenever the activation or the deactivation of a PDP context is performed (150 s and 40 s respectively).

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

☞ LARA-R6
The command cannot be aborted.

17.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGACT=[<status>[,<cid>[,...]]]	OK	AT+CGACT=1,1 OK
Read	AT+CGACT?	[+CGACT: <cid>,<status> [+CGACT: <cid>,<status> [...]]] OK	+CGACT: 1,1 OK
Test	AT+CGACT=?	+CGACT: (list of supported <status>s) OK	+CGACT: (0-1) OK

17.9.3 Defined values

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

17.9.4 Notes

LARA-R6

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

17.9.5 Examples

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

Command sent by the DTE	DCE response	Description
AT+CMEE=2	OK	Set the verbose error result codes
AT+COPS=0	OK	

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

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

17.10 Enter data state +CGDATA

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

17.10.1 Description

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

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

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

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

☞ LARA-R6
The session is terminated sending **+++**, which may cause the deactivation, if active, of the PDP context depending on DTR line status, i.e. on the AT&D setting (see +++ behavior and DTR, +++ behavior).

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

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

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

The following table shows some examples:

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

A packet is sent if one of the following conditions is met:

- the length field is terminated with <CR>
- the length value is equal to # characters of hex-sequence and it is terminated with <CR>
- the input is terminated with a character not equal to a hex digit and <CR>

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

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

17.10.2 Syntax

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

17.10.3 Defined values

Parameter	Type	Description
<L2P>	String	Layer 2 protocol to be used between the DTE and MT; allowed values: • "PPP" (default value) • "M-HEX" • "M-RAW_IP" • "M-OPT-PPP" The application on the remote side must support the selected protocol as well.
<cid>	Number	See <cid>.

17.10.4 Notes

- The cid command, which has not to be confused with the <cid> parameter, can be used while in data mode for switching to a PDP context already active.
- The cid command accepts as parameter a <cid> value corresponding to a PDP context already active and has to be typed in lower-case.

LARA-R6

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

17.11 Enter PPP state/GPRS dial-up D*

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

17.11.1 Description

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

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

The data session is terminated by one of the following events:

- sending **~+++**.
- via a DTR transition from ON to OFF.
- sending an LCP Terminate Request.

17.11.2 Syntax

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

17.11.3 Defined values

Parameter	Type	Description
<dialing_type_char>	String	Optional (legacy) "T" or "P" character indicating the tone dialing or pulse dialing respectively
<dialing_number>	Number	List all the supported values
<address>	-	Ignored
<L2P>	String	Layer 2 protocol to be used between the DTE and MT; allowed values: • "PPP" (default value) • "M-HEX" • "M-RAW_IP" • "M-OPT-PPP" The application on the remote side must support the selected protocol as well.
<cid>	Number	See <cid>

17.11.4 Notes

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

LARA-R6

- The <L2P> parameter is ignored and automatically set to "PPP".
- ~+++ is not supported.
- +++ is used to switch to online command mode. The O AT command is used to switch back to data mode.

17.12 Show PDP address +CGPADDR

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

17.12.1 Description

Returns a list of PDP addresses for the specified context identifiers. Only defined PDP contexts are displayed.

If the <cid> parameter is omitted, the addresses for all defined contexts are returned.

17.12.2 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

17.12.3 Defined values

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

17.13 GPRS network registration status +CGREG

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

17.13.1 Description

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

- +CGREG: <stat> if <n>=1 and there is a change in the GPRS network registration status in GERAN/UTRAN
- +CGREG: <stat>[,<lac>,<ci>[,<AcT>,<rac>]] if <n>=2 and there is a change of the network cell in GERAN/UTRAN

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

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

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

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

17.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGREG=[<n>]	OK	AT+CGREG=1 OK
Read	AT+CGREG?	If <n>=0 or 1: +CGREG: <n>,<stat> OK	+CGREG: 0,4 OK
		If <n>=2: +CGREG: <n>,<stat>[,<lac>,<ci>[,<AcT>,<rac>]] OK	+CGREG: 2,1,"61EF","7D58A3",2,"14" OK
Test	AT+CGREG=?	+CGREG: (list of supported <n>s) OK	+CGREG: (0-2) OK
URC		If <n>=1: +CGREG: <stat>	+CGREG: 1
		If <n>=2: +CGREG: <stat>[,<lac>,<ci>[,<AcT>,<rac>]]	+CGREG: 1,"4E54","44A5"

17.13.3 Defined values

Parameter	Type	Description
<n>	Number	Allowed values: • 0 (default value and factory-programmed value): network registration URC disabled • 1: network registration URC enabled • 2: network registration and location information URC enabled
<stat>	Number	Allowed values: • 0: not registered, the MT is not currently searching an operator to register to • 1: registered, home network • 2: not registered, but MT is currently searching a new operator to register to • 3: registration denied • 4: unknown (e.g. out of GERAN/UTRAN coverage) • 5: registered, roaming • 8: attached for emergency bearer services only (see 3GPP TS 24.008 [79] and 3GPP TS 24.301 [114] that specify the condition when the MS is considered as attached for emergency bearer services) (applicable only when <AcT> indicates 2,4,5,6)
<lac>	String	Two bytes location area in hexadecimal format; it is optionally provided in the URC and in the response to the read command if <n>=2. The value FFFF means that the current <lac> value is invalid.
<ci>	String	From 2 to 4 bytes cell ID in hexadecimal format; it is optionally provided in the URC and in the response to the read command if <n>=2. The value FFFFFFFF means that the current <ci> value is invalid.
<AcT>	Number	Indicates the radio access technology: • 0: GSM • 1: GSM COMPACT • 2: UTRAN • 3: GSM/GPRS with EDGE availability • 4: UTRAN with HSDPA availability • 5: UTRAN with HSUPA availability • 6: UTRAN with HSDPA and HSUPA availability • 7: E-UTRAN • 8: EC-GSM-IoT (A/Gb mode) • 9: E-UTRAN (NB-S1 mode) • 255: the current <AcT> value is invalid Allowed values: • LARA-R6001 / LARA-R6001D / LARA-R6801 - 0, 2, 3, 4, 5, 6
<rac>	String	One byte routing area in hexadecimal format

17.13.4 Notes

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

17.14 Manual deactivation of a PDP context H

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

17.14.1 Description

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

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

17.14.2 Syntax

Type	Syntax	Response	Example
Action	ATH	OK	

17.15 PDP context modify +CGCMOD

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

17.15.1 Description

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

17.15.2 Syntax

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

17.15.3 Defined values

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

17.16 3G Quality of service profile (requested) +CGEQREQ

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

17.16.1 Description

Allows the TE to specify the QoS profile that is used when the MT sends an Activate PDP Context Request message to the network. The set command specifies a profile for the context identified by the <cid>. The specified profile will be stored in the MT and sent to the network only at activation or MS-initiated modification of the related context. The command is actually an extension of the commands +CGDCONT and +CGDSCONT. The QoS profile consists of a number of parameters, each of which may be set to a separate value. The special form +CGEQREQ=<cid> causes the requested profile related to <cid> to become undefined.

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

17.16.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGEQREQ=[<cid>[,<Traffic_class>[,<Maximum_bitrate_UL>[,<Maximum_bitrate_DL>[,<Guaranteed_bitrate_UL>[,<Guaranteed_bitrate_DL>[,<Delivery_order>[,<Maximum_SDU_size>[,<SDU_error_ratio>[,<Residual_bit_error_ratio>[,<Delivery_of_erroneous_SDUs>[,<Transfer_delay>[,<Traffic_handling_priority> [,<Source_statistics_descriptor> [,<Signalling_indication>]]]]]]]]]]]]]]	OK	AT+CGEQREQ=1,2,64,64,,,0,320,"1E4","1E5",1,,3,0,0 OK
Read	AT+CGEQREQ?	+CGEQREQ: <cid>,<Traffic_class>,<Maximum_bitrate_UL>,<Maximum_bitrate_DL>,<Guaranteed_bitrate_UL>,<Guaranteed_bitrate_DL>,<Delivery_order>,<Maximum_SDU_size>,<SDU_error_ratio>,<Residual_bit_error_ratio>,<Delivery_of_erroneous_SDUs>,<Transfer_delay>,<Traffic_handling_priority>,<Source_statistics_descriptor>,<Signalling_indication> [+CGEQREQ: <cid>,<Traffic_class>,<Maximum_bitrate_UL>,<Maximum_bitrate_DL>,<Guaranteed_bitrate_UL>,<Guaranteed_bitrate_DL>,<Delivery_order>,<Maximum_SDU_size>,<SDU_error_ratio>,<Residual_bit_error_ratio>,<Delivery_of_erroneous_SDUs>,<Transfer_delay>,<Traffic_handling_priority>,<Source_statistics_descriptor>,<Signalling_indication> [...]] OK	+CGEQREQ: 1,2,5760,5760,0,0,0,1500,"1E4","1E5",0,1000,1,0,0 OK
Test	AT+CGEQREQ=?	+CGEQREQ: <PDP_type>,(list of supported <Traffic_class>s),(list	+CGEQREQ: "IP",(0-4),(1-63 in 1 kbps steps, 64-568 in 8 kbps steps, 576-

Type	Syntax	Response	Example
		of supported <Maximum_bitrate_UL>s),(list of supported <Maximum_bitrate_DL>s),(list of supported <Guaranteed_bitrate_UL>s),(list of supported <Guaranteed_bitrate_DL>s),(list of supported <Delivery_order>s),(list of supported <Maximum_SDU size>s),(list of supported <SDU_error_ratio>s),(list of supported <Residual_bit_error_ratio>s),(list of supported <Delivery_of_erroneous_SDUs>s),(list of supported <Transfer_delay>s),(list of supported <Traffic_handling_priority>s) [+CGEQREQ: <PDP_type>,(list of supported <Traffic_class>s),(list of supported <Maximum_bitrate_UL>s),(list of supported <Maximum_bitrate_DL>s),(list of supported <Guaranteed_bitrate_UL>s),(list of supported <Guaranteed_bitrate_DL>s),(list of supported <Delivery_order>s),(list of supported <Maximum_SDU_size>s),(list of supported <SDU_error_ratio>s),(list of supported <Residual_bit_error_ratio>s),(list of supported <Delivery_of_erroneous_SDUs>s),(list of supported <Transfer_delay>s),(list of supported <Traffic_handling_priority>s),(list of supported <Source_statistics_descriptor>s),(list of supported <Signalling_indication>s) [...]] OK	8640 in 64 kbps steps),(1-63 in 1 kbps steps, 64-568 in 8 kbps steps, 576-8640 in 64 kbps steps, 8700-16000 in 100 kbps steps),(1-63 in 1 kbps steps, 64-568 in 8 kbps steps, 576-8640 in 64 kbps steps),(1-63 in 1 kbps steps, 64-568 in 8 kbps steps, 576-8640 in 64 kbps steps, 8700-16000 in 100 kbps steps),(0-1),(10-1500,1502,1510,1520),("1E6","1E5","1E4","1E3","7E3","1E2","1E1"),("6E8","1E6","1E5","1E4","5E3","4E3","1E3","5E2","1E2"),(0-2),(10-150 in 10 ms steps, 200-950 in 50 ms steps, 1000-4000 in 50 ms steps),(0-3),(0-1),(0-1) OK

17.16.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<PDP_type>	String	See <PDP_type>
<Traffic_class>	Number	Indicates the application type for which the UMTS bearer service is optimized (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • 0: conversational • 1: streaming • 2: interactive • 3: background • 4: subscribed value
<Maximum_bitrate_UL>	Number	Indicates the maximum number of kb/s delivered to UMTS (up-link traffic) at an application processor (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • Range 1-63 in steps of 1 • Range 64-568 in steps of 8 • Range 576-8640 in steps of 64 • Range 8700-16000 in steps of 100 • Range 17000-128000 in steps of 1000 • Range 130000-256000 in steps of 2000
<Maximum_bitrate_DL>	Number	Indicates the maximum number of kb/s delivered by UMTS (down-link traffic) at an application processor (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • Range 1-63 in steps of 1 • Range 64-568 in steps of 8

Parameter	Type	Description
		• Range 576-8640 in steps of 64 • Range 8700-16000 in steps of 100 • Range 17000-128000 in steps of 1000 • Range 130000-256000 in steps of 2000
<Guaranteed_bitrate_UL>	Number	Indicates the guaranteed number of kb/s delivered to UMTS (up-link traffic) at an application processor (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • Range 1-63 in steps of 1 • Range 64-568 in steps of 8 • Range 576-8640 in steps of 64 • Range 8700-16000 in steps of 100 • Range 17000-128000 in steps of 1000 • Range 130000-256000 in steps of 2000
<Guaranteed_bitrate_DL>	Number	Indicates the guaranteed number of kb/s delivered by UMTS (down-link traffic) at an application processor (see the 3GPP TS 24.008 [79], subclause 10 .5.6.5): • Range 1-63 in steps of 1 • Range 64-568 in steps of 8 • Range 576-8640 in steps of 64 • Range 8700-16000 in steps of 100 • Range 17000-128000 in steps of 1000 • Range 130000-256000 in steps of 2000
<Delivery_order>	Number	Indicates whether the UMTS bearer shall provide in-sequence SDU (Service Data Unit) delivery or not (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • 0: no • 1: yes • 2: subscribed value
<Maximum_SDU_size>	Number	Indicates the maximum allowed SDU (Service Data Unit) size in octets (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • 0: subscribed value • Range 10-1500 in steps of 10 octets • 1502 • 1510 • 1520
<SDU_error_ratio>	String	Indicates the target value for the fraction of SDUs (Service Data Unit) lost or detected as erroneous. SDU error ratio is defined only for conforming traffic (see the 3GPP TS 24.008 [79], subclause 10.5.6.5). The value is specified as 'mEe', e.g. a target SDU error ratio of $1*10^{-6}$ would be specified as '1E6': • "1E6": $1*10^{-6}$ • "1E5": $1*10^{-5}$ • "1E4": $1*10^{-4}$ • "1E3": $1*10^{-3}$ • "7E3": $7*10^{-3}$ • "1E2": $1*10^{-2}$ • "1E1": $1*10^{-1}$ • "0E0": subscribed value
<Residual_bit_error_ratio>	String	Indicates the target value for the undetected bit error ratio in the delivered SDUs (Service Data Unit). If no error detection is requested, the parameter indicates the bit error ratio in the delivered SDUs (see the 3GPP TS 24.008 [79], subclause 10.5.6.5). The value is specified as 'mEe', e.g. a target SDU error ratio of $5*10^{-2}$ would be specified as '5E2': • "6E8": $6*10^{-8}$ • "1E6": $1*10^{-6}$ • "1E5": $1*10^{-5}$ • "1E4": $1*10^{-4}$ • "5E3": $5*10^{-3}$ • "4E3": $4*10^{-3}$ • "1E3": $1*10^{-3}$ • "5E2": $5*10^{-2}$ • "1E2": $1*10^{-2}$

Parameter	Type	Description
		• "0E0": subscribed value
<Delivery_of_erroneous_SDUs>	Number	Indicates whether SDUs (Service Data Unit) detected as erroneous shall be delivered or not (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • 0: no • 1: yes • 2: no detect • 3 (default value): subscribed value
<Transfer_delay>	Number	Indicates the target time, in milliseconds, between a request to transfer an SDU (Service Data Unit) at an application processor and its delivery at the other application processor (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • Range 10-150 in steps of 10 • Range 200-950 in steps of 50 • Range 1000-4000 in steps of 100
<Traffic_handling_priority>	Number	Specifies the relative importance for handling of all SDUs (Service Data Unit) belonging to the UMTS bearer compared to the SDUs of other bearers (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • 0: subscribed • 1: priority level 1 • 2: priority level 2 • 3: priority level 3
<Source_statistics_descriptor>	Number	Specifies the characteristics of the source of the submitted SDUs for a PDP context: • 0 (default value): characteristics of the SDUs unknown • 1: characteristics of the SDUs correspond to a speech source
<Signalling_indication>	Number	Specifies signaling content of submitted SDUs for a PDP context: • 0 (default value): PDP context is not optimized for signalling • 1: PDP context is optimized for signalling <PDP_type>

17.16.4 Notes

- If <Maximum_bitrate_UL>, <Maximum bitrate DL>, <Guaranteed_bitrate_UL>, <Guaranteed_bitrate_DL>, <Maximum_SDU_size> and <Transfer_delay> parameters are set outside the allowed range, an error message will be provided. If the value is selected within the allowed range, it is rounded to the closest allowed value according to the specified steps.
- If <Traffic_class>=0 (conversational) or <Traffic_class>=1 (streaming), <Maximum_bitrate_UL>, <Maximum_bitrate_DL>, <Guaranteed_bitrate_UL> and <Guaranteed_bitrate_DL> must be provided.
- If <Traffic_class>=0 (conversational) or <Traffic_class>=1 (streaming), <Source_statistics_descriptor> must be provided.
- If <Traffic_class>=2 (interactive), <Signalling_indication> must be provided.

17.17 3G Quality of service profile (minimum acceptable) +CGEQMIN

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

17.17.1 Description

This command allows the TE to specifiy a minimum acceptable profile, which is checked by the MT against the negotiated profile returned in the Activate/Modify PDP Context Accept message. The set command specifies a profile for the context identified by the <cid>. The specified profile will be stored in the MT and checked against the negotiated profile only at activation or MS initiated modification of the related context. This command is actually an extension to the commands +CGDSCONT and +CGDCONT. The special form of this command +CGEQMIN=<cid> causes the minimum acceptable profile for context number <cid> to become undefined. No check is made against the negotiated profile.

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

17.17.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGEQMIN=[<cid>[,<Traffic_class>[,<Maximum_bitrate_UL>[,<Maximum_bitrate_DL>[,<Guaranteed_bitrate_UL>[,<Guaranteed_bitrate_DL>[,<Delivery_order>[,<Maximum_SDU_size>[,<SDU_error_ratio>[,<Residual_bit_error_ratio>[,<Delivery_of_erroneous_SDUs>[,<Transfer_delay>[,<Traffic_handling_priority>[,<Source_statistics_descriptor> [,<Signalling_indication>]]]]]]]]]]]]]]	OK	AT+CGEQMIN=1,2,5760,7168,0,0,0,1480,"1E3","1E5",2,1000,1,0,0 OK
Read	AT+CGEQMIN?	+CGEQMIN: <cid>,<Traffic_class>,<Maximum_bitrate_UL>,<Maximum_bitrate_DL>,<Guaranteed_bitrate_UL>,<Guaranteed_bitrate_DL>,<Delivery_order>,<Maximum_SDU_size>,<SDU_error_ratio>,<Residual_bit_error_ratio>,<Delivery_of_erroneous_SDUs>,<Transfer_delay>,<Traffic_handling_priority>,<Source_statistics_descriptor>,<Signalling_indication> [+CGEQMIN: <cid>,<Traffic_class>,<Maximum_bitrate_UL>,<Maximum_bitrate_DL>,<Guaranteed_bitrate_UL>,<Guaranteed_bitrate_DL>,<Delivery_order>,<Maximum_SDU_size>,<SDU_error_ratio>,<Residual_bit_error_ratio>,<Delivery of erroneous SDUs>,<Transfer_delay>,<Traffic_handling_priority>,<Source_statistics_descriptor>,<Signalling_indication> [...]] OK	+CGEQMIN: 1,2,5760,7168,0,0,0,1480,"1E3","1E5",2,1000,1,0,0 OK
Test	AT+CGEQMIN=?	+CGEQMIN: <PDP_type>,(list of supported <Traffic_class>s),(list of supported <Maximum_bitrate_UL>s),(list of supported <Maximum_bitrate_DL>s),(list of supported <Guaranteed_bitrate_UL>s),(list of supported <Guaranteed_bitrate_DL>s),(list of supported <Delivery_order>s),(list of supported <Maximum_SDU_size>s),(list of supported <SDU_error_ratio>s),(list of supported <Residual_bit_error_ratio>s),(list of supported <Delivery_of_erroneous_SDUs>s),(list of supported <Transfer_delay>s),(list of supported <Traffic_handling_priority>s) [+CGEQMIN: <PDP_type>,(list of supported <Traffic_class>s),(list of supported <Maximum_bitrate_	+CGEQMIN: "IP",(0-3),(1-63 in 1 kbps steps, 64-568 in 8 kbps steps, 576-8640 in 64 kbps steps),(1-63 in 1 kbps steps, 64-568 in 8 kbps steps, 576-8640 in 64 kbps steps, 8700-16000 in 100 kbps steps),(1-63 in 1 kbps steps, 64-568 in 8 kbps steps, 576-8640 in 64 kbps steps),(1-63 in 1 kbps steps, 64-568 in 8 kbps steps, 576-8640 in 64 kbps steps, 8700-16000 in 100 kbps steps),(0-1),(10-1500,1502,1510,1520),("1E6","1E5","1E4","1E3","7E3","1E2","1E1"),("6E8","1E6","1E5","1E4","5E3","4E3","1E3","5E2","1E2"),(0-2),(10-150 in 10 ms steps, 200-950 in 50 ms steps, 100 0-4000 in 50 ms steps),(0-3),(0-1),(0-1) OK

Type	Syntax	Response	Example
		UL>s),(list of supported <Maximum_ bitrate_DL>s),(list of supported <Guaranteed_bitrate_UL>s), (list of supported <Guaranteed_ bitrate_DL>s),(list of supported <Delivery_order>s),(list of supported <Maximum_SDU_size>s),(list of supported <SDU_error_ratio>s),(list of supported <Residual_bit_error_ ratio>s),(list of supported <Delivery_ of_erroneous_SDUs>s),(list of supported <Transfer_delay>s),(list of supported <Traffic_handling_ priority>s),(list of supported <Source_statistics_descriptor>s), (list of supported <Signalling_ indication>s) [...]] OK	

17.17.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<PDP_type>	String	See <PDP_type>
<Traffic_class>	Number	Indicates the application type for which the UMTS bearer service is optimized (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • 0: conversational • 1: streaming • 2: interactive • 3: background • 4: subscribed value
<Maximum_bitrate_UL>	Number	Indicates the maximum number of kb/s delivered to UMTS (up-link traffic) at an application processor (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • Range 1-63 in steps of 1 • Range 64-568 in steps of 8 • Range 576-8640 in steps of 64 • Range 8700-16000 in steps of 100 • Range 17000-128000 in steps of 1000 • Range 130000-256000 in steps of 2000
<Maximum_bitrate_DL>	Number	Indicates the maximum number of kb/s delivered by UMTS (down-link traffic) at an application processor (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • Range 1-63 in steps of 1 • Range 64-568 in steps of 8 • Range 576-8640 in steps of 64 • Range 8700-16000 in steps of 100 • Range 17000-128000 in steps of 1000 • Range 130000-256000 in steps of 2000
<Guaranteed_bitrate_UL>	Number	Indicates the guaranteed the maximum number of kb/s delivered to UMTS (up-link traffic) at an application processor (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • Range 1-63 in steps of 1 • Range 64-568 in steps of 8 • Range 576-8640 in steps of 64 • Range 8700-16000 in steps of 100 • Range 17000-128000 in steps of 1000 • Range 130000-256000 in steps of 2000
<Guaranteed_bitrate_DL>	Number	Indicates the guaranteed number of kb/s delivered by UMTS (down-link traffic) at an application processor (see the 3GPP TS 24.008 [79], subclause 10 .5.6.5):

Parameter	Type	Description
		• Range 1-63 in steps of 1 • Range 64-568 in steps of 8 • Range 576-8640 in steps of 64 • Range 8700-16000 in steps of 100 • Range 17000-128000 in steps of 1000 • Range 130000-256000 in steps of 2000
<Delivery_order>	Number	Indicates whether the UMTS bearer shall provide in-sequence SDU (Service Data Unit) delivery or not (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • 0: no • 1: yes • 2: subscribed value
<Maximum_SDU_size>	Number	Indicates the maximum allowed SDU (Service Data Unit) size in octets (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • 0: subscribed value • Range 10-1500 in steps of 10 octets • 1502 • 1510 • 1520
<SDU_error_ratio>	String	Indicates the target value for the fraction of SDUs (Service Data Unit) lost or detected as erroneous. SDU error ratio is defined only for conforming traffic (see the 3GPP TS 24.008 [79], subclause 10.5.6.5). The value is specified as 'mEe', e.g. a target SDU error ratio of $1*10^{-6}$ would be specified as '1E6': • "1E6": $1*10^{-6}$ • "1E5": $1*10^{-5}$ • "1E4": $1*10^{-4}$ • "1E3": $1*10^{-3}$ • "7E3": $7*10^{-3}$ • "1E2": $1*10^{-2}$ • "1E1": $1*10^{-1}$ • "0E0": subscribed value
<Residual_bit_error_ratio>	String	Indicates the target value for the undetected bit error ratio in the delivered SDUs (Service Data Unit). If no error detection is requested, the parameter indicates the bit error ratio in the delivered SDUs (see the 3GPP TS 24.008 [79], subclause 10.5.6.5). The value is specified as 'mEe', e.g. a target SDU error ratio of $5*10^{-2}$ would be specified as '5E2': • "6E8": $6*10^{-8}$ • "1E6": $1*10^{-6}$ • "1E5": $1*10^{-5}$ • "1E4": $1*10^{-4}$ • "5E3": $5*10^{-3}$ • "4E3": $4*10^{-3}$ • "1E3": $1*10^{-3}$ • "5E2": $5*10^{-2}$ • "1E2": $1*10^{-2}$ • "0E0": subscribed value
<Delivery_of_erroneous_SDUs>	Number	Indicates whether SDUs (Service Data Unit) detected as erroneous shall be delivered or not (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • 0: no • 1: yes • 2: no detect • 3 (default value): subscribed value
<Transfer_delay>	Number	Indicates the target time, in milliseconds, between a request to transfer an SDU (Service Data Unit) at an application processor and its delivery at the other application processor (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • Range 10-150 in steps of 10 • Range 200-950 in steps of 50 • Range 1000-4000 in steps of 100

Parameter	Type	Description
<Traffic_handling_priority>	Number	Specifies the relative importance for handling of all SDUs (Service Data Unit) belonging to the UMTS bearer compared to the SDUs of other bearers (see the 3GPP TS 24.008 [79], subclause 10.5.6.5): • 0: subscribed • 1: priority level 1 • 2: priority level 2 • 3: priority level 3
<Source_statistics_ descriptor>	Number	Specifies the characteristics of the source of the submitted SDUs for a PDP context: • 0 (default value): characteristics of the SDUs unknown • 1: characteristics of the SDUs correspond to a speech source
<Signalling_indication>	Number	Specifies signaling content of submitted SDUs for a PDP context: • 0 (default value): PDP context is not optimized for signalling • 1: PDP context is optimized for signalling

17.17.4 Notes

- If <Maximum_bitrate_UL>, <Maximum bitrate DL>, <Guaranteed_bitrate_UL>, <Guaranteed_bitrate_DL>, <Maximum_SDU_size> and <Transfer_delay> parameters are set outside the allowed range, an error message will be provided. If the value is selected within the allowed range, it is rounded to the closest allowed value according to the specified steps.
- If <Traffic_class>=0 (conversational) or <Traffic_class>=1 (streaming), <Maximum_bitrate_UL>, <Maximum bitrate DL>, <Guaranteed_bitrate_UL>, <Guaranteed_bitrate_DL>, <Source_statistics_ descriptor> must be provided.
- If <Traffic_class>=2 (interactive), <Signalling_indication> must be provided.

17.18 Define secondary PDP context +CGDSCONT

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

17.18.1 Description

Configures the PDP context parameter values for a secondary PDP context, identified by the local context identification parameter <cid>, associated to a primary PDP context identified by the local context identification parameter <p_cid>:

- The <p_cid> parameter is mandatory when a secondary context is newly defined.
- The <p_cid> parameter can be omitted only when the context is already defined; in this case the PDP context identified by <cid> becomes undefined.

17.18.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGDSCONT=[<cid>[,<p_cid>[,<d_comp>[,<h_comp>[,<IM_CN_Signalling_Flag_Ind>]]]]]	OK	AT+CGDSCONT=2,1 OK
Read	AT+CGDSCONT?	+CGDSCONT: <cid>,<p_cid>,<d_comp>,<h_comp>[,<IM_CN_Signalling_Flag_Ind>] [+CGDSCONT: <cid>,<p_cid>,<d_comp>,<h_comp>[,<IM_CN_Signalling_Flag_Ind>] [...]] OK	+CGDSCONT: 2,1,0,0,0 OK
Test	AT+CGDSCONT=?	+CGDSCONT: (list of supported <cid>s),(list of <cid>s for defined primary contexts),(list of supported	+CGDSCONT: (1-8),(4,8),(0-2),(0-2),(0-1)

Type	Syntax	Response	Example
		<d_comp>s),(list of supported <h_comp>s)[,(list of supported <IM_CN_Signalling_Flag_Ind>)] OK	OK

17.18.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<p_cid>	Number	Numeric parameter that identifies the particular PDP context definition, specified using +CGDCONT, to which a secondary PDP context definition will be associated using +CGDSCONT. This parameter is only locally valid on the interface TE-MT.
<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)
<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

17.19 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

17.19.1 Description

Configures the network registration URC related to EPS domain. The URC assumes a different syntax depending on the network and the <n> parameter:

- +CEREG: <stat> when <n>=1 and there is a change in the MT's EPS network registration status in E-UTRAN
- +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>]] when <n>=2 and there is a change of the network cell in EUTRAN
- +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,<cause_type>,<reject_cause>]] when <n>=3 and the value of <stat> changes
- +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,,[,[<Assigned_Active_Time>,[<Assigned_Periodic_TAU>]]]]] when <n>=4 if there is a change of the network cell in E-UTRAN
- +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,[<cause_type>],[<reject_cause>][,[<Assigned_Active_Time>,[<Assigned_Periodic_TAU>]]]]] when <n>=5 and the value of <stat> changes

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

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

registered with the network, PSM is granted by the network and an extended periodic TAU value (T3412_ext) is assigned.

LARA-R6
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.

17.19.2 Syntax

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

17.19.3 Defined values

Parameter	Type	Description
<n>	Number	Mode configuration: • 0: network registration URC disabled • 1: network registration URC +CEREG: <stat> enabled • 2: network registration and location information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>]] enabled • 3: network registration, location information and EMM cause value information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,<cause_type>,<reject_cause>]] enabled • 4: PSM, network registration and location information information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,,[,[<Assigned_Active_Time>[,<Assigned_Periodic_TAU>]]]]] enabled • 5: PSM, network registration, location information and EMM cause value information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,[<cause_type>],[<reject_cause>][,[<Assigned_Active_Time>,[<Assigned_Periodic_TAU>]]]]] enabled Allowed values: • LARA-R6 - 0 (default value), 1, 2, 3, 4
<stat>	Number	EPS registration status: • 0: not registered • 1: registered, home network • 2: not registered, but the MT is currently trying to attach or searching an operator to register to • 3: registration denied • 4: unknown (e.g. out of E-UTRAN coverage) • 5: registered, roaming • 8: attached for emergency bearer services only (see 3GPP TS 24.008 [79] and 3GPP TS 24.301 [114] that specify the condition when the MS is considered as attached for emergency bearer services)
<tac>	String	Two bytes tracking area code in hexadecimal format
<ci>	String	Four bytes E-UTRAN cell-id in hexadecimal format
<AcT>	Number	Access technology of the serving cell: • 0: GSM • 3: GSM/GPRS with EDGE availability

Parameter	Type	Description
		• 7: E-UTRAN (see 3GPP TS 44.060 [115] that specifies the System Information messages which give the information about whether the serving cell supports EGPRS) • 8: E-UTRAN EC-GSM-IoT (A/Gb mode) • 9: E-UTRAN NB-IoT Allowed values: • LARA-R6 - 7
<cause_type>	Number	<reject_cause> type: • 0: indicates that <reject_cause> contains an EMM cause value, see 3GPP TS 24.301 [114] Annex A • 1: indicates that <reject_cause> contains a manufacture-specific cause Allowed values: • LARA-R6 - 0
<reject_cause>	Number	Cause of the failed registration. The value is of type as defined by <cause_type>
<Assigned_Active_Time>	String	One byte in an 8 bit format. Assigned Active Time value (T3324) allocated to the UE. The assigned Active Time value is coded as one byte (octet 3) of the GPRS Timer 2 information element coded as bit format (e.g. "00100100" equals 4 minutes). For the coding and the value range, see the GPRS Timer 2 IE in 3GPP TS 24.008 table 10.5.163/3GPP TS 24.008 [79]. See also 3GPP TS 23.682 [154], 3GPP TS 23.060 [77]) and 3GPP TS 23.401 [155].
<Assigned_Periodic_TAU>	String	One byte in an 8 bit format. Assigned extended periodic TAU value (T3412_ext) allocated to the UE. The assigned extended periodic TAU value is coded as one byte (octet 3) of the GPRS Timer 3 information element coded as bit format (e.g. "01000111" equals 70 hours). For the coding and the value range, see the GPRS Timer 2 IE in 3GPP TS 24.008 table 10.5.163a/3GPP TS 24.008 [79]. See also 3GPP TS 23.682 [154] and 3GPP TS 23.401 [155].
<rac_or_mme>	String	RAC (Routing Area Code) or MME Code (Mobile Management Entity) in hexadecimal format

17.19.4 Notes

LARA-R6

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

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

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

17.20.1 Description

Configures the authentication parameters of a defined PDP/EPS bearer. The authentication parameters will be sent during the context activation phase as a protocol configuration options (PCO) information element.

LARA-R6
The command returns an error result code if the input <cid> is already active or not yet defined.

17.20.2 Syntax

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

17.20.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>.
<auth_type>	Number	Configure the authentication: • 0 (factory-programmed value): no authentication • 1: PAP • 2: CHAP • 3: automatic selection of authentication type (none/CHAP/PAP) Allowed values: • LARA-R6 - 0, 1, 2, 3
<username>	String	Username. The factory-programmed value is an empty string: • LARA-R6 - The maximum length is 127.
<password>	String	Password. The default value is an empty string: • LARA-R6 - The maximum length is 127.

17.20.4 Notes

- In a PPP dial-up scenario, the authentication parameters set by the +UAUTHREQ command are overwritten whenever the host provides a new setting via the PPP authentication protocol (PAP or CHAP).

LARA-R6

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

17.21 Define EPS quality of service +CGEQOS

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

17.21.1 Description

Allows the TE to specify the EPS quality of service parameters <cid>, <QCI>, <DL_GBR>, <UL_GBR>, <DL_MBR> and <UL_MBR> for a PDP context or traffic flows (see 3GPP TS 24.301 [114] and 3GPP TS 23.203 [117]). When in UMTS/GPRS the MT applies a mapping function to UTMS/GPRS quality of service.

The read command returns the current settings for each defined QoS.

☞ The set command +CGEQOS=<cid> causes the values for context number <cid> to become undefined.

☞ LARA-R6
Before activating a secondary PDP context, issue the +CGEQOS set command to set specific EPS quality of service parameters.

17.21.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGEQOS=[<cid>[,<QCI>[,<DL_GBR>,<UL_GBR>[,<DL_MBR>,<UL_MBR>]]]]	OK	AT+CGEQOS=1,1,2500,7000,2500,7000 OK
Read	AT+CGEQOS?	[+CGEQOS: <cid>,<QCI>,[<DL_GBR>,<UL_GBR>],[<DL_MBR>,<UL_MBR>]] [+CGEQOS: <cid>,<QCI>,[<DL_GBR>,<UL_GBR>],[<DL_MBR>,<UL_MBR>] [...]] OK	+CGEQOS: 1,1,2500,7000,2500,7000 OK

Type	Syntax	Response	Example
Test	AT+CGEQOS=?	+CGEQOS: (list of supported <cid>s),(list of supported <QCI>s), (list of supported <DL_GBR>s), (list of supported <UL_GBR>s),(list of supported <DL_MBR>s),(list of supported <UL_MBR>s) OK	+CGEQOS: (1-8),(0-9),(0-5000),(0-21000),(0-5000),(0-21000) OK

17.21.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>.
<QCI>	Number	Specifies a class of EPS QoS (see 3GPP TS 24.301 [114]): • 0: QCI is selected by network • 1-4: value range for guaranteed bit rate traffic flows • 5-9: value range for non-guaranteed bit rate traffic flows • 128-254: value range for Operator-specific QCIs
<DL_GBR>	Number	Indicates DL guaranteed bit rate (GBR) in case of GBR QCI. The value is expressed in kb/s. This parameter is omitted for a non-GBR QCI (see 3GPP TS 24.301 [114]).
<UL_GBR>	Number	Indicates UL guaranteed bit rate (GBR) in case of GBR QCI. The value is expressed in kb/s. This parameter is omitted for a non-GBR QCI (see 3GPP TS 24.301 [114]).
<DL_MBR>	Number	Indicates DL maximum bit rate (MBR) in case of GBR QCI. The value is expressed in kb/s. This parameter is omitted for a non-GBR QCI (see 3GPP TS 24.301 [114]).
<UL_MBR>	Number	Indicates UL maximum bit rate (MBR) in case of GBR QCI. The value is expressed in kb/s. This parameter is omitted for a non-GBR QCI (see 3GPP TS 24.301 [114]).

17.22 PDP context read dynamic parameters +CGCONTRDP

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

17.22.1 Description

Returns the relevant information <bearer_id>, <APN>, <local_addr_and_subnet_mask>, <gw_addr>, <DNS_prim_addr>, <DNS_sec_addr>, <P-CSCF_prim_addr>, <P-CSCF_sec_addr>, <IM_CN_Signalling_Flag_Ind>, <LIPA_indication>, <IPv4_MTU> and <WLAN_offload> for an active non secondary PDP context with the context identifier <cid>.

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

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

LARA-R6
If the <pdp_type> parameter is set to "IPV4V6", for each IP address both the IPv4 and the IPv6 addresses are printed. The printing format depends on the parameter:

- <local_addr_and_subnet_mask>, <P-CSCF_prim_addr>, <P-CSCF_sec_addr>: the IPv4 address and the IPv6 addresses are separated by a comma (**<IPv4>,<IPv6>**).
- <gw_addr>, <DNS_prim_addr>, <DNS_sec_addr>: the IPv4 address and the IPv6 addresses are separated by a space (**<IPv4> <IPv6>**).

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

LARA-R6
The IPv6 addresses notation depends on the +CGPIAF setting.

17.22.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGCONTRDP[=<cid>]	[+CGCONTRDP: <cid>,<bearer_id>,<APN>[,<local_addr_and_subnet_mask>[,<gw_addr>[,<DNS_prim_addr>[,<DNS_sec_addr>[,<P-CSCF_prim_addr>[,<P-CSCF_sec_addr>[,<IM_CN_Signalling_Flag_Ind>[,<LIPA_indication>[,<IPv4_MTU>[,<WLAN_offload>[,<Local_Addr_Ind>[,<Non_IP_MTU>[,<Serving_PLMN_rate_control_value>]]]]]]]]]]]]] [+CGCONTRDP: <cid>,<bearer_id>,<APN>[,<local_addr_and_subnet_mask> [,<gw_addr>[,<DNS_prim_addr>[,<DNS_sec_addr>[,<P-CSCF_prim_addr>[,<P-CSCF_sec_addr>[,<IM_CN_Signalling_Flag_Ind>[,<LIPA_indication>[,<IPv4_MTU>[,<WLAN_offload>[,<Local_Addr_Ind>[,<Non_IP_MTU>[,<Serving_PLMN_rate_control_value>]]]]]]]]]]]]] [...]] OK	AT+CGCONTRDP=1 +CGCONTRDP: 1,0,"web.omnitel.it", "109.113.62.238.255.255.255.255", "109.113.62.201","83.224.70.77", "83.224.70.54",,,,0,0,0,0 OK
Test	AT+CGCONTRDP=?	+CGCONTRDP: (list of active non secondary PDP contexts) OK	+CGCONTRDP: 1 OK

17.22.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>.
<APN>	String	See <APN>.
<bearer_id>	Number	Identifies the bearer, i.e. the EPS bearer in EPS and the NSAPI in UMTS/GPRS. The range goes from 5 to 16.
<local_addr_and_subnet_mask>	String	IP address and subnet mask of the MT. The string is given as dot-separated numeric (0-255) parameters on the form: • "a1.a2.a3.a4.m1.m2.m3.m4" for IPv4 • "a1.a2.a3.a4.a5.a6.a7.a8.a9.a10 .a11.a12.a13.a14.a15.a16.m1.m2.m3.m4.m5.m6.m7.m8.m9.m10 .m11.m12.m13.m14.m15.m16" for IPv6
<gw_addr>	String	Gateway address of the MT. The string is given as dot-separated numeric (0-255) parameters.
<DNS_prim_addr>	String	IP address of the primary DNS server.
<DNS_sec_addr>	String	IP address of the secondary DNS server.
<P-CSCF_prim_addr>	String	IP address of the primary P-CSCF server.
<P-CSCF_sec_addr>	String	IP address of the secondary P-CSCF server.
<IM_CN_Signalling_Flag_Ind>	Number	Shows whether the PDP context is for IM CN subsystem-related signalling only or not: • 0: PDP context is not for IM CN subsystem-related signalling only • 1: PDP context is for IM CN subsystem-related signalling only
<LIPA_indication>	Number	Indicates that the PDP context provides connectivity using a LIPA PDN connection. This parameter cannot be set by the TE: • 0: indication not received that the PDP context provides connectivity using a LIPA PDN connection • 1: indication received that the PDP context provides connectivity using a LIPA PDN connection
<IPv4_MTU>	Number	Provides the IPv4 MTU size in octets.

Parameter	Type	Description
<WLAN_offload>	Number	Indicates whether the traffic can be offloaded using the specified PDN connection via a WLAN or not. This refers to bits 1 and 2 of the WLAN offload acceptability IE as specified in 3GPP TS 24.008 [79] subclause 10.5.6.20. Allowed values: • 0: offloading the traffic of the PDN connection via a WLAN when in S1 mode or when in Iu mode is not acceptable • 1: offloading the traffic of the PDN connection via a WLAN when in S1 mode is acceptable, but not acceptable in Iu mode • 2: offloading the traffic of the PDN connection via a WLAN when in Iu mode is acceptable, but not acceptable in S1 mode • 3: offloading the traffic of the PDN connection via a WLAN when in S1 mode or when in Iu mode is acceptable
<Local_Addr_Ind>	Number	Indicates whether or not the MS and the network support local IP address in TFTs (see 3GPP TS 24.301 [114] and 3GPP TS 24.008 [79] subclause 10.5.6.3). Allowed values: • 0: indicates that the MS or the network or both do not support local IP address in TFTs • 1: indicates that the MS and the network support local IP address in TFTs
<Non_IP_MTU>	Number	Non-IP MTU size in octets.
<Serving_PLMN_rate_control_value>	Number	Indicates the maximum number of uplink messages the UE is allowed to send in a 6 minutes interval. This refers to octet 3 to 4 of the Serving PLMN rate control IE as specified in 3GPP TS 24.301 [114].

17.22.4 Notes

LARA-R6

- The <IM_CN_Signalling_Flag_Ind>, <LIPA_indication>, <WLAN_offload>, <Local_Addr_Ind>, <Non_IP_MTU> and <Serving_PLMN_rate_control_value> parameters are not supported.
- The <local_addr_and_subnet_mask> do not include the MT subnet mask.

17.23 Traffic flow template +CGTFT

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

17.23.1 Description

Allows the TE to specify a packet filter (PF) for a traffic flow template (TFT) that is used in the gateway GPRS support node (GGSN) for routing of down-link packets onto different QoS flows towards the TE (see the 3GPP TS 23.060 [77] and 3GPP TS 24.008 [79]). A TFT is identified by a <packet filter identifier> and each packet filter also has an <evaluation precedence index>. The set command specifies a Packet Filters to be added to the TFT stored in the MT and used for the context identified by <cid>. This command is effectively an extension of the +CGDCONT and +CGDSCONT AT commands that shall be issued previously.

The syntax +CGTFT=<cid> causes all of the Packet Filters in the TFT for the specified <cid> to become undefined.

Not all the parameters combinations are allowed in a Packet Filter, some may coexist but others are mutually exclusive. The possible combinations are specified in 3GPP TS 23.060 [77].

☞ A valid packet filter must contain a unique identifier and a unique evaluation precedence index within all TFTs for one PDP address. The network will reject the activation of a secondary PDP context if the corresponding packet filter contains an identifier or an evaluation precedence index which is not unique within all TFTs for one PDP address.

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

17.23.2 Syntax

Type	Syntax	Response	Example
Set	AT+CGTFT=[<cid>,<packet_filter_identifier>,<evaluation_precedence_index>[,<remote_address_and_subnet_mask>[,<protocol_number_(ipv4)-next_header_(ipv6)>[,<destination_port_range>[,<source_port_range>[,<ipsec_security_parameter_index_(spi)>[,<type_of_service_(tos)_(ipv4)_and_mask-traffic_class_(ipv6)_and_mask>[,<flow_label (ipv6)>[,<direction>[,<local_address_and_subnet_mask>]]]]]]]]]	OK	AT+CGTFT=2,1,1,"10 9.115.183.216.255.255.0.0" OK
Read	AT+CGTFT?	+CGTFT: <cid>,<packet_filter_identifier>,<evaluation_precedence_index>,<remote_address_and_subnet_mask>,<protocol_number_(ipv4)-next_header_(ipv6)>,<destination_port_range>,<source_port_range>,<ipsec_security_parameter_index_(spi)>,<type_of_service_(tos)_(ipv4)_and_mask-traffic_class_(ipv6)_and_mask>,<flow label (ipv6)>,<direction>,<local_address_and_subnet_mask> [+CGTFT: <cid>,<packet_filter_identifier>,<evaluation_precedence_index>,<remote_address_and_subnet_mask>,<protocol_number_(ipv4)-next_header_(ipv6)>,<destination_port_range>,<source_port_range>,<ipsec_security_parameter_index_(spi)>,<type_of_service_(tos)_(ipv4)_and_mask-traffic_class_(ipv6)_and_mask>,<flow_label (ipv6)>,<direction>,<local_address_and_subnet_mask> [...]] OK	+CGTFT: 2,1,1,"10 9.115.183.216.255.255.0.0",0,"0.0","0 .0",00000000,"0.0",00000 OK
Test	AT+CGTFT=?	+CGTFT: <PDP_type>,(list of supported <packet_filter_identifier>s),(list of supported <evaluation_precedence_index>s),(list of supported <remote_address_and_subnet_mask>s),(list of supported <protocol_number_(ipv4)-next_header_(ipv6)>s),(list of supported <destination_port_range>s),(list of supported <source_port_range>s),(list of supported <ipsec_security_parameter_index_(spi)>s),(list of supported <type_of_service_(tos)_(ipv4)_and_mask-traffic_class_(ipv6)_and_mask>s),(list of supported <flow_label (ipv6)>s),(list of supported <direction>s),(list of supported <local_address_and_subnet_mask>s) [+CGTFT: <PDP_type>,(list of supported <packet_filter_identifier>s),(list of supported	+CGTFT: IP,(1-16),(0-255),("0.0.0.0.0.0.0.0-255.255.255.255.255.255.255.255"),(0-255),("0.0-65535.65535"),("0.0-65535.65535"),(00000000-ffffffff),("0.0-255.255"),(00000-FFFFF),("0.0.0.0.0.0.0.0-255.255.255.255.255.255.255.255") OK

Type	Syntax	Response	Example
		<evaluation_precedence_index>s),(list of supported <source_address_and_subnet_mask>s),(list of supported <protocol_number_(ipv4)-next_header_(ipv6)>s),(list of supported <destination_port_range>s),(list of supported <source_port_range>s),(list of supported <ipsec_security_parameter_index_(spi)>s),(list of supported <type_of_service_(tos)_(ipv4)_and_mask-traffic_class_(ipv6)_and_mask>s),(list of supported <flow_label (ipv6)>s),(list of supported <direction>s),(list of supported <local_address_and_subnet_mask>s) [...]] OK	

17.23.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>
<PDP_type>	String	See <PDP_type>
<packet_filter_identifier>	Number	Packet filter: • LARA-R6 - Range: 1-16
<evaluation_precedence_index>	Number	Evaluation precedence index that is unique within all TFTs associated with the PDP contexts that share the same PDP address: • Range: 0-255 (from highest evaluation precedence to lowest evaluation precedence)
<remote_address_and_subnet_mask>	String	Specifies the remote address and subnet mask attribute of a valid packet filter. Consists of dot-separated numeric (0-255) parameters on the form: • "a1.a2.a3.a4.m1.m2.m3.m4" for IPv4 • "a1.a2.a3.a4.a5.a6.a7.a8.a9.a10.a11.a12.a13.a14.a15.a16 .m1.m2.m3.m4.m5.m6.m7.m8.m9.m10 .m11.m12.m13.m14.m15.m16" for IPv6
<protocol_number_(ipv4)-next_header_(ipv6)>	Number	Specifies the Protocol Number / Next Header attribute of a valid packet filter. It shall contain either an IPv4 Protocol Number or an IPv6 Next Header value: • Range: 0-255
<destination_port_range>	String	String parameter given as dot-separated numbers on the form "f.t" that specifies the destination port range attribute of a valid packet filter: • Range: 0-65535
<source_port_range>	String	Dot-separated numbers on the form "f.t" that specifies the source port range attribute of a valid packet filter: • Range: 0-65535
<ipsec_security_parameter_index_(spi)>	Number	IPSec SPI attribute of a valid packet filter which is a 32-bit field: • Range: 00000000-FFFFFFFF
<type_of_service_(tos)_(ipv4)_and_mask-traffic_class_(ipv6)_and_mask>	String	Dot-separated numbers on the form "t.m" that specifies the Type of Service / Traffic Class and Mask attribute of a valid packet filter. It shall contain either an IPv4 TOS octet or an IPv6 Traffic Class octet along with a mask defining which of the 8 bits should be used for matching. • Range: 0-255
<flow_label(ipv6)>	Number	Specifies the Flow Label attribute of a valid packet filter. It shall contain an IPv6 flow label, which is a 20-bit field. It only is valid for IPv6.

Parameter	Type	Description
		• Range: 00000-FFFFF
<direction>	Number	Specifies the transmission direction in which the packet filter shall be applied: • 0: Pre Release 7 TFT Filter (see 3GPP TS 24.008 [79], table 10 .5.162) • 1: uplink • 2: downlink • 3: bidirectional (used for uplink and downlink)
<local_address_and_subnet_mask>	String	Specifies the local address and subnet mask attribute of a valid packet filter. Consists of dot-separated numeric (0-255) parameters on the form: • "a1.a2.a3.a4.m1.m2.m3.m4" for IPv4 • "a1.a2.a3.a4.a5.a6.a7.a8.a9.a10.a11.a12.a13.a14.a15.a16 .m1.m2.m3.m4.m5.m6.m7.m8.m9.m10 .m11.m12.m13.m14.m15.m16" for IPv6

17.24 Read counters of sent or received PS data +UGCNTRD

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

17.24.1 Description

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

LARA-R6
The command returns the counters values for total sent / received bytes only for activated contexts.

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

17.24.2 Syntax

Type	Syntax	Response	Example
Action	AT+UGCNTRD	+UGCNTRD: <cid>,<sent_sess_ bytes>,<received_sess_bytes>, <sent_total_bytes>,<received_ total_bytes> [[...] +UGCNTRD: <cid>,<sent_sess_ bytes>,<received_sess_bytes>, <sent_total_bytes>,<received_ total_bytes>]] OK	AT+UGCNTRD +UGCNTRD: 1,100,0,100,0 OK
Test	AT+UGCNTRD=?	OK	

17.24.3 Defined values

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

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

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

17.25.1 Description

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

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

☞ LARA-R6
If <cid>=0 than the total counter for every defined context is set to zero. The offset parameters are ignored in this case.

☞ LARA-R6
The command allows to set the counter for total sent/received bytes only for activated contexts.

17.25.2 Syntax

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

17.25.3 Defined values

Parameter	Type	Description
<cid>	Number	Local PDP context identifier: • LARA-R6 - the range goes from 0 to 24
<total_bytes_sent_offset>	Number	Long number containing the offset of total sent bytes used for counting in the range 0-0x7FFFFFFE.
<total_bytes_received_offset>	Number	Long number containing the offset of total received bytes used for counting in the range 0-0x7FFFFFFE.
<sim_id>	Number	SIM identity. Only value 0 is supported.

17.25.4 Notes

LARA-R6

- The <sim_id> parameter is not supported.

17.26 PDP IP configuration when roaming +UDCONF=75

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

17.26.1 Description

Configures the PDP IP when roaming. When set, the PDP IP can be limited to IPv4, IPv6, or IPv4v6 when roaming on a network.

The configuration will be effective at the next power on.

Only one PDP profile can be set using this command.

17.26.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=75,<cid>,<PDP_IP_conf>	OK	AT+UDCONF=75,1,0 OK
Read	AT+UDCONF=75	+UDCONF: 75,<cid>,<PDP_IP_conf> OK	AT+UDCONF=75 +UDCONF: 75,1,0 OK

17.26.3 Defined values

Parameter	Type	Description
<cid>	Number	See <cid>.
<PDP_IP_conf>	Number	PDP IP configuration when roaming: • 0: IP • 1: IPv6 • 2: IPv4v6 See <PDP_type>.

17.26.4 Notes

LARA-R6

- Set the <PDP_IP_conf> parameter before to read it.

17.27 Disable data when roaming +UDCONF=76

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

17.27.1 Description

Disables the PDP when roaming. When disabled, the PDP will not be able to send data when roaming on a network. The default is value is "off".

The configuration will be effective at the next power on.

Only one PDP profile can be set using this command.

17.27.2 Syntax

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

17.27.3 Defined values

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

Parameter	Type	Description
		• 1: ON - PDP is disabled when roaming

17.27.4 Notes

LARA-R6

- Set the <Data_Flag> parameter before to read it.

18 System features

18.1 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

18.1.1 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.

LARA-R6
During the update process, the device cannot be used to make calls, even emergency calls. Do not remove the power supply or reset the module during the installation procedure even if it is fault tolerant!
In case of power loss during the install phase, at the next module wake-up a fault is detected and the module remains in Firmware Install Mode until the end of the procedure (install terminated).

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

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

LARA-R6
Once the +UFWINSTALL AT command has been issued, the FW installation process shall begin. If the firmware update includes a boot code update, then there is relatively small window during the update process of this code section where an interruption, such as the removal or the loss of power supply to the module, can lead to image corruption of the module that is not recoverable.

LARA-R6
During the update operations, the +UUFWINSTALL URC displays the progress indication and the result operation on the interface chosen via the +UFWINSTALL command at the baud rate set by the same command as well. The progression of the installation is incremental, but the increment can be different from 1. The last URC with a value greater than 100 indicates the update operation result (e.g. 128 means operation completed with success). For more details about firmware install final result codes, (see FWINSTALL error result codes). After this last result code, the device will reset and enter a normal mode of operation with new firmware updated.

LARA-R6
The relevant URC along with result codes will not be received on any USB interface.

LARA-R6
At the end of a successful installation, the main firmware software boots up and the SIM is reset (the PIN will be required if enabled).

18.1.2 Syntax

Type	Syntax	Response	Example
Firmware upgrade			
Set	AT+UFWINSTALL[=<Serial_Port_Number>[,<BaudRate>]]	OK	AT+UFWINSTALL=1,115200 OK
Configure uFOTA FW update URCs			
Set	AT+UFWINSTALL=[<Serial_Port_Number>],[<BaudRate>],[<Reserved>],<uFOTA_URC>	OK	AT+UFWINSTALL=1,115200,,1 OK
Test	AT+UFWINSTALL=?	+UFWINSTALL: (list of supported <Serial_Port_Number>s),(list of supported <BaudRate>s),,(list of supported <uFOTA_URC>s)	+UFWINSTALL: (0,2),(9600,19200,38400,57600,115200,230400,460800),,(1)

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

18.1.3 Defined values

Parameter	Type	Description
<Serial_Port_Number>	Number	Serial interface where the progress percentage and the information text responses will be sent: • 0: no info will be shown. In this case the <BaudRate> parameter is ignored • 1: UART interface • 2: AUX UART interface If omitted, the command will take as default value for <Serial_Port_Number> the port where the command is issued.
<BaudRate>	Number	Baud rates expressed in b/s: • 9'600 • 19'200 • 38'400 • 57'600 • 115'200 • 230'400 • 460'800 • 921'600 • 3'000'000 If omitted, the command will take the current value set for the <BaudRate> parameter as the baud rate to be used during the FW installation. Allowed values: • LARA-R6 - 115'200, 230'400, 460'800, 921'600 and 3'000'000
<Reserved>	String	Reserved for future usage
<uFOTA_URC>	String	Allowed value: • 1: enables the +UUFWINSTALL URCs during the next FW upgrade by means of uFOTA; the URCs will be issued on the specified <Serial_Port_Number> using the specified <BaudRate>. If the <Serial_Port_Number> parameter is omitted, the URCs will be issued on the port where the command has been issued. If the <BaudRate> parameter is omitted, the current value set for the <BaudRate> parameter will be used. For more details, see the SARA-R4 series Firmware update with uFOTA, FOAT and EasyFlash application note [67]. The parameter setting is stored in the file system and is persistent across power cycles.
<progress_install>	Number	Provide the installation progress from 1 to 100 and the update result (see FWINSTALL error result codes).

18.1.4 Notes

LARA-R6

- After the command is issued, the module reboots and starts the install process which can take up to 35 minutes long.
- Store the update file into the module file system before starting the install with +UFWINSTALL AT command. Otherwise the "FFS file not found" error result code is issued. The procedure for FS storing is up to the user (by means of the +UDWNFILE or +UFTPC AT commands). When the new FW has been installed, the update file is deleted from the file system.

Command	Response	Description
AT+UFWINSTALL=1,115200	OK	The "OK" final result code is printed out just before the FW reset.
	+UUFWINSTALL: 1	The progression of installation is incremental (the subsequent increment of <progress_install> can be more than 1).
	+UUFWINSTALL: 2	
	+UUFWINSTALL: 3	
	+UUFWINSTALL: 4	
	....	

Command	Response	Description
	+UUFWINSTALL: 9	
	+UUFWINSTALL: 12	
	+UUFWINSTALL: 15	
	....	
	+UUFWINSTALL: 99	
	+UUFWINSTALL: 100	The installation is done when the percentage ends with +UUFWINSTALL: 100.
	+UUFWINSTALL: 128	The last URC with a value greater than 100 indicates the update operation result (e.g. 128 means operation completed with success (for more details see the FWINSTALL error result codes).

Table 16: +UFWINSTALL example

18.2 Firmware update Over AT (FOAT) +UFWUPD

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

18.2.1 Description

Triggers the download of the update package using the Xmodem or Xmodem-1k protocol. The host can start the download process on the USB interface or on any UART interface at speed set by the +IPR AT command (the factory-programmed value is 115200 b/s). After the successful download, the module starts automatically the firmware update with the downloaded update package. If the updated package validation is successful, the FW installation procedure will start with the +UFWUPD URCs. Otherwise the update procedure will be suspended, and a proper +UFWUPD URC error result code will be issued. The module exits from the update procedure mode and returns to the normal mode since the firmware is unchanged and usable. During the update operations, +UFWUPD URCs display the progress indication and the result operation on the primary UART interface. Progress URCs are issued on the primary UART interface at the 115200 b/s baud rate. When the firmware update is completed, a URC will notify the final result of the operation.

☞ The relevant URC along with result codes will not be received on any USB interface.

☞ 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 and extended error result codes.

☞ If no data comes to the module after having issued the set command, three 'C' and then ten 'NACK' are sent before timeout and then Firmware Update Mode is dropped out coming back to normal mode; the FW is unchanged and still usable (ERROR1).

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

☞ In case of power loss during the download by the set command or during Xmodem transfer, at the next module wake-up the module is again in normal mode.

18.2.2 Syntax

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

18.2.3 Defined values

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

18.3 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

18.3.1 Description

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

18.3.2 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

18.3.3 Defined values

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

18.3.4 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.

18.4 RX antenna selection +UANT

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

18.4.1 Description

Allows user to select the active antenna receiver path. The user can activate the primary antenna receiver only, the secondary antenna receiver only, or both antenna receiver paths together. The command can be used for

the execution of receiver sensitivity measurements like the Total Isotropic Sensitivity (TIS) test. The command execution does not affect the antenna transmitting path.

18.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UANT=<setting>,<value>	OK	AT+UANT=0,1 OK
Test	AT+UANT=?	+UANT: (list of supported <setting>s),(list of supported <value>s) OK	+UANT: (0),(0-2) OK

18.4.3 Defined values

Parameter	Type	Description
<setting>	Number	Setting type: • 0: RX path selection
<value>	Number	Selects which antenna RX path to use: • 0: both antennas • 1: primary antenna RX path only • 2: secondary antenna RX path only

18.4.4 Notes

- To be sure to perform a test in a reliable starting condition, it is suggested to issue AT+CFUN=15 (silent reset) command before each test.

LARA-R6

- Select the antenna after silent reset.
- Re-enable the RX diversity after the tests.

18.5 Rx diversity +URXDIV

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

18.5.1 Description

Controls the Rx diversity in LTE and UMTS radio access technologies (RAT).

For more details on UMTS Rx diversity capabilities, see 3GPP TS 25.101 [106].

When only one antenna is connected, the Rx diversity (<RxDiv>=0) must be disabled. It is recommended to change the setting in deregistered state.

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 [112], 3GPP TS 34.121-2 [113], 3GPP TS 36.521-2 [134] and 3GPP TS 36.523-2 [135], 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.

18.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+URXDIV=<RxDiv>	OK	AT+URXDIV=1 OK
Read	AT+URXDIV?	+URXDIV: <RxDiv>	+URXDIV: 1

Type	Syntax	Response	Example
		OK	OK
Test	AT+URXDIV=?	+URXDIV: (list of supported <RxDiv>s) OK	+URXDIV: (0-1) OK

18.5.3 Defined values

Parameter	Type	Description
<RxDiv>	Number	Rx diversity configuration. Allowed values: • 0: Rx diversity disabled • 1 (factory-programmed value): Rx diversity enabled

18.5.4 Notes

LARA-R6

- Issue the AT+CFUN=15 (silent reset) command to apply the last RX diversity setting saved inside NVM.

18.6 Digital pins testing +UTEST=10

+UTEST=10						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	Up to 1 s	+CME Error

18.6.1 Description

Sets the module in non-signalling (or test) mode and enables the module testing on digital pins to perform some verifications on all the digital pins of the u-blox cellular modules.

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

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

These commands are intended for production to check the correct digital pins behavior, detect possible soldering or functional problems and can be executed only in non-signalling mode (otherwise the "+CME ERROR: operation not allowed" or "+CME ERROR: 3" error result code - depending on the +CMEE AT command setting - is issued without performing any operations).

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

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

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

- The module switches off the protocol stack for performing single tests which could not be performed during signalling mode.
- The module accepts some non-signaling related commands. Although it is recommended that only +UTEST commands are used
- The +CMEE AT command cannot be set

The command only accepts the parameter set supported by the specific module version. When an unsupported parameter is issued, an error result code will be provided ("+CME ERROR: operation not supported" or "+CME ERROR: 4" depending on the +CMEE AT command setting).

In normal mode:

- The only allowed +UTEST command is the AT+UTEST=1 used to enable the testing interface

- All other +UTEST commands return an error result code ("+CME ERROR: operation not allowed" or "+CME ERROR: 3" depending on the +CMEE AT command setting)

☞ LARA-R6
A network deregistration is needed, issue the AT+COPS=2 command before entering the non-signalling mode.

To return to the normal mode:

- LARA-R6 - Issue the AT+UTEST=0 and then reboot (by means of the AT+CFUN=15) or power off the module. After the module power on, issue a AT+CFUN=0/AT+CFUN=1 cycle and the +UTEST read command.

For more more details on test command examples, guidance about test equipment setup and more information on module reboot, see:

- LARA-R6 - LARA-R6 series application development guide [10]

and the corresponding data sheet for pins levels characteristics.

18.6.2 Syntax

Type	Syntax	Response	Example
Digital pins testing generic syntax			
Set	AT+UTEST=<mode>,<op_code>[,[<bit_padding>]<pin_seq>]	OK	AT+UTEST=10,3,"00000010000000300" OK
Entering normal mode			
Set	AT+UTEST=0	OK	AT+UTEST=0 OK
Entering test mode			
Set	AT+UTEST=1	OK	AT+UTEST=1 OK
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

18.6.3 Defined values

Parameter	Type	Description
<mode>	Number	Test mode setting: • 0: the module returns to the normal mode • 1: the module enters the test mode • 10: digital pins testing
<op_code>	Number	Test mode setting: • 0: exits the digital test mode and restores the pins to the original configuration • 2: defines a set of pins that will be tested and initializes these pins to be ready for testing. The original pins configuration is kept for final restore. In the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: o 0: the pin will not be tested o 1: the pin will be tested (as digital input or output) • 3: configures the logical pins previously enabled for testing as output or input; the command has effect only if AT+UTEST=10,2 has been previously issued. If a non enabled pin is set as digital input or output, the command does not return an error and the setting is not applied. In the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: o 0: the pin will be set as an output o 1: the pin will be set as an input • 4: configures the value of the output pins under testing; the command has effect only if AT+UTEST=10,3 has been previously issued; The command is not mandatory if there are no output pins to configure. In the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: o 0: the pin will output a "low" logic level o 1: the pin will output a "high" logic level • 5: applies the setting change defined with <op_code>= 2 / 3 / 4 and triggers the execution of the digital testing. Digital testing of the pins is possible only after the execution of the AT+UTEST=10,5 command. • 6: returns the logic value of pins under testing (both input and output); in the [<bit_padding>]<pin_seq> parameter use this notation to represent each module pin with its binary digit: o 0: "low" logic digital level measured at the module pin o 1: "high" logic digital level measured at the module pin
[<bit_padding>]<pin_seq>	Number	Sequence of hexadecimal digits containing the pin information and the action to execute: • LARA-R6 - See the Notes and the LARA-R6 application development guide, [TBD] for detailed number description
<param_valx>	Number	Supported content depends on related <mode> (details are given above).

18.6.4 Notes

- Consider these steps to construct the [<bit_padding>]<pin_seq> sequence:
  - o Consider the total number of the module's pins available
    - LARA-R6 - 96 pins
  - o When a non-testable pin is selected, the command does not return an error result code but the value is not considered and not applied.
  - o The status of the n-th pin will be represented by the corresponding n-th bit; see the <op_code> description for the notation of each mode setting
  - o Convert each group of four binary digits into its hexadecimal representation

LARA-R6

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

Command	Response	Description
		Configure the formatting of the error result code by means of +CMEE AT command
AT+COPS=2	OK	Deregister the module from the network
AT+UTEST=1	OK	The module enters the test mode

Command	Response	Description
AT+UTEST=10,2,"000007F400C000D83F00"	OK	The command puts the module in Interface initialized state; the command saves the pins status to restore it at the end of the test. Pins enabled for testing: DTR, RTS, CTS, TXD, RXD, GPIO2, GPIO3, SIM_IO, SIM_RST, VCC, ANT1, ANT_DET, ANT2
AT+UTEST=10,3,"0000049400 4000C01800"	OK	Pins configuration: o GPIO2, GPIO3, SIM_IO, ANT1, ANT_DET as input o DTR, RTS, CTS, TXD, RXD, SIM_RST, VCC, ANT1, ANT2 as output
AT+UTEST=10,4,"0000036000 8000182700"	OK	Digital logic value of the output pins: o DTR, RTS, CTS, SIM_RST, VCC, ANT_DET 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 DTR, RTS, CTS, TXD, RXD, GPIO2, GPIO3, SIM_IO, SIM_RST, VCC, ANT1, ANT_DET, ANT2: "high" level detected
AT+UTEST=0	OK	Module exits from the test mode and normal pin configuration is restored.

Table 17: Digital pins test command examples

The digital pins can be configured as many times as needed by the testing process; AT+UTEST=10,2 command is not needed any more as the DUT is already in Interface initialized state.

18.7 Smart temperature supervisor +USTS

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

18.7.1 Description

Enables/disables the Smart Temperature Supervisor feature.

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

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

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

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

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

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

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

18.7.2 Syntax

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

18.7.3 Defined values

Parameter	Type	Description
<mode>	Number	Enables / disables the smart temperature mode: • 0 (default value and factory-programmed value): smart temperature feature disabled • 1: smart temperature feature enabled; the indication by means of the +UUSTS URC and shutting down (if needed) are performed • 2: smart temperature indication enabled; the +UUSTS URC will be issued to notify the Smart Temperature Supervisor status • 3: smart temperature feature enabled with no indication; the shutdown (if needed) is performed, but without a URC notification Allowed values: • LARA-R6 - 0 (default value and factory-programmed value), 1, 2
<event>	Number	Provides the event status: • -2: temperature below t_{-2} threshold • -1: temperature below t_{-1} threshold • 0: temperature inside the allowed range - not close to the limits • 1: temperature above t_{+1} threshold • 2: temperature above the t_{+2} threshold • 10: timer expired and no emergency call is in progress, shutdown phase started • 20: emergency call ended, shutdown phase started • 100: error during measurement

18.8 MSPR profile handling configuration +UDCONF=40

+UDCONF=40						
Modules	LARA-R6001 LARA-R6001D LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

18.8.1 Description

The multi-slot transmission power can be reduced according to the 3GPP specifications and set to a defined threshold.

☞ 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 [112], 3GPP TS 34.121-2 [113], 3GPP TS 36.521-2 [134] and 3GPP TS 36.523-2 [135], 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 3G mode (i.e. UMTS radio access), the maximum output power cannot be set through the AT command, but is automatically set by the module according to the UE Maximum Power Reduction for the nominal maximum output power with HS-DPCCH and E-DCH defined by 3GPP specifications.

In 2G mode (i.e. GPRS and EDGE radio access), the maximum output power in GMSK or 8-PSK multi-slot configuration can be set by selecting the active multi-slot power reduction profile within the available profiles defined in Table 18 according to 3GPP specifications.

The maximum output power in GMSK or 8-PSK multislot configuration depends on the active MSPR profile set by the AT command and the number of active Tx slots set by the network, as described in Table 18:

Active Tx slots	MSPR profile 0	MSPR profile 1	MSPR profile 2	MSPR profile 3
1	0	0	0	0
2	3	1	0	0
3	4,8	2,8	0,8	0
4	6	4	2	0

Table 18: Power reduction (dBm)

LARA-R6
The changes in the user defined power reduction are effective after reboot.

18.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=40,<GMSK_profile>[,<8PSK_profile>]	OK	AT+UDCONF=40,2,3 OK
Read	AT+UDCONF=40	+UDCONF: 40,<GMSK_profile>,<8PSK_profile> OK	AT+UDCONF=40 +UDCONF: 40,2,2 OK

18.8.3 Defined values

Parameter	Type	Description
<GMSK_profile>	Number	User defined power reduction: MSPR GMSK profile (range 0-3). The factory-programmed value depends on the series module: • LARA-R6 - 2
<8PSK_profile>	Number	User defined power reduction: MSPR 8-PSK profile (range 0-3). This parameter is optional: if omitted, the MSPR 8-PSK profile is not affected. The factory-programmed value depends on the series module: • LARA-R6 - 2. This parameter is optional: if omitted, the MSPR 8-PSK profile is not affected

18.8.4 Notes

- For AT&T certification: the 8-PSK MSPR profile should be limited to values 2 and 3.

LARA-R6

- The +UFACTORY AT command cannot be used to restore the factory-programmed values.
- The GCF certification has been done using the factory-programmed values for both MSPR profiles. If a different couple of values is used, the same RF performance could be not guaranteed.

18.9 RING line handling +URING

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

18.9.1 Description

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

The RING line will be asserted when one of the configured events occurs and it remains asserted for 1 s unless another configured event happens (in this case the 1 s timer will be started again). Same behavior will be applied if the events are the incoming call or the incoming SMS.

18.9.2 Syntax

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

18.9.3 Defined values

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

18.9.4 Notes

LARA-R6

- The physical RING line handling depends on +USIO AT command configuration. It is not supported:
  - When MAIN UART and AUX UART are both enabled as 5-wire configuration (for more details, see +USIO AT command, <active_variant>=1).
  - When MAIN UART is not enabled (for more details, see +USIO AT command, <active_variant>=3, 4).
- The virtual RING line on USB and MUX (if enabled) is handled regardless of +USIO AT command configuration.

18.10 UART baud rate and flow control NVM management +UUARTCONF

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

18.10.1 Description

Stores the baud rate and flow control values to NVM (see the +IPR and &K AT commands) for the specified UART interface. The read command returns the NVM setting for all the available UART interfaces.

This command is intended to extend the possibility to have different stored values of +IPR and &K AT commands across the two UART interfaces.

☞ Setting in NVM for AUX UART interface is applied at boot regardless the +USIO configuration, that is AUX UART mode (AT, binary).

☞ The settings are saved immediately in NVM; the new configuration will be effective at the subsequent module reboot.

18.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+UUARTCONF=<uart_id>[,<rate>[,<fctrl>]]	OK	AT+UUARTCONF=1,115200,3 OK

Type	Syntax	Response	Example
Read	AT+UUARTCONF?	+UUARTCONF: <uart_id>,<rate>,<fctrl> [[..] +UUARTCONF: <uart_id>,<rate>,<fctrl>] OK	+UUARTCONF: 0,115200,3 +UUARTCONF: 1,115200,3 OK
Test	AT+UUARTCONF=?	+UUARTCONF: (list of supported <uart_id>s),(list of fixed only supported <rate>s),(list of supported <fctrl>s) OK	+UUARTCONF: 1,(300,600,1200,2400,4800,9600,14400,19200,38400,57600,115200,230400,460800,921600,1000000,1200000,1500000,2000000,3000000),(0-3) OK

18.10.3 Defined values

Parameter	Type	Description
<uart_id>	Number	UART identification code: • 0: main UART identification code • 1: auxiliary UART identification code Allowed values: • LARA-R6 - 1
<rate>	Number	Allowed baud rates expressed in b/s (default and factory-programmed value is 115200) ☞ LARA-R6 The information text response to the test command returns a list of baud rates; within this list the only supported baud rates are: 115200 (default and factory-programmed value), 230400, 460800, 921600, 3000000.
<fctrl>	Number	DTE flow control mode (see the &K AT command): • 0: disable DTE flow control • 3 (default and factory-programmed value): enable the RTS/CTS DTE flow control

18.10.4 Notes

LARA-R6

- The HW flow control for AUX UART cannot be changed when +USIO: 1 and +UPSV: 1; for more details, see the +UPSV AT command.

18.11 Serial interfaces configuration selection +USIO

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

18.11.1 Description

Selects the serial interfaces' configuration.

The configuration affects how an available (either physical or logical) serial interface is used, i.e. the meaning of the data flowing over it. Possible usages are:

- Modem interface (AT command)
- Trace interface (diagnostic log)
- Raw interface (e.g. GPS/GNSS tunneling or SAP)
- Digital audio interface
- None

A set of configurations, that considers all the available serial interfaces' and their associated usage, is called +USIO's configuration variant.

☞ The serial interfaces' configuration switch is not performed run-time. The settings are saved in NVM; the new configuration will be effective at the subsequent module reboot.

☞ A serial interface might not support all the usages. For instance, UART cannot be used as digital audio interface.

☞ For the complete list of allowed USIO variants supported by each series modules, see Notes.

18.11.2 Syntax

Type	Syntax	Response	Example
Set	AT+USIO=<requested_variant>	OK	AT+USIO=1 OK
Read	AT+USIO?	+USIO: <requested_variant>, *<active_variant> OK	+USIO: 1, *1 OK
Test	AT+USIO=?	+USIO: Variant=<requested_variant>: [AT=<AT_interface>;][GNSS=<GNSS_interface>;][TRACE=<Trace_interface>;][DIGITAL AUDIO=<Digital_audio_interface>] [+USIO: Variant=<requested_variant>: [AT=<AT_interface>;][GNSS=<GNSS_interface>;][TRACE=<Trace_interface>;][DIGITAL AUDIO=<Digital_audio_interface>] [...]] OK	+USIO: Variant=0: AT="UART"; AT="AUX UART"; TRACE="EXT UART" +USIO: Variant=1: AT="UART"; TRACE="AUX UART"; DIGITAL AUDIO="I2S" +USIO: Variant=2: AT="UART"; AT="AUX UART"; DIGITAL AUDIO="I2S" +USIO: Variant=3: AT="UART"; GNSS="AUX UART"; TRACE="EXT UART" +USIO: Variant=4: AT="UART"; GNSS="AUX UART"; DIGITAL AUDIO="I2S" OK

18.11.3 Defined values

Parameter	Type	Description
<requested_variant>	Number	Requested (stored in NVM for next boot) configuration variant (range 0-255). For the factory-programmed value, see the value in supported USIO variants table in Notes.
<active_variant>	Number	Active (currently used) configuration variant (range 0-255). For the factory-programmed value, see the value in supported USIO variants table in Notes.
<AT_interface>	String	Serial interface configured for AT commands
<GNSS_interface>	String	Serial interface configured for GNSS tunneling
<Trace_interface>	String	Serial interface configured for diagnostic log
<Digital_audio_interface>	String	Serial interface configured for digital audio

18.11.4 Notes

- Table 19 explains the meaning of <AT_interface>, <GNSS_interface>, <Trace_interface>, <Digital_audio_interface>.

<AT_interface>, <GNSS_interface>, <Trace_interface>, <Digital_audio_interface>	Serial interface description
"UART"	Main UART: It is the full featured UART (9-wire), used as main interface to the host.
"AUX UART"	Auxiliary UART: It is the general purpose UART (3-wire or 5-wire), with limited v.24 features.
"EXT UART"	External UART: It is not a real UART, but the SPI interface is used to communicate with an external chip providing SPI to UART conversion. Basically, it is limited to diagnostic log.

<AT_interface>, <GNSS_interface>, <Trace_interface>, <Digital_audio_interface>	Serial interface description
"USB"	USB CDC-ACM or Network over USB: USB CDC-ACM is a virtual UART, providing simulated v.24 features over a USB interface. Network over USB is a virtual network interface providing diagnostic logging.
"I2S"	I^2S interface: It can be used for the digital audio. See the Chapter 22 for the required configurations.
"SPI"	SPI interface: It is limited to diagnostic log.
"SDIO"	SDIO interface: It is limited to diagnostic log.

Table 19: Serial interfaces

LARA-R6

- The allowed configurations are listed as follows:

<active_variant>	AT instance 1	AT instance 2	AT instance 3	Diagnostic log	GNSS tunneling
0 (factory-programmed value)	UART (9-wire)	USB1	USB2	USB0	Not available
1	UART (5-wire)	USB1	AUX UART (5-wire)	USB0	Not available
2	UART (9-wire)	USB1	-	USB0	USB3
3	USB2	USB1	-	USB0	USB3
4	USB2	USB1	USB3	USB0	Not available

Table 20: Supported USIO variants

18.12 Internal temperature monitor +UTEMP

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

18.12.1 Description

Returns the values of internal temperature sensors of the specified unit.

The command handling (sensors position and command syntax) depends on the module series:

- LARA-R6 - The AT command returns the value measured by the temperature sensor on the **Die**.

18.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+UTEMP=<unit>	OK	AT+UTEMP=0 OK
Read	AT+UTEMP?	+UTEMP: <die_temp>[,<unit>] OK	+UTEMP: 100,1 OK
Test	AT+UTEMP=?	+UTEMP: (list of supported <unit>) OK	+UTEMP: (0-1) OK

18.12.3 Defined values

Parameter	Type	Description
<unit>	Number	Select the measurement unit for value representation: • 0: values in tenth of Celsius degrees returned • 1: values in tenth of Fahrenheit degrees returned
<die_temp>	Number	Fetched value of Die temperature of the selected measurement unit; the allowed range depends on the measurement unit: • Celsius degrees: [-40; 140] • Fahrenheit degrees: [-40; 284] • 655355: no valid temperature measure is available

18.13 Restore factory configuration +UFACTORY

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

18.13.1 Description

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

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

18.13.2 Syntax

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

18.13.3 Defined values

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

18.13.4 Notes

LARA-R6

- <fs_op>=1 deletes all user files previously stored with "USER" tag.
- <fs_op>=2 is not supported.
- <nvm_op>=1 deletes all modem profiles.
- <nvm_op>=2 restores the UART interface and +UPSV AT command settings to the factory-programmed setting.
- After a <nvm_op>=1, it is required a second reboot in order to make the module again ready to properly accept and store new settings to NVM.

18.14 Backup and restore the file system +UBKUPDATA

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

18.14.1 Description

Backs up the file system. Upon receiving the action command and after the backup process is finished, the module performs a reboot. Upon a detection of a file system corruption, the module autonomously triggers a restore of the last backup and immediately performs a reboot; it is possible to manually restore the last backup by means of the set command. If no backup has been performed, the factory-programmed file system image is restored.

The read command displays the backup and restore statistics. The +UUBKUPDATA URC notifies the result of the backup / restore operation.

18.14.2 Syntax

Type	Syntax	Response	Example
Action	AT+UBKUPDATA	OK	OK
Set	AT+UBKUPDATA=<command>	OK	AT+UBKUPDATA=r OK
Read	AT+UBKUPDATA?	+UBKUPDATA: <last_backup>,<last_restore>,<backup_number>,<restore_number>,<failed_op_type>,<last_failed_op>,<failure_code_location>	+UBKUPDATA: 172800,20,2,1,1,20,"file: fs_db.c, function: down_find, line: 1168" OK
URC		+UUBKUPDATA: <op_type>,<result>	+UUBKUPDATA: 0,0

18.14.3 Defined values

Parameter	Type	Description
<command>	String	Allowed value: • r: triggers a restore operation The string is not enclosed within quotation marks.
<last_backup>	Number	Time in seconds elapsed since last backup operation
<last_restore>	Number	Time in seconds elapsed since last restore operation
<backup_number>	Number	Total number of backup operations performed
<restore_number>	Number	Total number of restored operations performed
<failed_op_type>	Number	Last failed operation type. Allowed values: • 0: no operation failed • 1: backup operation • 2: restore operation
<last_failed_op>	Number	Time in seconds elapsed since last failed operation. If there are no failures (<failed_op_type>=0), value 0 is returned.
<failure_code_location>	String	Filename, function name and line number where the failure was triggered. If there are no failures, no indication regarding filename, function name and line number are provided.
<op_type>	Number	Operation type. Allowed values: • 0: no operation • 1: backup operation • 2: restore operation
<result>	Number	Operation result. Allowed values: • 0: operation failure • 1: operation success • 2: operation start

18.14.4 Notes

LARA-R6

- Only personalization data for security, calibrations and unique data will be restored; user files, parameters and profiles will be brought to the factory-programmed setting.

18.15 Cancel FOTA download +UFOTA

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

18.15.1 Description

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

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

18.15.2 Syntax

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

18.15.3 Defined values

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

18.16 Sets FOTA status URCs +UFOTASTAT

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

18.16.1 Description

Enables URC reporting status for FOTA downloads and updates.

18.16.2 Syntax

Type	Syntax	Response	Example
Set	AT+UFOTASTAT=<n>	OK	AT+UFOTASTAT=1 OK
Read	AT+UFOTASTAT?	+UFOTASTAT: <n> OK	+UFOTASTAT: 1 OK
Test	AT+UFOTASTAT=?	+UFOTASTAT: (list of supported<n>s) OK	+UFOTASTAT: (0,1) OK
Generic syntax			
URC		+UFOTASTAT: <event>,<param1>[,<param2>]	+UFOTASTAT: 3,1,0 OK

Type	Syntax	Response	Example
		OK	
Download progress			
URC		+UFOTASTAT: 0,<progress_status>[,<percentage>] OK	+UFOTASTAT: 0,1,10 OK
Download start			
URC		+UFOTASTAT: 1,<start_triggered>,0 OK	+UFOTASTAT: 1,0,0 OK
Download complete			
URC		+UFOTASTAT: 2,<status>,<status_details> OK	+UFOTASTAT: 2,2,100 OK
FOTA status			
URC		+UFOTASTAT: 3,<update_result>,<update_state> OK	+UFOTASTAT: 3,1,0 OK
Registration status			
URC		+UFOTASTAT: 4,<registration_result> OK	+UFOTASTAT: 4,2 OK

18.16.3 Defined values

Parameter	Type	Description
<n>	Number	Enable FOTA status URCs: • 0: FOTA status URC disabled • 1 (factory-programmed value): FOTA status +UFOTASTAT URC enabled
<event>	Number	Event type: • 0: download progress • 1: download start • 2: download complete • 3: FOTA status • 4: registration status Allowed values: • LARA-R6 - 0, 1, 2, 3
<progress_status>	Number	Allowed value: • 1: download in progress
<percentage>	Number	Download completion in percentage
<start_triggered>	Number	Allowed value: • 0: download start triggered
<status>	Number	FOTA completed download status: • 2: success • 3: fail
<status_details>	Number	Provides more information about FOTA completed download status: • 100: success if <status>=2 • 100: user cancel if <status>=3 • 101: memory error. This value can be returned only when <status>=3 • 102: network error. This value can be returned only when <status>=3 • 103: unknown error.This value can be returned only when <status>=3 • 104: bad url.This value can be returned only when <status>=3 • 105: failure due to connectivity loss.This value can be returned only when <status>=3
<update_result>	Number	Provides more information about FOTA update result: • 0: initial • 1: success • 2: memory error

Parameter	Type	Description
		• 3: RAM error • 4: connection lost • 5: checksum error • 6: unsupported package • 7: URI error • 8: firmware update fail • 9: unsupported protocol
<update_state>	Number	Provides more information about FOTA update status: • 0: idle • 1: downloading • 2: downloaded • 3: updating
<registration_result>	Number	Provides more information about registration status: • 0: idle • 1: bootstrap started • 2: bootstrap successful • 3: bootstrap failed • 4: connect successful • 5: connect failed • 6: registration successful • 7: registration failed • 8: registration timeout • 9: client life time timeout • 10: client halted • 11: update successful • 12: update failed • 13: update timeout • 14: response failed • 15: notify failed • 16: deregistration successful • 17: deregistration failed
<param1>	Number	Contains additional information depending on <event> value.
<param2>	Number	Contains additional information depending on <event> and <param1> values.

18.16.4 Notes

LARA-R6

- In case of error only the "ERROR" final result code is returned.
- The <n> factory-programmed value is 0 (FOTA status +UFOTASTAT URC disabled).

18.17 Last gasp configuration +ULGASP

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

18.17.1 Description

Enables/disables and configures the last gasp feature. The application is automatically triggered by a properly configured GPIO (see GPIO introduction, <gpio_mode>=19). The feature supports the sending of a predefined last notification in case of power outage, just before the power goes off. It is assumed that the cellular module is registered to the network when the alarm is triggered; however the command just configures the feature so it is possible to issue it also if PIN is not inserted. It is possible to enable/disable the +UULGASP URC to be notified about the operation result.

This AT command must be issued after a proper configuration of the GPIO pin via the +UGPIOC command, <gpio_mode>=19. Otherwise, if +UGPIOC is issued after +ULGASP, the last gasp will work only after a reboot.

☞ The parameters will be set to the values stored in the NVM in case they are omitted in the set command.

After having sent the last gasp notification:

- LARA-R6 - the module does not automatically shut down and it remains in a pending status until the power supply is removed without performing a clean network detach.

18.17.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULGASP=<GPIO_mode>[,[<text>],[<msg_format>],[<tel_number>],[<cid>],[<IP_protocol>],[<IP_addr:PORT>],[<method>],[<max_pow_red>],[<urc_enable>]]	OK	AT+ULGASP=0,"Power_loss",0,"+39347123456",3,6,"192.168.100.20:8080",2,, OK
Read	AT+ULGASP?	+ULGASP: <GPIO_mode>,<text>,<msg_format>,<tel_number>,<cid>,<IP_protocol>,<IP_addr:PORT>,<method>,<max_pow_red>,<urc_enable> OK	+ULGASP: 0,"Power_loss",0,"+39347123456",3,6,"192.168.100.20:8080",2,0,1 OK
Test	AT+ULGASP=?	+ULGASP: (list of supported <GPIO_mode>'s),,(list of supported <msg_format>'s),,(list of supported <cid>'s),(list of supported <IP_protocol>'s),,(list of supported <method>'s),(list of supported <max_pow_red>'s),(list of supported <urc_enable>'s) OK	+ULGASP: (0-2),,(0-1),,(0-6,255),(6,17),,(0-3),(0-1),(0-1) OK
URC		+UULGASP: <result>,<bearer>	+UULGASP: 0,1

18.17.3 Defined values

Parameter	Type	Description
<GPIO_mode>	Number	Select the interrupt trigger. Allowed values: • 0 (factory-programmed value): trigger disabled; the following arguments will be ignored • 1: falling edge • 2: rising edge
<text>	String	The string that will be sent upon GPIO movement. Text or binary format can be selected with the <msg_format> parameter. When the text format is selected, a maximum of 160 ASCII characters is allowed. When the binary format is selected, every 8-bit octet of the message must be written as two IRA character long hexadecimal numbers, e.g. an octet with integer value 42 (i.e. 0x2A) must be written as a string of two characters "2A" (IRA 50 and 65). The factory-programmed value is "Last Gasp".
<msg_format>	Number	Format of the <text> parameter. Allowed values: • 0 (factory-programmed value): text • 1: binary
<tel_number>	String	Destination number of the SMS, it is mandatory if <method> is 0 or 2. Factory-programmed value: empty string.
<profile_id>	Number	PSD profile identifier, in range 0-6. See +UPSD AT command.
<cid>	Number	Specifies the PDP context that will be used for the HTTP data. For the parameter range, see <cid>. • LARA-R6 - The special value <cid>=255 (factory-programmed value) can be also selected, in this case the PDP context set by the +UDCONF=19 AT command is used. • LARA-R6001D - The special value <cid>=255 (factory-programmed value) can be also selected, in this case the default PDP context is used.
<IP_protocol>	Number	IP protocol used for socket connection. Allowed values: • 6: TCP • 17 (factory-programmed value): UDP

Parameter	Type	Description
<IP_addr:PORT>	String	IPv4 server address with the socket port, it is mandatory if <method> is different from 0 (SMS sending). Factory-programmed value: empty string.
<method>	Number	Notification method, it is the way the application send out the <text message>; in case of fail of the preferred bearer the second one is used. Allowed values: • 0 (factory-programmed value): send SMS • 1: use IP (TCP or UDP) connection • 2: SMS preferred • 3: IP (TCP or UDP) preferred
<max_pow_red>	Number	Maximum power reduction. Allowed values: • 0 (factory-programmed value): no power reduction • 1: 3 dB power reduction for UMTS bands (3G RAT); 2 dB power reduction for GSM bands (2G RAT)
<urc_enable>	Number	Flag determining if the URC is to be issued or not. Allowed values: • 0 (factory-programmed value): disabled • 1: enabled
<result>	Number	Operation result. Allowed values: • 0: success • 1: generic fail
<bearer>	Number	Notification used bearer. Allowed values: • 0: SMS • 1: IP (TCP or UDP) connection

18.17.4 Notes

LARA-R6

- The <max_pow_red>=1 parameter is not supported.
- Only an IP (TCP or UDP) connection is allowed. Hence, only <method>=1 (send SMS as notification method) and <bearer>=1 (send SMS as notification used bearer) are supported. The factory-programmed value of <method> is 1 (IP (TCP or UDP) connection).

18.18 URC over AT terminal configuration +UURCCONF

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

18.18.1 Description

Configures the list of the AT terminals enabled for URC reception.

The AT command should be used by any application that is requiring URCs to be displayed only a specific set of AT terminals.

The example section will show the suggested mode of operation.

☞ The AT command is volatile and it will reset to its factory-programmed setting at each reboot.

18.18.2 Syntax

Type	Syntax	Response	Example
Set	AT+UURCCONF=<conf>	OK	AT+UURCCONF=1 OK
Read	AT+UURCCONF?	+UURCCONF: <conf>,<is_terminal_in_list>,<numbers_of_terminals_in_list> OK	+UURCCONF: 1,1,1 OK
Test	AT+UURCCONF=?	+UURCCONF: (list of the supported <conf> values)	+UURCCONF: (0-2)

Type	Syntax	Response	Example
		OK	OK

18.18.3 Defined values

Parameter	Type	Description
<conf>	Number	URC over AT terminal configuration values: • 0 (factory-programmed value): the feature is disabled. The list of enabled AT terminal is emptied. The URC will be displayed on all available AT terminals. • 1: the feature is active. The current terminal, meaning the AT terminal on which the AT command was given, will be added to the list of enabled AT terminals. Only the AT terminal belonging to this list will display the URCs. • 2: the feature is active but the list is cleared, hence URC displaying is disabled on all AT terminals. This is useful for example if the user wishes to re-build the list from scratch without incurring in undesired URC.
<is_terminal_in_list>	Number	Flag that returns the status of the AT terminal on which the AT command was given: • 0: current AT terminal is not present in the list of enabled AT terminals • 1: current AT terminal is present in the list of enabled AT terminals
<numbers_of_terminals_in_list>	Number	Number of AT terminals enabled for URC display

18.18.4 Examples

The following section will show +UURCCONF suggested mode of operation.

Command	Response	Description
Enabling the feature at each module reboot		
AT+UURCCONF=2	OK	The feature is active and URCs are disabled on all terminals.
AT+UURCCONF?	+UURCCONF: 2,0,0 OK	The read command confirms that the feature is active and no AT terminal is enabled for URC display.
AT+UURCCONF=1	OK	The AT terminal on which the AT command has been given is now enabled for URC display. ☞ This should be given on all the required AT terminals.
Read examples		
AT+UURCCONF?	+UURCCONF: 1,1,1 OK	The read command given on an URC enabled AT terminal confirms that the latter is in the list.
AT+UURCCONF?	+UURCCONF: 1,0,1 OK	The read command given on a different AT terminal confirms that the latter is not in the list and hence it is not enabled for URC reception.
Disabling the feature		
AT+UURCCONF=0	OK	The feature is disabled, URCs will be displayed on all active AT terminals.
AT+UURCCONF?	+UURCCONF: 0,0,0 OK	The read command confirms that the feature is disabled.

Table 21: +UURCCONF suggested mode of operation

19 Power management

19.1 Power saving control (Power SaVing) +UPSV

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

19.1.1 Description

Sets the UART power saving configuration, but it has a global effect on the module power saving configuration:

- If the power saving is disabled (+UPSV: 0), the UART interface is always enabled and the module does not enter idle mode
- If the power saving is enabled (+UPSV: 1), the UART interface is cyclically enabled and the module enters idle mode automatically whenever possible
- If the power saving is controlled by the UART **RTS** line (+UPSV: 2), the UART interface is enabled and the module does not enter idle mode as long as the UART **RTS** line state is ON
- If the power saving is controlled by the UART **DTR** line (+UPSV: 3), the UART interface is enabled and the module does not enter idle mode as long as the UART **DTR** line state is ON
- If the power saving is controlled by the UART **DTR** line (+UPSV: 4), the UART interface is enabled and the module does not enter idle mode as long as the UART **DTR** line state is ON. The TCXO and power supplies voltage level are functional but internal clock network is held at TCXO minimal running frequency.

19.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UPSV=<mode>[,<Timeout>]	OK	AT+UPSV=1,3000 OK
Read	AT+UPSV?	+UPSV: <mode>[,<Timeout>] OK	+UPSV: 1,3000 OK
Test	AT+UPSV=?	+UPSV: (list of supported <mode>s), (list of supported <Timeout>s) OK	+UPSV: (0-3),(40-65000) OK

19.1.3 Defined values

Parameter	Type	Description
<mode>	Number	Power saving configuration. Allowed values: • 0 (default and factory-programmed value): disabled • 1: enabled o The UART is re-enabled from time to time to allow the DTE to transmit, and the module switches from idle to active mode in a cyclic way. If during the active mode any data is received, the UART (and the module) is forced to stay "awake" for a time specified by the <Timeout> parameter. Any subsequent data reception during the "awake" period resets and restarts the "awake" timer • 2: power saving is controlled by UART **RTS** line: o If the **RTS** line state is set to OFF, the power saving mode is allowed o If the **RTS** line state is set to ON, the module shall exit from power saving mode ☞ <mode>=2 is allowed only if the HW flow control has been previously disabled on the UART interface (e.g. with AT&K0), otherwise the command returns an error result code (+CME ERROR: operation not allowed if +CMEE is set to 2). ☞ With <mode>=2 the DTE can start sending data to the module without risk of data loss after having asserted the UART **RTS** line (**RTS** line set to ON state). • 3: power saving is controlled by UART **DTR** line: o If the **DTR** line state is set to OFF, the power saving mode is allowed o If the **DTR** line state is set to ON, the module shall exit from power saving mode

Parameter	Type	Description
		<mode>=3 is allowed regardless the flow control setting on the UART interface. In particular, the HW flow control can be set on UART during this mode. With <mode>=3 the DTE can start sending data to the module without risk of data loss after having asserted the UART **DTR** line (**DTR** line set to ON state). • 4: power saving is controlled by UART **DTR** line: o If the **DTR** line state is set to OFF, the power saving mode is allowed. The TCXO and power supplies voltage level are functional but internal clock network is held at TCXO minimal running frequency o If the **DTR** line state is set to ON, the module shall exit from power saving mode <mode>=4 is allowed regardless the flow control setting on the UART interface. In particular, the HW flow control can be set on UART during this mode.
<Timeout>	Number	If <mode>=1 and active mode entered, it provides the guard period of no reception of characters on the UART interface before entering idle mode again. It is expressed in GSM frames (4.615 ms) • The range goes from 40 to 65000 (approximately from 184 ms to 300 s); the default value is 2000 GSM frames (ca 9.2 s) • This parameter is accepted only if <mode>=1

19.1.4 Notes

- For a detailed explanation of modules' operating modes, modules and interfaces behavior in reference to the +UPSV command setting, see the corresponding system integration manual.

LARA-R6

- <mode>=2 and <mode>=4 are not supported.
- <mode>=1 and <mode>=3 are applicable only in reference to the UART interface, even if the command is accepted by all the serial interfaces (physical and MUX virtual interfaces).
- <mode>=3 is not supported in the two UART configurations (for more details on SIO configuration, see +USIO AT command).
- There is an extended behavior in case both UART and AUX UART are configured as AT interfaces (for more details, see the +USIO AT command). The command can be issued on either UART or AUX UART interface, and it has a global effect.
  - o If power saving is disabled (+UPSV: 0), both UART and AUX UART interfaces are always enabled and the module does not enter idle mode.
  - o Power saving can be enabled (+UPSV: 1), only if both UART and AUX UART interfaces have the same HW flow control settings, see AT&K and +UUARTCONF.
  - o If power saving is enabled (+UPSV: 1) and HW flow control is enabled, both UART and AUX UART interfaces are cyclically enabled and the module enters idle mode automatically whenever possible. The enabling is synchronous,and the interfaces share the same <Timeout> parameter configuration.
  - o If power saving is enabled (+UPSV: 1) and HW flow control is disabled, both UART and AUX UART are always disabled and they are both enabled when a character is received by one of them.
- The command setting is stored in the NVM.

20 GPIO

20.1 Introduction

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

20.1.1 GPIO functions

On u-blox cellular modules, GPIO pins can be opportunely configured as general purpose input or output. Moreover GPIO pins of u-blox cellular modules can be configured to provide custom functions via +UGPIOC AT command. The custom functions availability can vary depending on the u-blox cellular modules series and version: see Table 22 for an overview of the custom functions supported by u-blox cellular modules.

<gpio_mode>	Output	Input	Network status indication	External GNSS supply enable	External GNSS data ready	External GNSS RTC sharing	Jamming detection indication	SIM card detection	Headset detection	GSM Tx burst indication	Module status indication	Module operating mode indication	I2S digital audio interface	SPI serial interface	Master clock generation	UART (DSR, DTR, DCD and RI) interface	Wi-Fi enable	Ring indicator	Last gasp	External GNSS antenna / LNA control	Time pulse GNSS	Time pulse output	Time stamp of external interrupt	Fast and safe power-off	LwM2M pulse	Hardware flow control (RTS, CTS)	Antenna dynamic tuning	External GNSS time pulse input	External GNSS time stamp of external interrupt	DTR mode for power saving control	32.768 kHz output	Pad disabled
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	32	255
LARA-R6001 / LARA-R6401 / LARA-R6801	*	*	*	*	*			*					*			*[2]		*	*					*								*
LARA-R6001D / LARA-R6401D	*	*	*	*	*			*								*[2]		*	*					*								*

Table 22: 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.

20.1.2 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.

20.1.2.1 LARA-R6001D / LARA-R6401D GPIO mapping

<gpio_id>	Pin name	Pin number	Factory-programmed function	Remarks
16	GPIO1	16	Pin disabled	-
23	GPIO2	23	External GNSS supply enable	-
24	GPIO3	24	External GNSS data ready	Only pin 24 can be configured for "GNSS data ready", "Last gasp" or "Faster and safe power-off" functionalities
25	GPIO4	25	General purpose output (low)	-
42	GPIO5	42	SIM card detection	Only pin 42 can be configured for "SIM card detection" functionality

[2] only DTR

<gpio_id>	Pin name	Pin number	Factory-programmed function	Remarks
34	I2S_WA	34	Pin disabled	
35	I2S_TXD	35	Pin disabled	
36	I2S_CLK	36	Pin disabled	
37	I2S_RXD	37	Pin disabled	

Table 23: LARA-R6001D LARA-R6401D GPIO mapping

20.1.2.2 LARA-R6001 / LARA-R6401 / LARA-R6801 GPIO mapping

<gpio_id>	Pin name	Pin number	Factory-programmed function	Remarks
16	GPIO1	16	Pin disabled	-
23	GPIO2	23	External GNSS supply enable	-
24	GPIO3	24	External GNSS data ready	Only pin 24 can be configured for "GNSS data ready", "Last gasp" or "Faster and safe power-off" functionalities
25	GPIO4	25	General purpose output (low)	-
42	GPIO5	42	SIM card detection	Only pin 42 can be configured for "SIM card detection" functionality
34	I2S_WA	34	I2S word alignment input/output	
35	I2S_TXD	35	I2S transmit data output	
36	I2S_CLK	36	I2S clock input/output	
37	I2S_RXD	37	I2S receive data input	

Table 24: LARA-R6001 LARA-R6401 LARA-R6801 GPIO mapping

20.1.2.3 Additional notes

☞ LARA-R6
When "SIM card detection" functionality is enabled, the status is reported by +CIND AT command.

☞ LARA-R6
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.
Beware that the SIM will be in a not-ready state if the SIM hot insertion is enabled and the "SIM card detection" feature is disabled.

☞ <gpio_mode>=24 (fast and safe power-off) triggers the emergency fast shutdown of the module. The process status is provided by means of the +UUFASTSHUTDOWN URC. For more details about the URC syntax, see +CFUN AT command.

☞ LARA-R6
The "External GNSS supply enable" and "External GNSS data ready" functions can be handled by the +UGPS and the +UGPRF AT commands to manage the u-blox GNSS receiver connected to the cellular module and the embedded GNSS aiding.
After having enabled the "Last gasp" feature reboot the module in order to make the change effective. For more details, see the +ULGASP AT command.
After having enabled or disabled the "SIM card detection" feature (<gpio_mode>=7), reboot the module in order to make the change effective.

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

20.1.3 Network status indication

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

- No service: indicates no network coverage or not registered state
- Registered home network 2G: indicates registered state on home network in 2G RAT
- Registered home network 3G: indicates registered state on home network in 3G RAT
- Registered home network NB-IoT: indicates registered state on home network in NB-IoT

- Registered roaming 2G: indicates registered state with visitor 2G network (roaming in 2G RAT)
- Registered roaming 3G: indicates registered state with visitor 3G network (roaming in 3G RAT)
- Registered roaming NB-IoT: indicates registered state with visitor NB-IoT network (roaming in NB-IoT)
- Data transmission: indicates voice or data call active either in 2G, 3G or 4G RAT
- Data transmission roaming: indicates voice or data call active either in 2G, 3G or 4G RAT with visitor network

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

20.1.3.1 No service (no network coverage or not registered)

- Continuous Output / Low



Figure 2: GPIO pin progress for no service

20.1.3.2 Registered home network 2G

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

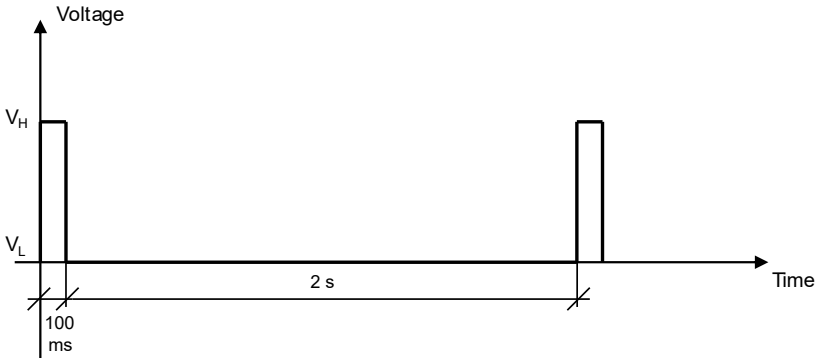


Figure 3: GPIO pin progress for registered home network 2G

20.1.3.3 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

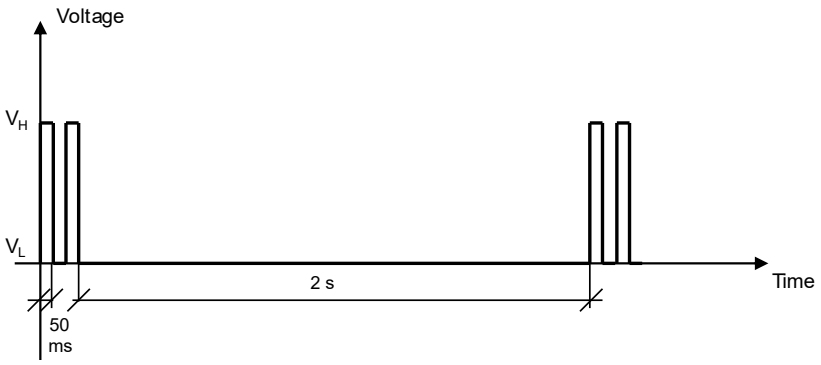


Figure 4: GPIO pin progress for registered home network 3G

20.1.3.4 Registered home network NB-IoT

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

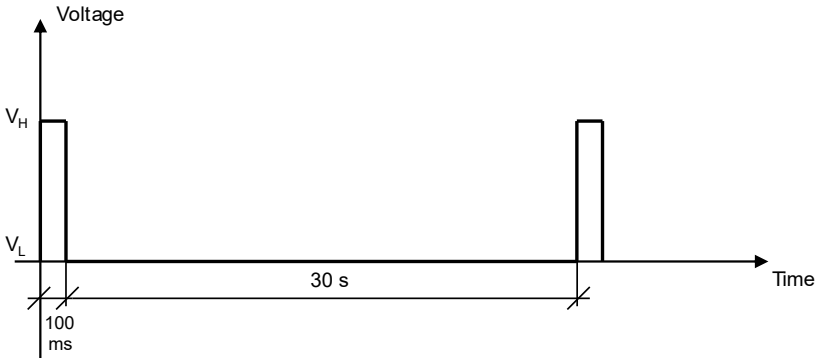


Figure 5: GPIO pin progress for registered home network NB-IoT

20.1.3.5 Registered roaming 2G

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

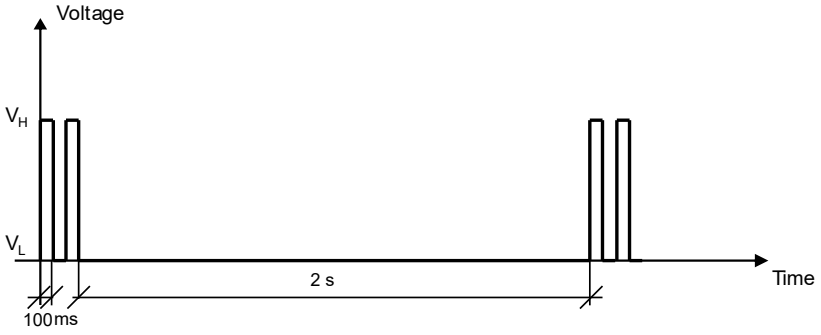


Figure 6: GPIO pin progress for registered roaming 2G

20.1.3.6 Registered roaming 3G

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

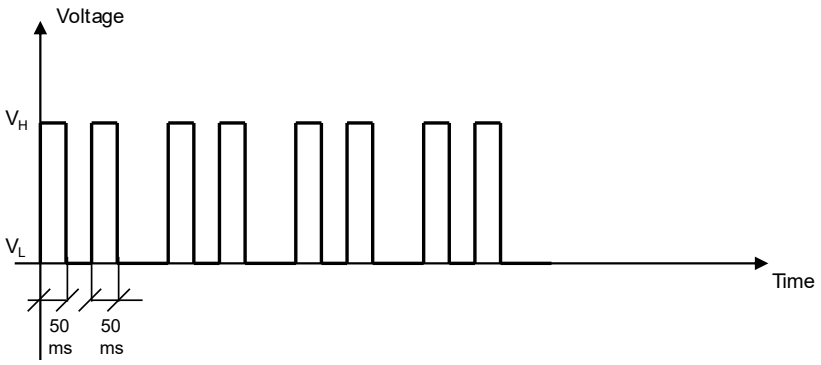


Figure 7: GPIO pin progress for registered roaming 3G

20.1.3.7 Registered roaming NB-IoT

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

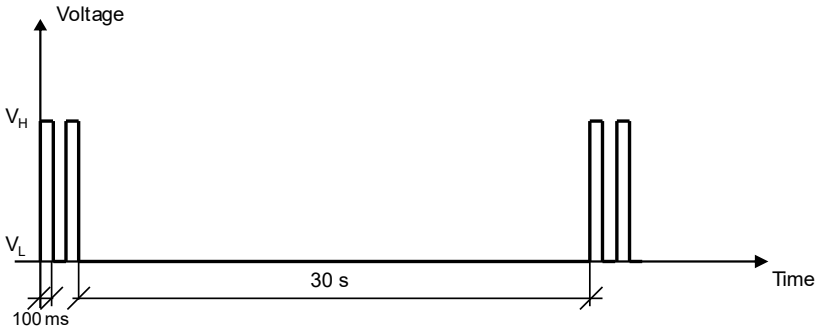


Figure 8: GPIO pin progress for registered roaming NB-IoT

20.1.3.8 Data transmission

- Continuous Output / High

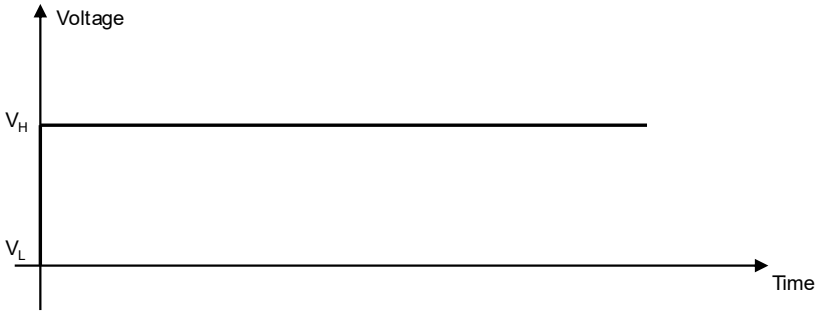


Figure 9: GPIO pin progress for data transmission

20.1.3.9 Data transmission roaming

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

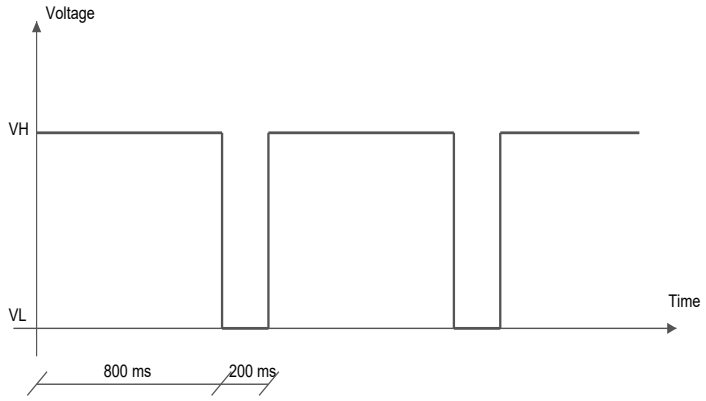


Figure 10: GPIO pin progress for data transmission roaming

☞ LARA-R6
When registered on 4G (LTE) network, the GPIO pin progress is the same as for data transmission (Figure 9) because a PDP context/EPS bearer is available.

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

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

☞ LARA-R6
When both the UART and AUX UART interfaces are enabled simultaneously (that is the +USIO AT command active variant is 1), the primary UART DTR line can be set on GPIO3 or GPIO4 pin.
Reboot the module to make the functionality effective.

20.1.5 Module status indication

When a GPIO pin is configured to provide module status indication, its progress depends on the current module status (power-off mode, i.e. module switched off, versus idle, active or connected mode, i.e. module switched on):

- Output / High, when the module is switched on (any operating mode during module normal operation: idle, active or connected mode)
- Output / Low, when the module is switched off (power-off mode)

20.1.6 Module operating mode indication

When a GPIO pin is configured to provide module operating mode indication, its progress depends on the current module operating mode (the low power idle mode versus active or connected mode):

- Output / High, when the module is in active or connected mode
- Output / Low, when the module is in idle mode (that can be reached if the power saving is enabled by the +UPSV AT command)

20.2 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

20.2.1 Description

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

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

Not all the GPIO functions can be assigned to each GPIO pin. If the configuration is not allowed, an error result code will be returned (error result code 1502 - "+CME ERROR: Select GPIO mode error").
The following custom functions cannot be simultaneously configured on 2 GPIOs:

- Network status indication
- External GNSS supply enable
- External GNSS data ready
- External GNSS RTC sharing
- Jamming detection indication
- SIM card detection
- Headset detection
- GSM Tx burst indication
- Module status indication
- Module operating mode indication
- Ring indicator
- Last gasp
- External GNSS antenna / LNA control
- Time pulse GNSS
- Time pulse output
- Time stamp of external interrupt
- Fast and safe power-off
- External GNSS time pulse input
- External GNSS time stamp of external interrupt
- DTR mode for power saving control
- 32.768 kHz output
- Primary UART DTR line on GPIO pin

For more details regarding the custom functions supported by the u-blox cellular modules and the factory-programmed settings, see GPIO functions and GPIO mapping.

20.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPIOC=<gpio_id>,<gpio_mode>[,<gpio_out_val>\<gpio_in_pull>]	OK	AT+UGPIOC=20,0,1 OK
Read	AT+UGPIOC?	+UGPIOC: <gpio_id>,<gpio_mode> [<gpio_id>,<gpio_mode> [....]] OK	+UGPIOC: 20,0 21,3 23,255 24,255 42,7 OK
Test	AT+UGPIOC=?	+UGPIOC: (list of supported <gpio_id>),(list of supported <gpio_mode>),(list of supported <gpio_out_val>\<gpio_in_pull>) [<gpio_id1>,<gpio_mode> ... <gpio_idN>,<gpio_mode>] OK	+UGPIOC: (20,21,23,24,42),(0-5,7,9,255),(0-2) OK

20.2.3 Defined values

Parameter	Type	Description
<gpio_id>	Number	GPIO pin identifier: pin number

Parameter	Type	Description
		See the GPIO mapping for the available GPIO pins, their mapping and factory-programmed values on different u-blox cellular modules series and product version.
<gpio_mode>	Number	Mode identifier: configured function See the GPIO functions for custom functions supported by different u-blox cellular modules series and product version. Allowed values: • 0: output • 1: input • 2: network status indication • 3: external GNSS supply enable • 4: external GNSS data ready • 5: external GNSS RTC sharing • 6: jamming detection indication • 7: SIM card detection • 8: headset detection • 9: GSM Tx burst indication • 10: module status indication • 11: module operating mode indication • 12: I^2S digital audio interface • 13: SPI serial interface • 14: master clock generation • 15: UART (DSR, DTR, DCD e RI) interface • 16: Wi-Fi enable • 18: ring indicator • 19: last gasp • 20: external GNSS antenna / LNA control enable • 21: time pulse GNSS • 22: time pulse output • 23: time stamp of external interrupt • 24: fast and safe power-off • 25: LwM2M pulse • 26: hardware flow control (RTS, CTS) • 27: antenna dynamic tuning • 28: external GNSS time pulse input • 29: external GNSS time stamp of external interrupt • 30: DTR mode for power saving control • 32: 32.768 kHz output • 255: pad disabled
<gpio_out_val>	Number	GPIO output value (for output function <gpio_mode>=0 only): • 0 (default value): low • 1: high
<gpio_in_pull>	Number	GPIO input value (for input function <gpio_mode>=1 only): • 0 (default value): no resistor activated • 1: pull up resistor active • 2: pull down resistor active

20.2.4 Notes

LARA-R6

- <gpio_in_pull> is not supported.
- The network status indication function can be set only on the GPIO1, GPIO2, GPIO3 and GPIO4 pins.
- The ring indicator is supported on all pins.
- The DTR line of main UART on GPIO functionality is supported only when both the main and auxiliary UART interfaces are enabled (that is the +USIO AT command active variant is 1). Reboot the module to make the functionality effective.

20.3 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

20.3.1 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.

20.3.2 Syntax

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

20.3.3 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.

20.3.4 Notes

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

20.4 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

20.4.1 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).

20.4.2 Syntax

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

20.4.3 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.

20.4.4 Notes

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

21 File System

21.1 File tags

21.1.1 Description

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

The file tag applicability depends on the module series: see Table 25 for the allowed tags supported by the interested product. An overview about each file tag is provided in Table 26.

Module	"USER"	"FOAT"	"AUDIO"	"ECALL_EXT"	"FOTA_EXT"	"AUDIO_EXT"	"PROFILE"	"GNSS"	"CALLSRV_EXT"	"XLWM2M"	"MNO"
LARA-R6	*	*				*	*				

Table 25: Tag applicabilities to module series

Tag	Name	Specification
"USER"	User file system	This is the default type if the <tag> parameter is omitted in file system AT commands. All generic files can be stored in this manner. Example: `AT+UDWNFILE="foobar",25,"USER"` is the same as `AT+UDWNFILE="foobar",25`
"FOAT"	FOAT file system	This tag is used to specify the file type as a firmware update package. It will place the firmware update package in the proper file cache to be used later by the +UFWINSTALL command.
"AUDIO"	Audio parameters	This tag is used to store audio calibration file "audio_gain_calibration<X>.xml" and "voice<X>.nvm" in the selected profile <X>=0,1. The profile is stored into NVM by using ATZ<X>. ☞ The "audio_gain_calibration<X>.xml" and "voice<X>.nvm" files can be over-written with AT&W<X> command.
"ECALL_EXT"	eCall controller configuration and custom eCall prompts	This tag is used to read, download and delete the eCall controller configuration (see the eCall implementation in u-blox cellular modules application note [54]) or download and delete custom eCall prompts (see the eCall Prompts section). Reading and downloading commands use a dedicated channel of the USB CDC-ACM interface. To download the eCall controller configuration or custom eCall prompts in the module, use the +UDWNFILE command. To read the eCall controller configuration from the module, use the +URDFILE command. To delete eCall controller configuration or custom eCall prompts from the module, use the +UDELFILE command.
"FOTA_EXT"	Firmware for FOTA procedure	This tag has to be used to store the firmware file for the FOTA procedure using a dedicated channel of the USB CDC-ACM interface.
"AUDIO_EXT"	Audio configuration	This tag is used to read or download audio configuration (see Audio parameters tuning section). The audio configuration file includes the NVM settings of the following AT commands (where applicable): • +CLVL AT command • +CRSL AT command • +UI2S AT command • +UMAFE AT command • +USAFE AT command • +UMSEL AT command

Tag	Name	Specification
		• +UMGC AT command • +USGC AT command • +USPM AT command • +UTI AT command To download the audio configuration in the module, use the +UDWNFILE command. To read configuration from the module, use the +URDFILE command.
"PROFILE"	Profile files	This tag refers to the profile files that can be loaded on to the module to support Mobile Network Operators (MNOs) specific configurations. For more details on the profiles, see the +UMNOPROF command. The +URDFILE and +ULSTFILE AT commands are not allowed with this tag, the user can only download or delete these files.
"GNSS"	GNSS files	This tag has to be used to store the firmware file for the internal GNSS receiver.

"CALLSRV_EXT"	Emergency Call Number List (ECNL) management	This tag is used to manage the Emergency Call Number List (ECNL) file stored in NVM. All numbers in the list will be treated as emergency numbers when dialled and will result in disabling the thermal daemon software shutdown. Some notes about ECNL:
		• If eCall is enabled, the ECNL list is not used and call is treated as any normal call.
		• Conflict manager will not manage these calls, meaning no ongoing calls will be dropped.
		• Maximum allowed numbers in the ECNL list is 20. Numbers after 20 will be ignored.
		• Reboot is required to reload the ECNL list after download.
		
		File should be composed by text lines consisting of 'type','number' lines that end with carriage return where 'type' is a type of the number in 'number' according to one of the formats supported by 3GPP TS 24.008 [79] sub-clause 10.5.4.7).
		
		All numbers that start with '00' should be stored with '+' instead in order to keep only one occurrence for international number. In order to manage numbers properly the configuration file should contain the number with international prefix and without it.
		
		Example of a two line ECNL file:
		
		`2,+390123456789`
		
		`2,390123456789`

"XLWM2M"	LwM2M object script files	This tag is used to read or store Lua files defining a LwM2M object for use by the LwM2M client. The file specified with the "XLWM2M" can be only downloaded completely (see +UDWNFILE AT command), deleted (see +UDELFILE AT command), fully or partially read (see +URDFILE or +URDBLOCK) and queried (see +ULSTFILE AT command).
"MNO"	ICCID and MCC/MNC MNO lists	This tag refers to the files containing the ICCID and MCC/MNC MNO lists used by the SIM ICCID/IMSI selection (see the +UMNOPROF AT command). The file specified with the "MNO" tag can be downloaded to the module (see the +UDWNFILE AT command), deleted (see the +UDELFILE AT command), fully or partially read (see the +URDFILE or +URDBLOCK AT commands) and queried (see the +ULSTFILE AT command). Depending on the file name (<filename>) the file contains the ICCID and MCC/MNC MNO lists. The allowed file names are: • "iccid_list": SIM Issuer Identifier Number (IIN) list. The list format is: `MNO1%iccid1%iccid2%MNO2%iccid3%iccid4...%MNOn%iccidm`. By factory-programmed configuration no iccid_list file is stored in the module file system. • "mno_list": MCC and MNC list. The list format: `MNO1%mcc1mnc1%mcc2mnc2%MNO2%mcc3mnc3...%MNOn%mcckmnck`. By factory-programmed configuration the following mno_list file is stored in the module file system: `ATT%310150%310170%310410%310560%311180%310030%310280%310950%313790%VZW%310890%311480%311270%310010%310012%310013%310590%310890%310910%311110%311270%311271%311272%311273%311274%311275%311276%311277%311278%311279%311280%311281%311282%311283%311284%311285%311286%311287%311288%311289%311390%311480%311481`

Tag	Name	Specification
		%311482%311483%311484%311485%311486%311487%311488 %311489%TELSTRA%50501%50511%50539%50571%50572%FN %313100%312670%313130%313140%313110%313120%TMOUS %310160%310200%310210%310220%310230%310240%310250 %310260%310270%310310%310490%310660%310800%SB%44000 %44020%44021%44101%DOCOMO%44010%KDDI%44050%44051 %44052%44053%44054%44070%44071%44072%44073%44074 %44075%44076%SKT%45005%45011%45012%RGS%302720%TELUS %302220%302760%USC%310730%311220%311580%BELL%302610 %302640%302690%LGU%45006 Allowed MNO1,..., MNOn values for both iccid_list and mno_list files are: • ATT: AT&T • VZW: Verizon • CB: Generic voice capable AT&T • FN: FirstNet • TELSTRA: Telstra • TMOUS: T-Mobile US • DOCOMO: NTT DoCoMo • KDDI: KDDI • SB: SoftBank • SKT: SKT • RGS: Rogers • TELUS: Telus • USC: US Cellular • BELL: Bell • LGU: LGU+ The maximum entries number in the MCC/MNC list and ICCID list is 256 and the file overall maximum size is 2048 bytes.

Table 26: Tag meanings

21.2 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

21.2.1 Description

Stores (writes) a file into the file system:

- The stream of bytes can be entered after the '>' prompt has been provided to the user. The file transfer is terminated exactly when <size> bytes have been entered and either "OK" final result code or an error result code is returned. The feed process cannot be interrupted i.e. the command mode is re-entered once the user has provided the declared the number of bytes.
- If the file already exists, the data will be appended to the file already stored in the file system.
- If the data transfer stops, after 20 s the command is stopped and the "+CME ERROR: FFS TIMEOUT" error result code (if +CMEE: 2) is returned.
- If the module shuts down during the file storing, all bytes of the file will be deleted.
- If an error occurs during the file writing, the transfer is aborted and it is up to the user to delete the file.

LARA-R6

- The available free memory space is checked before starting the file transfer. If the file size exceeds the available space, the "+CME ERROR: FFS MEMORY NOT AVAILABLE" error result code will be provided (if +CMEE: 2).
- If the file already exists, the data will be appended to the file already stored in the file system.

LARA-R6
For the FOTA file (+UDWNFILE of a "FOAT"-tagged file), the file is deleted after the FW update so the data is not overwritten.

21.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDWNFILE=<filename>,<size>[,<tag>] > <text>	OK	AT+UDWNFILE="filename",36,"USER" > The 36 downloaded bytes of the file! OK
Download audio configuration			
Set	AT+UDWNFILE=<filename>,<size>,"AUDIO_EXT"	OK	AT+UDWNFILE="audioconfig",4873,"AUDIO_EXT" OK

21.2.3 Defined values

Parameter	Type	Description
<filename>	String	Filename. For file system filename and data size limits see File system limits.
<size>	Number	File size expressed in bytes. For file system filename and data size limits see File system limits.
<tag>	String	Optional parameter that specifies the application file type. FILE TAGS table lists the allowed <tag> strings. For more details on specific limitations, see Notes.
<text>	String	Stream of bytes.

21.2.4 Notes

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

LARA-R6

- The <tag> parameter is mandatory for firmware package transfer. The tag must be given as "FOAT" for FW download, "AUDIO_EXT" for audio configuration file download, and "PROFILE" for carrier profile. For more details, see FILE TAGS.
- "AUDIO_EXT" tag:
  - The tag is used to download the audio configuration database file (i.e. acdb.mbn file) which contains the voice algorithm parameters and I2S settings for all u-blox audio profiles. The acdb.mbn file is part of the delivered u-blox binary package.
  - New audio configuration file will be generated by u-blox on customer request and could be delivered separately by the binary package.
  - After a successful download, the audio configuration is validated. If it is not valid, the configuration is not applied, the "+CME ERROR: operation not supported" error result code will be provided, the downloaded file will be deleted and the acdb.mbn version number verification by AT+UTI="uaud_save_data?" command will show the original version with checksum OK.
  - The download validation procedure is also performing a file checksum verification at the end of the downloading procedure. In case this fail the "+CME ERROR: operation not supported" error result code will be provided and the result of this check is stored in NVM.
  - The checksum result can be always shown by the AT+UTI="uaud_save_data?" command. In case this shows a fail, the audio quality cannot be guaranteed since the downloaded acdb.mbn is corrupted. Therefore it is strongly recommended to download the original acdb.mbn file provided within the delivered u-blox binary package.
  - After a successful application, reboot the module to activate the new audio configuration.
  - Current configuration is not backed up. To be restored, the original audio configuration is always available in the delivered u-blox binary package.
  - The downloaded file is deleted after the processing is successfully done.
  - The FOTA containing an acdb.mbn file will overwrite any previous acdb file downloaded by the +UDWNFILE AT command.

21.3 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

21.3.1 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.

21.3.2 Syntax

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

21.3.3 Defined values

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

21.4 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

21.4.1 Description

Retrieves a file from the file system.

21.4.2 Syntax

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

21.4.3 Defined values

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

21.4.4 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.

21.5 Partial read file +URDBLOCK

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

21.5.1 Description

Retrieves a file from the file system.

Differently from +URDFILE command, this command allows the user to read only a portion of the file, indicating the offset and amount of bytes.

21.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+URDBLOCK=<filename>,<offset>,<size>[,<tag>]	+URDBLOCK: <filename>,<size>,<data> OK	AT+URDBLOCK="filename",0,20 +URDBLOCK: "filename",20,"these bytes are the " OK

21.5.3 Defined values

Parameter	Type	Description
<filename>	String	Filename. For file system filename and data size limits see File system limits.
<offset>	Number	Offset in bytes from the beginning of the file.
<size>	Number	Number of bytes to be read starting from the <offset>.

Parameter	Type	Description
<data>	String	Content of the file read.
<tag>	String	The optional parameter <tag> specifies a different application file type. FILE TAGS table lists the allowed <tag> strings.

21.5.4 Notes

- The returned file data is displayed as an ASCII string of <length> characters in the range [0x00,0xFF]. At the end of the string, <CR><LF> are provided for user convenience and visualization purposes.
- If a size larger than the whole file size is required the command returns the file size only, indicating the amount of bytes read.
- If an offset larger than the whole file size is required, the "+CME ERROR: FFS file range" error result code is triggered.

21.6 Delete file +UDELFILE

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

21.6.1 Description

Deletes a stored file from the file system.

LARA-R6
If <filename> file is not stored in the file system the following error result code will be provided: "+CME ERROR: FILE NOT FOUND".

21.6.2 Syntax

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

21.6.3 Defined values

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

21.7 File system limits

21.7.1 Allowed characters in filenames

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

LARA-R6
Filenames starting with a dot (.) are not valid.

21.7.2 Limits

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

Maximum filename length:

- LARA-R6 - 248 characters

Maximum file size:

- LARA-R6 - File size limited by the available file system space retrieved by AT+ULSTFILE=1 command

Maximum number of files:

- LARA-R6 - There is no limit to files that can be stored.

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.

22 Audio interface

This section describes a set of standard and u-blox proprietary AT commands to be used for the audio features configuration:

- +CLVL command selects the speech volume.
- +CMUT command configures the uplink voice muting during all the voice calls.
- +CRSL command selects the sound level for the ringer of an incoming call and for the tone generator (see +UPAR command).
- +USPM command sets the audio path
- +UI2S command configures I^2S interfaces
- +UPAR, +USAR, +UPLAYFILE, +URECFILE, +USTOPFILE, +UAPLAY, +UAREC, +UTGN, +URNG, +UMSM commands manage players
- +UMCLK, +UEXTDCONF manage the external codec or other external audio IC
- +UDCONF=30 configures allowed speech codecs
- +UDCONF=33 sets volume or disables waiting call tone
- +UMAAT command checks the external hardware audio path

Audio parameters tuning section describes commands for the audio parameters tuning.

eCall section describes commands specific for eCall.

DTMF section describes commands specific for DTMF detection and generation.

Other standard commands available for audio configuration are listed as follows: +CALM, +VTD, +VTS, +UVTS.

The <silent> parameter in +CALA command refers to the alarm tone.

22.1 Loudspeaker volume level +CLVL

+CLVL						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

22.1.1 Description

Selects the speech volume.

22.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+CLVL=[<level>]	OK	AT+CLVL=30 OK
Read	AT+CLVL?	+CLVL: <level> OK	+CLVL: 80 OK
Test	AT+CLVL=?	+CLVL: (list of supported <level>s) OK	+CLVL: (0-100) OK

22.1.3 Defined values

Parameter	Type	Description
<level>	Number	• LARA-R6 - The allowed range is 0-6, where 0 means mute, 1 means -15 dB, 6 means 0 dB and the step size is 3 dB. The default and factory-programmed value is 6.

22.1.4 Notes

- If an incorrect number of parameters is provided or the parameter value is out of range, then the error result code "+CME ERROR: operation not supported" will be provided (if +CMEE is set to 2).
- The command affects only the speech volume during the call. Other players volume and tone generator volume are not affected.

LARA-R6

- The factory-programmed value can be restored by means of AT+CLVL= command (with no parameters).

22.2 Mute control +CMUT

+CMUT						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

22.2.1 Description

Configures the uplink voice muting during all the voice calls.

22.2.2 Syntax

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

22.2.3 Defined values

Parameter	Type	Description
<n>	Number	• 0 (default value): mute off • 1: mute on

22.2.4 Notes

- If an incorrect number of parameters is provided or the parameter value is out of range, then the error result code "+CME ERROR: operation not supported" will be provided (if +CMEE is set to 2).

22.3 Audio path mode setting +USPM

+USPM						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

22.3.1 Description

Sets the audio path mode enabling the different audio paths (audio uplink and downlink) of the module for different use cases. For example, the uplink path can be switched from the handset microphone to the headset microphone and the downlink path can be switched from the handset earpiece to the loudspeaker.

Besides the routing via analog or digital interface, the uplink and downlink paths are characterized by a set of audio parameters (gains, digital filters, echo canceller parameters). The uplink paths and downlink paths can be configured through the set of commands described in the Audio parameters tuning section.

The command is used to choose the uplink and downlink path used.

Only one single uplink path and one single downlink path can be used. Parallel paths are not managed.

22.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+USPM=<audio_path>,<profile_type>	OK	AT+USPM=1,1 OK

Type	Syntax	Response	Example
Read	AT+USPM?	+USPM: <audio_path>,<profile_type> OK	+USPM: 0,0 OK
Test	AT+USPM=?	+USPM: (list of supported <audio_path>s),(list of supported <profile_type>s) OK	+USPM: (0-1),(0-4) OK

22.3.3 Defined values

Parameter	Type	Description
<audio_path>	Number	Specifies the audio path. See Notes for allowed and default values.
<profile_type>	Number	Specifies the profile for selected audio path. See Notes for allowed and default values.

22.3.4 Notes

LARA-R6

- Allowed and default values for parameters:
  - **<audio_path>**:
    - 1 (factory-programmed value): digital audio path
  - **<profile_type>**:
    - 0 (factory-programmed value): headset profile
    - 1: hands-free profile
    - 2: flat profile
    - 3: alarm panel profile
- When audio path mode is changed, the following configuration is applied:
  - configuration for I^2S (if using digital audio path see +UI2S for details)
- Flat profile (<profile_type>=2) has all audio path processing blocks disabled.
- Alarm panel profile (<profile_type>=3) is specifically intended for alarm panel use case e.g. strong acoustic mic/speaker coupling.
- The factory-programmed values can be restored by means of AT+USPM= command (with no parameters).

22.4 I^2S digital interface mode +UI2S

+UI2S						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

22.4.1 Description

Configures the I^2S digital audio interface to be used when digital audio paths are chosen (see the +USPM AT command description, <main_uplink>=I2S RX, <main_downlink>=I2S TX).

The I^2S TX and RX data lines can be connected to two different access points of the uplink and downlink audio path (see the module audio block diagram in the Audio parameters tuning introduction).

The digital audio interface is I2S.

The I^2S interface can be configured either in Master or in Slave mode through the <I2S_Master_Slave> parameter:

- In Master mode, the module generates the WA (word alignment) and CLK (clock) signals
- In Slave mode, the remote device must generate the WA (word alignment) and CLK (clock) signals

The sample rate of transmitted and received words is configurable through the <I2S_sample_rate> parameter.

Furthermore synchronization between data, clock and word alignment lines can be configured in different modes through the <I2S_mode> parameter:

- PCM modes (short synchronization signal)
- Normal I²S modes (long synchronization signal)

For details about I²S technical features in PCM and Normal I²S mode, see the system integration manual for the corresponding module.

The physical I²S port is composed of 4 pins. The signals are:

- **I2S_WA** (Word Alignment): output signal in Master mode, input signal in Slave mode; it synchronizes the data word; the WA cycle frequency is <I2S_sample_rate>, while WA cycle timing depends on the mode (see PCM modes, PCM modes timing diagrams, Normal I²S modes and Normal I²S modes timing diagrams)
- **I2S_TXD** (Transmitted Data): output signal; sequence of data bits, most significant bit transmitted first. Each word is 16 bits long, in 2's complement format with the configured I²S sample rate
- **I2S_CLK** (Clock): output signal in Master mode, input signal in Slave mode; it synchronizes the bits composing the data words; CLK frequency and edge synchronization with TXD/RXD signals depends on <I2S_mode> and the configured I²S sample rate. See PCM modes and Normal I²S modes
- **I2S_RXD** (Received Data): input signal; sequence of data bits, most significant bit read first. Each word is 16 bits long, in 2's complement format with the configured I²S sample rate

☞ The I²S pins are mapped in the following way:

Product	I2S_WA	I2S_TXD	I2S_CLK	I2S_RXD
LARA-R6	34	35	36	37

Table 27: I²S pins mapping on u-blox cellular modules

22.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UI2S=<I2S_mode>,<I2S_port>,<I2S_clk_wa>[,<I2S_sample_rate>[,<I2S_Master_Slave>]]	OK	AT+UI2S=10,1,1,5,1 OK
Read	AT+UI2S?	+UI2S: <I2S_mode>,<I2S_port>,<I2S_clk_wa>,<I2S_sample_rate>,<I2S_Master_Slave> [...] (for all the I²S interfaces) OK	+UI2S: 4,1,1,4,1 +UI2S: 10,3,1,5,0 OK
Test	AT+UI2S=?	+UI2S: (list of supported <I2S_mode>s),(list of supported <I2S_port>s),(list of supported <I2S_clk_wa>)[,(list of supported <I2S_sample_rate>),(list of supported <I2S_Master_Slave>)] OK	+UI2S: (0-13),(1,3),(0-1),(0-8),(0-1) OK

22.4.3 Defined values

Parameter	Type	Description
<I2S_mode>	Number	Specifies I²S configurable modes: PCM modes (short synchronization signal) and normal I²S modes (long synchronization signal) are available. For more details, see: • PCM modes, Normal I²S modes for modes available on each connection point and for their settings • PCM modes timing diagrams and Normal I²S modes timing diagrams for the signals timing Allowed values: • LARA-R6 - 14, 30
<I2S_port>	Number	Specifies the I²S physical port (I2S or I2S1) and its connection in the internal audio processing path (I2Sx or I2Sy connection points) when the digital path is selected as audio path (see the +USPM AT command). I²S connections points positions are

Parameter	Type	Description
		showed in the audio paths block diagram in Audio parameters tuning introduction. The allowed values are: • 1: I2S is connected to I2Sx connection point • 2: I2S is connected to I2Sy connection point • 3: I2S1 is connected to I2Sx connection point • 4: I2S1 is connected to I2Sy connection point ☞ I2Sx connection point is parallel to the analog audio front end. In this case the digital audio path is comparable with the analog audio paths (see the AT+USPM command). ☞ Volume control (+CLVL) and hands-free algorithm (+UHFP) are active for both connection points. ☞ The analog gains in the +USGC and +UMGC commands are unused for both connection points. Allowed values: • LARA-R6 - 1
<I2S_clk_wa>	Number	Specifies when CLK and WA signals are active. The allowed values are: • 0: dynamic mode. CLK and WA outputs are active and only running when the audio path is active (audio samples are read on RX line and written on TX line). After the audio path is disabled (i.e. a call is hang up), CLK and WA are disabled too • 1: continuous mode. CLK and WA outputs are always active and running if the +USPM current setting implies the <I2S_port> usage, even when the module is idle and the audio path is disabled (no audio data written on TX line, no audio data read on RX line). This implies the module cannot enter power saving mode
<I2S_sample_rate>	Number	I^2S sample rate (frame rate). This is the frequency of the word set and received by the I^2S interface. The words are synchronized by the WA (word alignment) signal. Thus the <I2S_sample_rate> parameter matches with the frequency of WA signal. The allowed values are: • 0: 8 kHz sampling rate • 1: 11.025 kHz sampling rate • 2: 12 kHz sampling rate • 3: 16 kHz sampling rate • 4: 22.05 kHz sampling rate • 5: 24 kHz sampling rate • 6: 32 kHz sampling rate • 7: 44.1 kHz sampling rate • 8: 48 kHz sampling rate • 9: 96 kHz sampling rate • 10: 192 kHz sampling rate Allowed values: • LARA-R6 - 3
<I2S_Master_Slave>	Number	Indicates the Master/Slave mode of I^2S interface. The allowed values are: • 0: Master mode. CLK, WA, TX are output signals generated by the module. RX is an input signal • 1: Slave mode. Only TX signal is an output signal generated by the module. CLK, WA, RX are input signals and must be generated by the remote device.

22.4.4 Notes

LARA-R6

- <I2S_clk_wa>=1 is not supported.
- <I2S_master_slave>=1 is not supported.
- Table 28 describes the allowed combinations of <I2S_mode> and <I2S_port>

	PCM modes	Normal I^2S modes
I2Sx connection of I2S	30	14
I2Sy connection of I2S	Not supported	Not supported
I2Sx connection of I2S1	Not supported	Not supported

	PCM modes	Normal I²S modes
I2Sy connection of I2S1	Not supported	Not supported

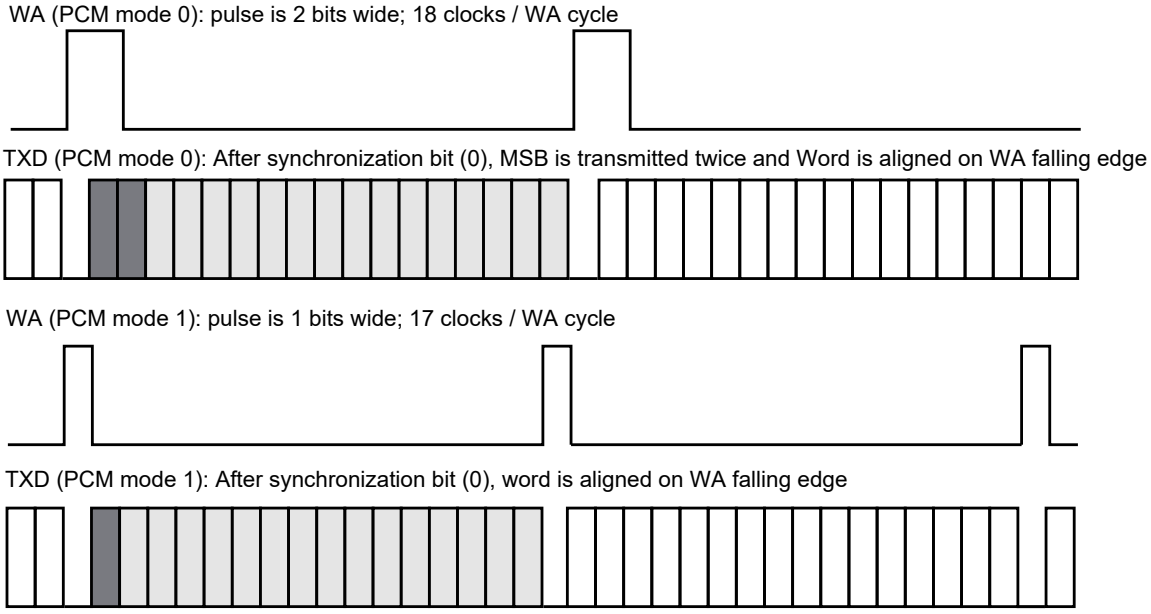
Table 28: I²S modes

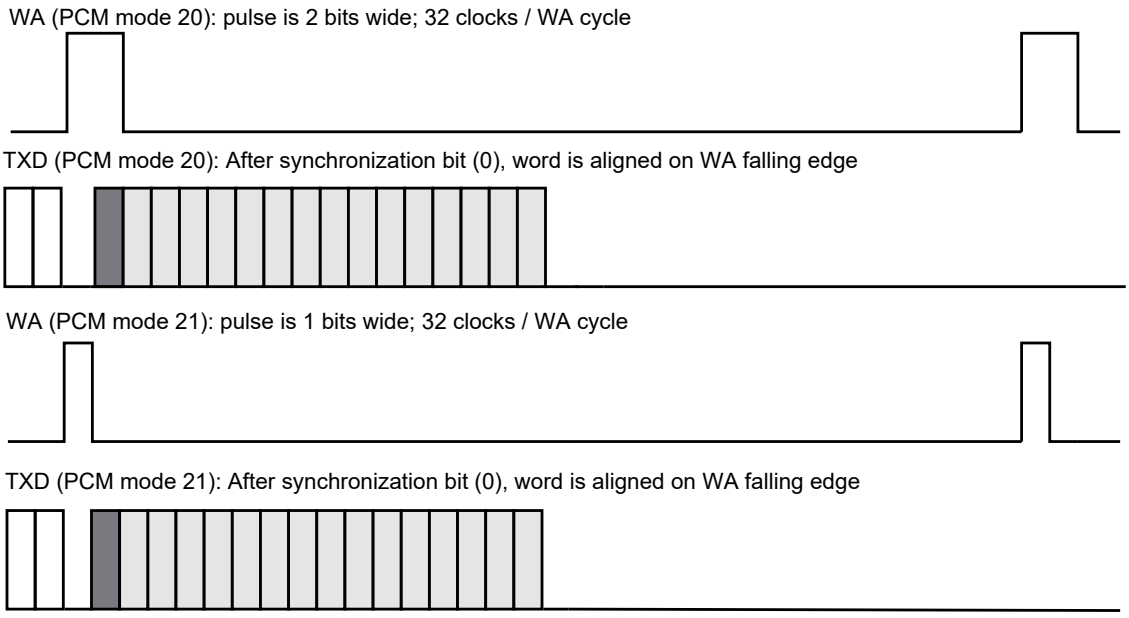
- If an incorrect number of parameters is provided or the parameter value is out of range, the error result code "+CME ERROR: operation not supported" will be provided if +CMEE is set to 2:
  - The command can be used run-time during voice call.
  - The command cannot be used run-time during audio loop (see +UPAR AT command).
- The factory-programmed values are as follows:
  - <I2S_mode>=14, <I2S_port>=1, <I2S_clk_wa>=0, <I2S_sample_rate>=3, <I2S_master_slave>=0
- The factory-programmed values can be restored by means of AT+UI2S= command (with no parameters).

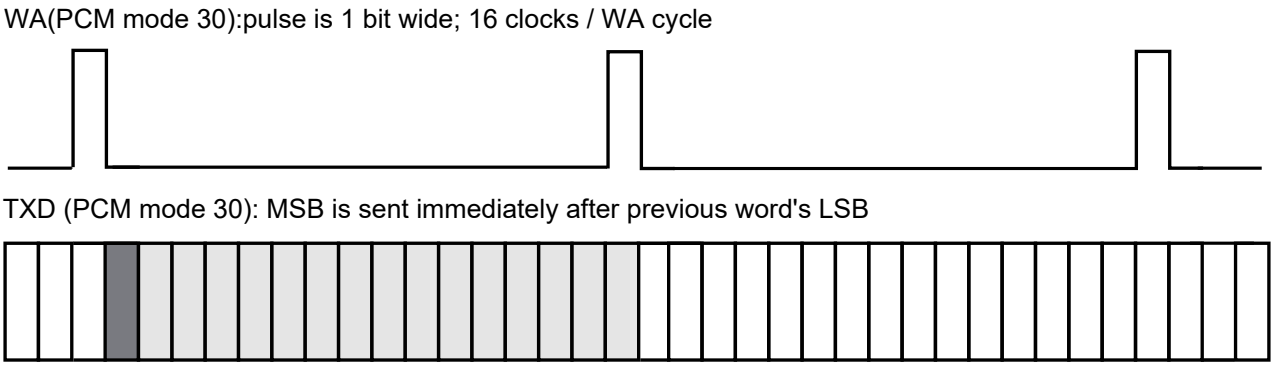
22.4.5 PCM modes (short synchronization signal)

Mode	CLK EDGE for TX	CLK EDGE for RX	WA pulse length	CLK frequency	WA frequency
0	RISING	FALLING	2 clks	18*<I2S_sample_rate>	<I2S_sample_rate>
1	RISING	FALLING	1 clk	17*<I2S_sample_rate>	<I2S_sample_rate>
20	RISING	FALLING	2 clks	32*<I2S_sample_rate>	<I2S_sample_rate>
21	RISING	FALLING	1 clk	32*<I2S_sample_rate>	<I2S_sample_rate>
22	FALLING	RISING	2 clks	32*<I2S_sample_rate>	<I2S_sample_rate>
23	FALLING	RISING	1 clk	32*<I2S_sample_rate>	<I2S_sample_rate>
30	RISING	FALLING	1 clk	16*<I2S_sample_rate>	<I2S_sample_rate>

22.4.6 PCM modes timing diagrams



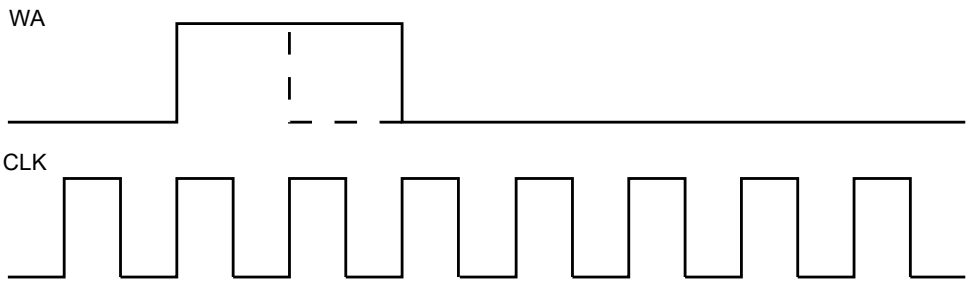




A single transmitted word is marked in grey. MSB is marked darker.

Since RXD bits are read on the falling edge of CLK signal, the RXD word slot starts half bit delayed respect TXD word slot.

Relation between WA and CLK edge for PCM mode is:



22.4.7 Normal I²S modes (long synchronization signal)

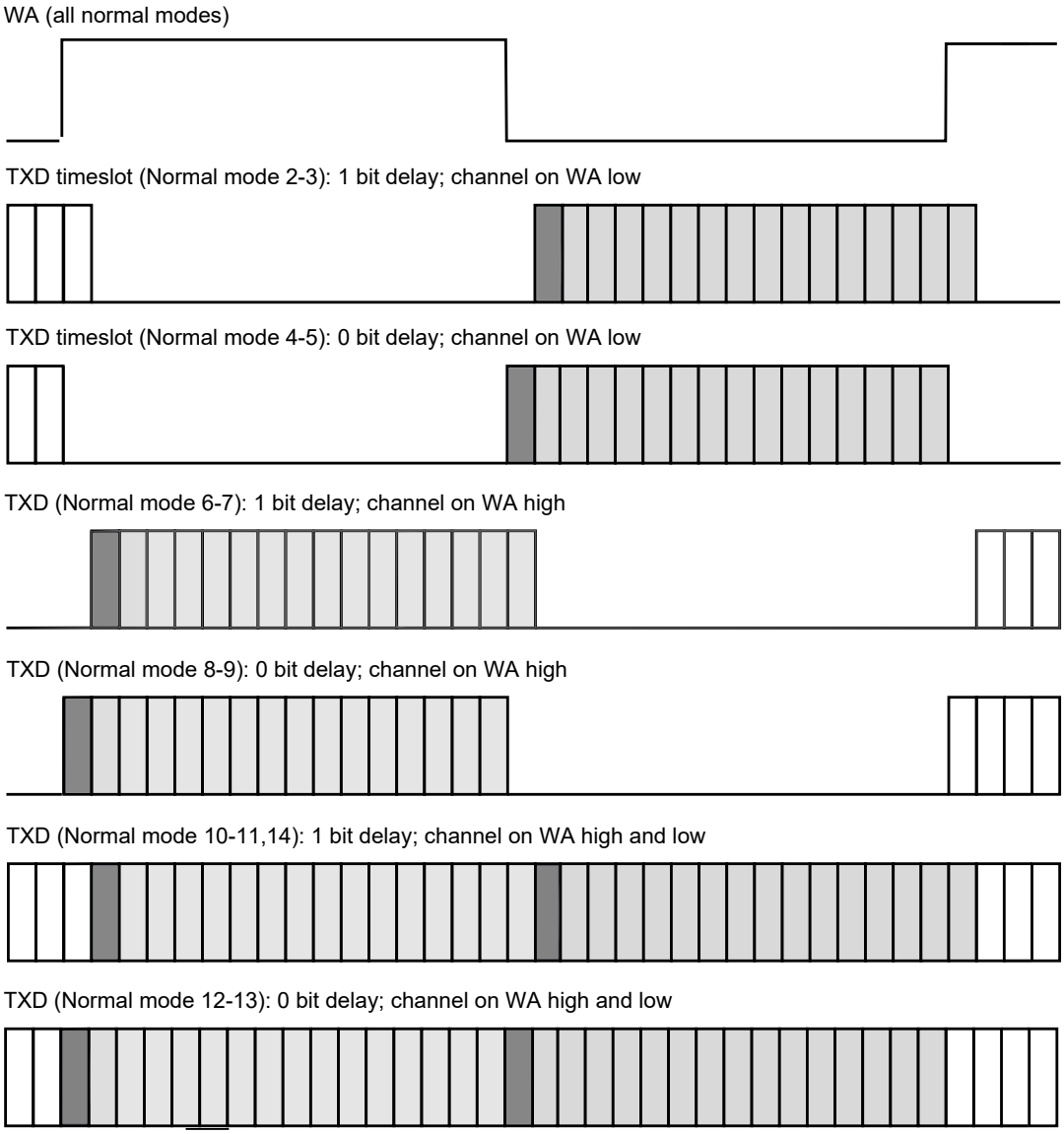
- LARA-R6

Mode	CLK edge for TX	CLK edge for RX	MSB delay	TX channel	RX channel	CLK frequency	WA frequency
2	FALLING	RISING	1 bit	WA LOW	WA LOW	32*<I2S_sample_rate>	<I2S_sample_rate>

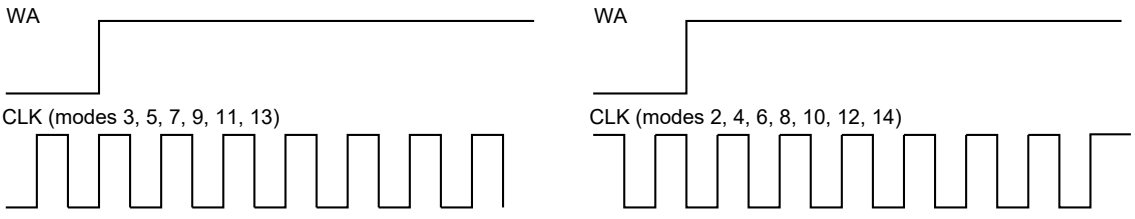
Mode	CLK edge for TX	CLK edge for RX	MSB delay	TX channel	RX channel	CLK frequency	WA frequency
3	RISING	FALLING	1 bit	WA LOW	WA LOW	32*<I2S_sample_rate>	<I2S_sample_rate>
4	FALLING	RISING	0 bit	WA LOW	WA LOW	32*<I2S_sample_rate>	<I2S_sample_rate>
5	RISING	FALLING	0 bit	WA LOW	WA LOW	32*<I2S_sample_rate>	<I2S_sample_rate>
6	FALLING	RISING	1 bit	WA HIGH	WA HIGH	32*<I2S_sample_rate>	<I2S_sample_rate>
7	RISING	FALLING	1 bit	WA HIGH	WA HIGH	32*<I2S_sample_rate>	<I2S_sample_rate>
8	FALLING	RISING	0 bit	WA HIGH	WA HIGH	32*<I2S_sample_rate>	<I2S_sample_rate>
9	RISING	FALLING	0 bit	WA HIGH	WA HIGH	32*<I2S_sample_rate>	<I2S_sample_rate>
10	FALLING	RISING	1 bit	WA HIGH & LOW	WA HIGH	32*<I2S_sample_rate>	<I2S_sample_rate>
11	RISING	FALLING	1 bit	WA HIGH & LOW	WA HIGH	32*<I2S_sample_rate>	<I2S_sample_rate>
12	FALLING	RISING	0 bit	WA HIGH & LOW	WA HIGH	32*<I2S_sample_rate>	<I2S_sample_rate>
13	RISING	FALLING	0 bit	WA HIGH & LOW	WA HIGH	32*<I2S_sample_rate>	<I2S_sample_rate>
14	FALLING	RISING	1 bit	WA HIGH & LOW	WA LOW	32*<I2S_sample_rate>	<I2S_sample_rate>

22.4.8 Normal I²S modes timing diagrams

- LARA-R6
  - A single transmitted word is marked in grey. MSB is marked darker.



- Since RXD bits are read on the opposite edge of CLK signal respect TXD bits, the RXD word slot starts half bit delayed respect TXD word slot.
- Relation between WA and CLK edge for Normal I^2S depends on mode:



22.5 Play audio resource +UPAR

+UPAR						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

22.5.1 Description

Starts the playback of the pre-defined tone of the selected audio resource.

22.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UPAR=<audio_resource>,<tone_id>,<nof_repeats>	OK	AT+UPAR=0,1,0 OK
Test	AT+UPAR=?	+UPAR: (list of supported <audio_resource>s),(list of supported <tone_id>s),(list of supported <nof_repeats>s) OK	+UPAR: (0-2),(0-66),(0-255) OK

22.5.3 Defined values

Parameter	Type	Description
<audio_resource>	Number	Specifies the audio resource. Allowed values: • 0: tone generator • 1: MIDI player • 2: audio loop for test purposes. Use this command to generate an audio loop between the uplink and downlink current path (+USPM) when not in a call. Use the sidetone command (+USTN) for the loop amount configuration. For the uplink to downlink loop on call use sidetone (+USTN) command only Allowed values: • LARA-R6 - 2
<tone_id>	Number	Specifies the pre-defined tone id to be played; the supported values depend by <audio_resource> values according to the Notes
<nof_repeats>	Number	Specifies the number of repeats. Allowed values: • 0: infinite loop • n: n repeats
<error>	Number	The "+CME ERROR: operation not supported" error result code will be provided in these cases (if +CMEE is set to 2): • An incorrect number of parameters is provided • The parameter values are out of range

22.5.4 Notes

LARA-R6

- During a speech call the audio loop test is not supported.
- During the audio loop test the speech profile change +USPM is not supported.
- During the audio loop test if MO/MT call is performed then the loop is automatically closed when the call is connected.

22.6 Stop audio resource +USAR

+USAR						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	-	+CME Error

22.6.1 Description

Stops the playback of the selected audio resource.

22.6.2 Syntax

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

22.6.3 Defined values

Parameter	Type	Description
<audio_resource>	Number	Specifies the audio resource. Allowed values: • 0: DSP tone generator • 1: MIDI player • 2: audio loop for test purposes. Use this command to stop an audio loop between uplink and downlink current path (+USPM). Allowed values: • LARA-R6 - 2
<error>	Number	The "+CME ERROR: operation not supported" error result code will be provided in these cases (if +CMEE is set to 2): • An incorrect number of parameters is provided • The parameter values are out of range

22.6.4 Notes

- During fast start / stop test sequence a queue overflow might occur, in this case an error result code (+CME ERROR: memory full) is returned.

LARA-R6

- The command AT+USAR=2 stops the audio loop test started by the +UPAR AT command.
- The command AT+USAR=2 is not supported when no audio resource is playing.

22.7 Tone generator +UTGN

+UTGN						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

22.7.1 Description

Starts a tone or a DTMF tone on the module tone generator. The frequency or the DTMF character, duration and volume of the tone must be set.

22.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+UTGN=<freq_or_tone>,<duration>,<volume>[,<UplinkSending>]	OK	AT+UTGN=1000,1000,100,1 OK AT+UTGN="A",1000,100,1 OK
Test	AT+UTGN=?	+UTGN: (list of supported <freq_or_tone>s),(list of supported <duration>s),(list of supported <volume>s)[,(list of supported <UplinkSending>s)] OK	+UTGN: (300-3400),(50-1360),(1-100),(0-2) OK +UTGN: (300-3400,"0"-"9","A"-"D","*","#"),(50-1360),(1-100),(0-1) OK
URC		+UUTGN: <state>	+UUTGN: 0

22.7.3 Defined values

Parameter	Type	Description
<freq_or_tone>	Number or String	If number, it represents the frequency of the sinus waveform in Hz for the tone generator. If string (where supported), it represents the DTMF tone to play: • LARA-R6 - If number the range goes from 300 to 3400. If string the valid tones are '0'-'9','A'-'D','*' and '#', maximum length string is 1 character.
<duration>	Number	Duration of the tone in milliseconds: • LARA-R6 - The range goes from 50 to 1360.
<volume>	Number	Volume for the tone generator: • LARA-R6 - The range goes from 0 to 100, where 0 means muted, 1 means -40 dB and 100 is 0dB.
<UplinkSending>	Number	Enables/disables the connection of the tone generator to uplink and/or downlink path: • 0 (default value): the tone is sent only on downlink path • 1: the tone is sent only on uplink path • 2: the tone is sent both on downlink and uplink path Allowed values: • LARA-R6 - 0, 1
<error>	Number	These error result codes will be provided if +CMEE is set to 2: • LARA-R6 - "+CME ERROR: operation not allowed": in case the tone generation starts in uplink while the call is not yet established
<state>	Number	The supported tone generator state is: • 0: tone generator is stopped

22.7.4 Notes

- The tone playing can be stopped by means of the set command: AT+UTGN=0,0,0. If no tone is playing an error result code (+CME ERROR: operation not supported) is returned.
- If the "silent mode" is enabled (+CALM=1) the +UTGN command returns an error result code (+CME ERROR: operation not supported).
- The ringer on an incoming call, the alarm tones (+CALA) and service tones (e.g.: Call Waiting tone) have the priority on the tone generator (+UTGN). If they are not muted and must be played, the tone generator (+UTGN) is stopped. An incoming call ringer and service tones can be muted by +CALM command (see notes), alarm tones can be muted by <silent> parameter in +CALA command.
- During fast start / stop test sequence a queue overflow might occur, in this case an error result code (+CME ERROR: memory full) is returned.

LARA-R6

- The +UUTGN URC is generated when the tone duration timer expires.
- The command AT+UTGN=0,0,0 stops the tone generated by +UTGN AT command. In this case the +UUTGN URC is not generated. If no tone is playing no error result code is returned.

- In case the +UTGN AT command is issued before the stop of a previous generated tone i.e. before +UUTGN URC generation, current tone generation will stop previous generated tone; no error result code is sent in this case.
- During a speech call the pre-defined tone is not mixed with speech; the speech is muted while the tone is playing.
- The ringer on an incoming call, the alarm tones and service tones (e.g.: Call Waiting tone) have the priority on the tone generator (+UTGN). Since they are never muted and must be played, the tone generator (+UTGN) is stopped and +UUTGN URC will not be generated.
- If waiting tones and SMS tones are playing +UTGN AT command cannot be sent. In this case an error result code (+CME ERROR: operation not supported) is returned.

22.8 Master clock control +UMCLK

+UMCLK						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

22.8.1 Description

Enables or disables the master clock output signal. This is mainly designed to feed the master clock input of an external audio codec. For more details see the corresponding module system integration manual.

The available output pin configurations are:

- Disabled, set as tristate
- Pin output low
- Generate 13 MHz clock
- Generate 26 MHz clock

Depending on the <enabling_mode> parameter value, the configuration can be applied as soon as the command is issued, or as soon as there is an audio activity (i.e. a digital audio interface is enabled).

22.8.2 Syntax

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

22.8.3 Defined values

Parameter	Type	Description
<mclk_mode>	Number	CODEC_CLK pin setting: • 0: disabled pin; 3-state with pull down resistor • 1: pin output steady low • 2: codec master clock at 13 MHz • 3: codec master clock at 26 MHz Allowed values: • LARA-R6 - 1 (default and factory-programmed value), 2
<enabling_mode>	Number	Specifies when the <mclk_mode> is enabled on CODEC_CLK pin • 0 (default and factory-programmed value): "Audio dependent" mode <mclk_mode> is applied to the CODEC_CLK pin only when the audio path is active (audio samples are read on the I2S_RX line and written on the I2S_TX line). When

Parameter	Type	Description
		the audio path is disabled (i.e. at call end), then the CODEC_CLK pin is disabled too (3-state with pull-down resistor) • 1: "Continuous" mode <mclk_mode> is applied to the CODEC_CLK pin as soon as the AT command is issued, even when the module is in idle and the audio path is disabled (no audio data written on I2S_TX line, no audio data read on I2S_RX line) When <mclk_mode>=0 (pin disabled) and <enabling_mode>=0 ("Audio dependent" mode), the CODEC_CLK pin is disabled both when audio path is enabled or disabled. In this case "Audio dependent" mode matches with "Continuous" mode (the command AT+UMCLK=0,0 and AT+UMCLK=0,1 are equivalent).

22.8.4 Notes

- If <mclk_mode>= 1 ("Continuous" mode) the actual clock generation occurs within 10 ms of the command issuing.
- When the power saving is enabled (i.e. AT+UPSV=1) and the module is in the power saving state, the master clock is disabled even if it is set to "Continuous" mode (+UMCLK=<mclk_mode>,1).
- The command setting is stored in the NVM; to restore the factory-programmed setting issue the AT +UMCLK= (with no parameters).
- If the external audio codec (Maxim MAX9860) is enabled by +UEXTDCONF: 0,1 (i.e.: <device_id>=0 and <configuration_enable>=1) this forces the setting codec master clock at 13 MHz, in "Audio dependent" mode (i.e. +UMCLK=2,0) at boot time. Thus current setting of +UMCLK in NVM will be overwritten at the module boot time. In this case, disable the master clock at 13 MHz, the AT+UMCLK=0 command must be explicitly issued after every startup.

LARA-R6001 / LARA-R6401 / LARA-R6801

- The clock supported by the platform is 12.288 MHz.
- The command cannot be issued when the call is ongoing, otherwise the "+CME ERROR: operation not allowed" error result code is returned.
- <enabling_mode> = 1 is not supported.

22.9 External device configuration +UEXTDCONF

+UEXTDCONF						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

22.9.1 Description

Configures an external device, e.g. an audio codec, at the boot time. The setting (on / off) and the configuration string for each supported device is stored in NVM and applied at each module power-on.

The information text response to the read command lists all the configured devices in separated lines.

The only supported external device is the Maxim MAX9860 audio codec. See Maxim datasheet [216].

22.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+UEXTDCONF=<device_id>[,<configuration_enable>[,<hex_data>]]	OK	AT+UEXTDCONF=0,1,"0000000010 1E3F0400000633002500000008A" OK
Read	AT+UEXTDCONF?	+UEXTDCONF: <device_0>,<configuration_enable0>,<hex_data0> [[...] +UEXTDCONF: <device_N>,<configuration_enableN>,hex_dataN>]	+UEXTDCONF: 0,0,"0000000010 1E3F0400000633005000000008A" +UEXTDCONF: 1,0,"0000000010 1E3F0400000644002500000008A" +UEXTDCONF: 2,1,"0000000010 1E3F0400000655006A0000008A" OK

Type	Syntax	Response	Example
		OK	
Test	AT+UEXTDCONF=?	+UEXTDCONF: (list of supported <device_id>s),(list of supported <configuration_enable>s),"hex data" OK	+UEXTDCONF: (0),(0,2),"hex data" OK

22.9.3 Defined values

Parameter	Type	Description
<device_id>	Number	Device identifier. Allowed value: • 0 (factory-programmed value): Maxim MAX9860 audio codec, connected via I²C. When enabled, at every start-up the module sets the external codec master clock at audio dependent 13 MHz (corresponding to the command AT+UMCLK=2,0) and configures the external codec via I²C, see Notes below. Codec Maxim MAX9860 is available on u-blox evaluation boards. ☞ Setting AT+UEXTDCONF=0,1 forces at every start-up +UMCLK: 2,0 in NVM. To undo / remove this setting, explicitly issue the AT+UMCLK=0 command after every start-up with +UEXTDCONF: 0,1. Setting back by means of the command AT+UEXTDCONF=0,0 the clock (+UMCLK) is not automatically forced back to 0. To fully disable the codec use this AT command sequence: • AT+UMCLK=0,0 • AT+UEXTDCONF=0,0 • AT+CFUN=16
<configuration_enable>	Number	Enables/disables the autoconfiguration of the specified external device: • 0: disabled • 1: enabled with enabling the master clock • 2: enabled without enabling/disabling the master clock Allowed values: • LARA-R6 - 0 (default and factory-programmed value), 1, 2
<hex_data>	String	External device configuration expressed in bytes in hexadecimal format: • LARA-R6 - The default and factory-programmed <hex_data> value for <device_id>=0 is "0000000010A0003030000633005000000008A". For **<device_id>=0** (Maxim MAX9860 audio codec): the string must be composed of 18 bytes in hexadecimal format, the first being 0x00, otherwise an error result code ("+CME ERROR: operation not supported" if +CMEE is set to 2) will be provided. At every module's start-up the specified bytes sequence is sent, via I²C, for the external codec configuration. • The first byte (0x00) is the address of the first register of the codec to be written (address 0x00). • The following 17 bytes are the values to be written in the codec's register 0x00 to 0x10 (for the meaning of bytes and the writing in the codec's registers, see Maxim MAX9860 datasheet [216].
<error>	String	If an incorrect number of parameters is provided or the parameter values are out of range the error result code "+CME ERROR: operation not supported" will be provided if +CMEE is set to 2.

22.9.4 Notes

LARA-R6

- For more examples, see the LARA-R6 series audio application note [11].
- Here below some remarks about possible command settings:

Command / Action	Meaning
AT+UEXTDCONF=0	It resets parameters to factory-programmed settings 0,0,"0000000010A0003030000 63300500000008A".
AT+UEXTDCONF=0,1	It enables the external device; current <hex_data> string in NVM is maintained.
AT+UEXTDCONF=0,0	It disables the external device; current <hex_data> string in NVM is maintained.
AT+UEXTDCONF=0,2	It configures the external device but does not change the state of the master clock (+UMCLK value is not changed).

- AT+UEXTDCONF=0,1,"" is not supported; it returns +CME ERROR: operation not supported.

- When the <configuration_enable> parameter changes from 0 to 1, the external device is initialized immediately with current <hex_data> string and +UMCLK is set to 1. Other <configuration_enable> transitions do not force external device initialization and +UMCLK setting.

22.10 Speech codec information +USPEECHINFO

+USPEECHINFO						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

22.10.1 Description

Provides the speech codec related information and enables the corresponding +UUSPEECHINFO URC. The URC is issued each time the speech codec changes. The information text response to the read command and the issued URC, depend on the <mode> parameter configuration:

- **<mode>=0**: the information text response to the read command returns only the <mode> parameter configuration; URC reporting is disabled.
- **<mode>=1**: the information text response to the read command returns only the <mode> parameter configuration; the URC provides the codec information.
- **<mode>=2**: the information text response to the read command returns the <mode> parameter configuration and the codec information (in case of a VoLTE call only downlink information are returned); the URC provides the codec information on 2G/3G networks or the VoLTE downlink codec information.
- **<mode>=3**: the information text response to the read command returns the <mode> parameter configuration and the codec information; the URC provides the codec information on 2G/3G networks or the VoLTE downlink and uplink codec information.

The codec information can be read also after the call ends.

22.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+USPEECHINFO=<mode>	OK	AT+USPEECHINFO=1 OK
Read	AT+USPEECHINFO?	**If <mode>=0 or 1:** +USPEECHINFO: <mode> OK	+USPEECHINFO: 1 OK
		If <mode>=2: +USPEECHINFO: <mode>,<codec>,<bitrate>	+USPEECHINFO: 2,21,14 OK
		If <mode>=3: +USPEECHINFO: <mode>,<DL_codec>,<DL_bitrate>,<UL_codec>,<UL_bitrate>	+USPEECHINFO: 3,21,14,21,13 OK
Test	AT+USPEECHINFO=?	+USPEECHINFO: (list of supported <mode>s) OK	+USPEECHINFO: (0,3) OK
URC		**If <mode>=1:** +UUSPEECHINFO: <codec>	+UUSPEECHINFO: 0
		If <mode>=2 or 3: +UUSPEECHINFO: <codec>,<bitrate>,<path>	+UUSPEECHINFO: 21,14,1

22.10.3 Defined values

Parameter	Type	Description
<mode>	Number	Configure speech codec reporting: • 0 (default value): disables the reporting of speech codec when it changes

Parameter	Type	Description
		• 1: enables the speech codec reporting through the +UUSPECHINFO URC • 2: enables the speech codec reporting also for VoLTE calls (downlink only). The information text response to the read command returns also the codec information (for VoLTE calls only downlink). • 3: enables the speech codec reporting also for VoLTE calls (UL and DL). The information text response to the read command returns also the codec information. Allowed values: • LARA-R6001 / LARA-R6401 / LARA-R6801 - 0, 1, 2, 3
<codec>	String	Speech codec. Allowed values: • 0: codec Full Rate Adaptive Multi-Rate • 1: codec GSM Enhanced Full Rate (12.2 kb/s) • 2: codec GSM Full Rate (13.0 kb/s) • 3: codec Half Rate Adaptive Multi-Rate • 4: codec GSM Half Rate (5.6 kb/s) • 5: codec Full Rate Adaptive Multi-Rate Wideband • 9: codec UMTS Adaptive Multi-Rate • 10: codec UMTS Adaptive Multi-Rate 2 • 11: codec UMTS Adaptive Multi-Rate Wideband • 20: codec LTE AMR Narrowband • 21: codec LTE AMR Wideband
<bitrate>	Number	Codec bit rate. Allowed values: • 1: GSMHR, 5.60 kb/s • 2: GSMEFR, 12.20 kb/s • 3: GSMFR, 13.00 kb/s • 4: LTE AMR NB, 4.75 kb/s • 5: LTE AMR NB, 5.15 kb/s • 6: LTE AMR NB, 5.90 kb/s • 7: LTE AMR NB, 6.70 kb/s • 8: LTE AMR NB, 7.40 kb/s • 9: LTE AMR NB, 7.95 kb/s • 10: LTE AMR NB, 10.20 kb/s • 11: LTE AMR NB, 12.20 kb/s • 12: LTE AMR WB, 6.60 kb/s • 13: LTE AMR WB, 8.85 kb/s • 14: LTE AMR WB, 12.65 kb/s • 15: LTE AMR WB, 14.25 kb/s • 16: LTE AMR WB, 15.85 kb/s • 17: LTE AMR WB, 18.25 kb/s • 18: LTE AMR WB, 19.85 kb/s • 19: LTE AMR WB, 23.05 kb/s • 20: LTE AMR WB, 23.85 kb/s • 255: codec bit rate unknown
<DL_codec>	Number	Speech codec on downlink path. For the allowed values, see <codec>.
<DL_bitrate>	Number	Codec bit rate on downlink path. For the allowed values, see <bitrate>.
<UL_codec>	Number	Speech codec on uplink path. For the allowed values, see <codec>.
<UL_bitrate>	Number	Codec bit rate on uplink path. For the allowed values, see <bitrate>.
<path>	Number	Speech codec path. Allowed values: • 0: uplink • 1: downlink

22.10.4 Notes

LARA-R6

- LTE codec information for uplink path is not available when using <mode>= 3.
- LTE codec bit rates are not available (<bitrate> is always 255: codec bit rate unknown).
- Indication for <codec>=3: the Half Rate Adaptive Multi-Rate codec is not supported and it is always reported as <codec>=0 (Full Rate Adaptive Multi-Rate codec).

22.11 Speech codec configuration +UDCONF=30

+UDCONF=30						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	NVM	No	-	+CME Error

22.11.1 Description

Configures the allowed speech codec to be presented to the network during a voice call setup.

The supported codec list may vary for each product. The <supported_codec_bitmap> must be checked before making any change.

☞ The command does not affect VoLTE calls.

☞ The new setting is saved in NVM and is immediately used.

☞ 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 [112], 3GPP TS 34.121-2 [113], 3GPP TS 36.521-2 [134] and 3GPP TS 36.523-2 [135], 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.

22.11.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=30,<codec_bitmap>	OK	AT+UDCONF=30,31 OK
Read	AT+UDCONF=30	+UDCONF: 30,<active_codec_bitmap>,<supported_codec_bitmap> OK	AT+UDCONF=30 +UDCONF: 30,31,255 OK

22.11.3 Defined values

Parameter	Type	Description
<codec_bitmap>	Number	Bitmask representing the list of available speech codecs to be presented to the network during voice call setup. The supported speech codecs and the corresponding bit in the bitmask are listed as follows: • 0: Full Rate Adaptive Multi-Rate (FR AMR) • 1: GSM Enhanced Full Rate (12.2 kb/s) (GSM EFR) • 2: GSM Full Rate (13.0 kb/s) (GSM FR) • 3: Half Rate Adaptive Multi-Rate (HR AMR) • 4: GSM Half Rate (5.6 kb/s) (GSM HR) • 5: Full Rate Adaptive Multi-Rate WideBand (FR AMR WB) • 6: reserved • 7: reserved • 8: reserved • 9: UMTS Adaptive Multi-Rate (UMTS AMR) • 10: UMTS Adaptive Multi-Rate 2 (UMTS AMR 2) • 11: UMTS Adaptive Multi-Rate WideBand (UMTS AMR WB) GSM Full Rate must be always presented to the network, thus is always implicitly set. See Table 29 for the meaning of each bit and codec availability.
<active_codec_bitmap>	Number	The currently active codecs, in the format described for <codec_bitmap>
<supported_codec_bitmap>	Number	The list of currently supported codecs, in the format described for <codec_bitmap>

22.11.4 Notes

Bit	11	10	9	8	7	6	5	4	3	2	1	0
LARA-R6	•						•		•			•

Table 29: Speech codec bit availability on modules

- On product supporting 2G RAT the bit 2 (GSM Full Rate) in the <codec_bitmap> parameter is always implicitly set to 1.

LARA-R6001 / LARA-R6401 / LARA-R6801

- The factory-programmed value of <active_codec_bitmap> is 2089.
- A power cycle is required to apply the new configuration.

22.12 VoLTE speech codec configuration +USPEECHCFG

+USPEECHCFG						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

22.12.1 Description

Configures the allowed speech codec to be presented to the network during a VoLTE call setup. Also the AMR codec modes (i.e.: bit rate) can be selected: the call starts only if the network accepts at least one of the proposed modes.

☞ If a codec mode is selected for MT calls and the network does not support that mode, any received call is discarded.

22.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+USPEECHCFG=<codec>,<enable_disable>[,<mode_bitmask>]	OK	AT+USPEECHCFG=20,1,255 OK
Read	AT+USPEECHCFG?	+USPEECHCFG: 20,<enable_disable>,<mode_bitmask> +USPEECHCFG: 21,<enable_disable>,<mode_bitmask> OK	+USPEECHCFG: 20,1,255 +USPEECHCFG: 21,1,255 OK
Test	AT+USPEECHCFG=?	+USPEECHCFG: (list of supported <codec>s),(list of supported <enable_disable>s),(list of supported <mode_bitmask>s) OK	+USPEECHCFG: (20,21),(0,2),(1,511) OK

22.12.3 Defined values

Parameter	Type	Description
<codec>	Number	Select AMR codec narrowband (NB) or wideband (WB): • 20: AMR NB • 21: AMR WB
<enable_disable>	Number	Enable or disable the codec, on MO calls only or both MO and MT: • 0: disable the codec • 1: enable the codec and select bit rate for MO calls • 2: enable the codec and select bit rate for MO and MT calls
<mode_bitmask>	Number	Bitmask representing the list of available speech codecs modes (i.e. bit rate) to be presented to the network during voice call setup. The supported speech codec modes and the corresponding bit in the bitmask are listed as follows:

Parameter	Type	Description
		For AMR narrowband (the maximum supported value is 255, corresponding to all bit rates enabled): • 0: 4.75 kbit/s • 1: 5.15 kbit/s • 2: 5.90 kbit/s • 3: 6.70 kbit/s • 4: 7.40 kbit/s • 5: 7.95 kbit/s • 6: 10.20 kbit/s • 7: 12.20 kbit/s For AMR wideband (the maximum supported value is 511, corresponding to all bit rates enabled): • 0: 6.60 kbit/s • 1: 8.85 kbit/s • 2: 12.65 kbit/s • 3: 14.25 kbit/s • 4: 15.85 kbit/s • 5: 18.25 kbit/s • 6: 19.85 kbit/s • 7: 23.05 kbit/s • 8: 23.85 kbit/s When the <mode_bitmask> parameter is not set, it means that no specific bit rate is required, therefore the network can assign any bit rate.

22.12.4 Notes

LARA-R6

- <codec>=20 (AMR NB) can not be disabled.
- <enable_disable>=1 (enable the codec and select bit rate for MO calls) is not supported.
- Allowed values for <mode_bitmask> parameter are: 255 (for AMR NB) and 511 (for AMR WB) (all bit rates enabled).

23 DNS

DNS service requires the user to define and activate a connection profile, either PSD or CSD.

☞ LARA-R6
If not specified, the <cid> and the <preferred_protocol_type> parameters set by means of the +UDCONF=19 AT command are used.
See +CGACT AT command for activating a PDP context.

☞ LARA-R6001D
If not specified the default CID (<cid>=1) is used. If not specified and the protocol type is IPv4v6, then the preferred protocol type is IPv4.
See +CGACT AT command for activating a PDP context.

When these command report an error which is not a +CME ERROR, the error class and code is provided through +USOER AT command.

23.1 Resolve name / IP number through DNS +UDNSRN

+UDNSRN						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 332 s	TCP/UDP/IP Error

23.1.1 Description

Translates a domain name to an IP address or an IP address to a domain name by using an available DNS. There are two available DNSs, primary and secondary. The network usually provides them after a GPRS activation or a CSD establishment. They are automatically used in the resolution process if available. The resolver will use first the primary DNS, otherwise if there is no answer, the second DNS will be involved.

☞ The DNS resolution timeout depends on the number of DNS servers available to the DNS resolution system. The response time for the DNS resolution is estimated if 8 servers are used to perform this task.

23.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDNSRN=<resolution_type>,<domain_ip_string>[,<async>[,<cid>[,<preferred_protocol_type>]]]	+UDNSRN: <resolved_ip_address> OK or +UDNSRN: <resolved_domain_name> OK	AT+UDNSRN=0,"www.google.com" +UDNSRN: "216.239.59.147" OK
			AT+UDNSRN=0,"www.dau.dau",1,1,0 OK +UUDNSRN: 0,"172.22.1.201"
			AT+UDNSRN=0,"www.rs-ipv6-test.com",1,1,1 OK +UUDNSRN: 0,"FC01:CAFE::1"
			AT+UDNSRN=0,"www.google.com",1 OK +UUDNSRN: "216.239.59.147"
			AT+UDNSRN=0,"www.google.com",0 +UDNSRN: "216.239.59.147" OK
URC		+UUDNSRN: <result_code>[,<resolved_ip_address>]	+UUDNSRN: 0,"216.239.59.147"

Type	Syntax	Response	Example
		+UUDNSRN: <result_code>[, <resolved_domain_name>]	+UUDNSRN: 0,"somedomain.com"
		+UUDNSRN: -1	+UUDNSRN: -1

23.1.3 Defined values

Parameter	Type	Description
<resolution_type>	Number	Type of resolution operation: • 0: domain name to IP address • 1: IP address to domain name (host by name)
<domain_ip_string>	String	Domain name (<resolution_type>=0) or the IP address in (<resolution_type>=1) to be resolved
<async>	Number	Asynchronous DNS resolution flag. Allowed values: • 0 (default value): the final result code is returned only once the DNS response is available, locking the AT interface until the DNS activity is running • 1: a final result code (OK or an error result code) is returned immediately unlocking the AT interface and making it available for the execution of other AT commands. Once the result of DNS resolution becomes available, it is notified to the AT interface through the +UUDNSRN URC
<cid>	Number	See <cid>. For more details on the default value of the parameter (where supported), see DNS.
<preferred_protocol_type>	Number	Select the specific IP type between IPv4 and IPv6. Allowed values: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see DNS.
<resolved_ip_address>	String	Resolved IP address corresponding to the specified domain name
<resolved_domain_name>	String	Resolved domain name corresponding to the provided IP address
<result_code>	Number	Result code of DNS resolution: • 0: no error • -1: DNS resolution failed. In this case the <resolved_ip_address> or the <resolved_domain_name> fields are not present

23.1.4 Notes

LARA-R6001D

- <resolution_type>=1 is not supported.

23.2 Dynamic DNS update +UDYNDNS

+UDYNDNS						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	- (except URC)	+CME Error

23.2.1 Introduction

The IP address assigned to a module by the network provider is often dynamic; this means the IP address changes every time a PDP context is enabled.

This could be a problem when it is needed to identify an internet host with a domain name, because they are usually used with static IP address that never changes (or rarely changes).

To solve this problem, the dynamic DNS services provide a way to assign a domain name to a host that owns a dynamic IP address, but they require a client that sends the latest IP given by the network to these services, to update their DNS tables.

With the +UDYNDNS command u-blox cellular modules can access to dynamic DNS services.

This functionality is disabled by default, but once configured and enabled it automatically sends updates to the configured Dynamc DNS service every time the module IP address change. The functionality only works for internal PDP context (see Multiple PDP contexts).

23.2.2 Description

Sets up the dynamic DNS client functionality.

The command configuration is stored into the NVM: if enabled, it automatically works after a reboot.

The following dynamic DNS providers are supported:

- TZO.com
- DynDNS.org
- DynDNS.it
- No-IP.org
- DNSDynamic.org

During the service subscription phase the dynamic DNS provider gives a domain name, a username and a password that the AT application will use later.

If the DYNDNS client is enabled when an internal PDP connection is already active, the DYNDNS client starts working on the next PDP context activation.

☞ Before changing the dynamic DNS client configuration it is required to stop (deactivate) it. Any attempt to reconfigure an already running DNS client raises an error.

☞ The dynamic DNS update is not allowed during the first 60 s after module power on. If a PDP connection is established before this time, a URC notifies that the update has been delayed. In this case the update is performed once the 60 s are elapsed.

☞ The dynamic DNS protocol does not allow more than one update every 60 s, anyhow the module's DYNDNS client will respect specific timing rules depending on the selected provider policies.

☞ Due to the various caches involved in the DNS resolution process, the time since the DNS update is done until it is available for a user, can significantly change among different internet providers.

23.2.3 Syntax

Type	Syntax	Response	Example
Set	AT+UDYNDNS=<on_off>[,<service_id>,<domain_name>,<username>,<password>[,<cid>[,<protocol_type>]]]	OK	**Enable the dynamic DNS client using the TZO DNS service and the domain name "remote001.tzo.net".** AT+UDYNDNS=1,0,"remote001.tzo.net","dummy_username","dummy_password" OK
			Disable the dynamic DNS client: AT+UDYNDNS=0 OK
Read	AT+UDYNDNS?	+UDYNDNS: <on_off>,<service_id>,<domain_name>,<username>,<password>,<[cid]>,<protocol_type> OK	+UDYNDNS: 1,0,"remote001.tzo.net","dummy_username","dummy_password",1,0 OK
Test	AT+UDYNDNS=?	+UDYNDNS: (list of supported <on_off>),(list of supported <service_id>),<domain_name>,<username>,<password>,(list of supported <cid>s),(list of supported <preferred_protocol_type>s) OK	+UDYNDNS: (0-1),(0-4),"domain_name","username","password",(1,24),(0,1) OK
URC		+UUDYNDNS: <status>,<code>	+UUDYNDNS: 1,0

23.2.4 Defined values

Parameter	Type	Description
<on_off>	Number	Enable / disable the dynamic DNS client: • 0 (factory-programmed value): disable the client • 1: enable the client
<service_id>	Number	Indicates which dynamic DNS service provider to use: • 0 (factory-programmed value): TZO.com • 1: DynDNS.org • 2: DynDNS.it • 3: No-IP.org • 4: DynamicDNS.org Mandatory parameter with <on_off>=1, not allowed with <on_off>=0.
<domain_name>	String	Indicates which domain name should be associated with the module IP address. The dynamic DNS service provider provides this value. Maximum length: 64 bytes. Mandatory parameter with <on_off>=1, not allowed with <on_off>=0. The factory-programmed value is an empty string.
<username>	String	The username used for the client authentication. Maximum length: 64 characters. Mandatory parameter with <on_off>=1, not allowed with <on_off>=0. The factory-programmed value is an empty string.
<password>	String	The password used for the client authentication. Maximum length: 32 characters. Mandatory parameter with <on_off>=1, not allowed with <on_off>=0. The factory-programmed value is an empty string.
<cid>	Number	PDP context identifier used for the DNS communication. The allowed range is product specific, see <cid>. For more details on the default value of the parameter (where supported), see DNS.
<preferred_protocol_type>	Number	Preferred protocol type to be specified when the <cid> protocol type is IPv4v6. Allowed values: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see DNS.
<status>	Number	This is the internal status of the dynamic DNS client. Each time the internal status changes or there is an error the URC +UUDYNDNS is issued: • 0: client inactive/stopped • 1: client enabled/active • 2: DNS update successfully executed • 3: DNS update failed • 4: DNS update delayed • 5: No DNS update is required • 6: Self deactivation: the dynamic DNS client will stop due to internal error or DynDNS protocol specification
<code>	Number	This is the code returned by the +UUDYNDNS URC. The meaning of the <code> value is described in Dynamic DNS unsolicited indication codes (see Dynamic DNS unsolicited indication codes).

23.2.5 Notes

- In case of self deactivation (+UUDYNDNS <status> = 6), the client is disabled (saving the disabled setting into the NVM); the customer has then to identify the cause (usually bad configuration of the client) and manually re-activate it. After a self deactivation it is always required to re-activate the client.
- If UDYNDNS is enabled and properly configured an +UUDYNDNS URC (+UUDYNDNS: 1,0) will be displayed at the "system power on" on AT terminal. The +UUDYNDNS URC (+UUDYNDNS: 1,0) notifies that the UDYNDNS service is enabled and that an dynamic IP address update will occur when an Internal PDP context will be activated or when an Internal PDP context IP address will change.

23.2.6 DynDNS client behavior in case of error

When the error result code is in range 1-10 and 100-108 the client waits for 60 s before allowing any update operation.

In all the other cases (error in range from 40 to 57) the following behaviors are applied:

- LARA-R6 - For TZO.com:

DynDNS client error code	Provider error code	Client action
40	200	Next update will be possible after 60 s
41	304	Next update will be possible after 10 minutes
45	401	Client self deactivation
53	403	Client self deactivation
55	414	Next update will be possible after 60 s
46	405	Client self deactivation
54	407	Client self deactivation
56	415	Client self deactivation
57	480	Next update will be possible after 24 hours

- LARA-R6 - For DynDNS.org, DynDNS.it, No-IP.org and DNSDynamic.org:

DynDNS client error code	Provider error code	Client action
40	good	Next update will be possible after 60 s
41	nochg	Next update will be possible after 10 minutes
45	badauth	Next update will be possible after 24 hours
47	!donator	Next update will be possible after 24 hours
42	notfqdn	Client self deactivation
43	nohost	Client self deactivation
44	numhost	Client self deactivation
48	abuse	Client self deactivation
46	badagent	Client self deactivation
49	dnserr	Next update will be possible after 30 minutes
50	911	Next update will be possible after 30 minutes
51	badsys	Client self deactivation
52	!yours	Client self deactivation

23.3 Override DNS configuration +UDNSCFG

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

23.3.1 Description

Overrides the primary and/or the secondary DNS defined for a selected context identifier.

It is also possible to delete an overridden DNS or list all overridden DNS, the list is empty in case no overridden DNSs are defined.

LARA-R6
The actual configuration of DNS servers for internal contexts can be retrieved using the +UIPADDR AT command.

LARA-R6
Although the +UDNSCFG AT command allows setting the primary and secondary DNS servers with the same IP address, in this case the current configuration of DNS servers for the specified internal context takes effect only on the primary server while the secondary is set as empty. This is valid for both IPv4 and IPv6 DNS server.

23.3.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UDNSCFG=<cid>[,<index>,<ip_type>[,<ipv4_or_ipv6_address>]]	OK	AT+UDNSCFG=1,1,0,"8.8.8.8" OK
Read all the overridden DNS for a selected <cid>			
Set	AT+UDNSCFG=<cid>	+UDNSCFG: <cid>,<index>,<ip_type>,<ipv4_or_ipv6_address> [[...] +UDNSCFG: <cid>,<index>,<ip_type>,<ipv4_or_ipv6_address>] OK	AT+UDNSCFG=2 +UDNSCFG: 2,1,0,"8.8.8.8" +UDNSCFG: 2,2,0,"9.9.9.9" OK
Delete an overridden DNS			
Set	AT+UDNSCFG=<cid>,<index>,<ip_type>	OK	AT+UDNSCFG=1,1,0 OK
Override a DNS			
Set	AT+UDNSCFG=<cid>,<index>,<ip_type>,<ipv4_or_ipv6_address>	OK	AT+UDNSCFG=2,2,0,"8.8.8.8" OK
Read all overridden DNS			
Read	AT+UDNSCFG?	+UDNSCFG: <cid>,<index>,<ip_type>,<ipv4_or_ipv6_address> [[...] +UDNSCFG: <cid>,<index>,<ip_type>,<ipv4_or_ipv6_address>] OK	+UDNSCFG: 1,1,0,"8.8.8.8" +UDNSCFG: 2,1,0,"8.8.8.8" OK
Test	AT+UDNSCFG=?	+UDNSCFG: (list of supported <cid>),(list of supported <index>),(0,1),<ipv4_or_ipv6_address> OK	+UDNSCFG: (1-24),(1-2),(0-1),"ipv4_or_ipv6_address" OK

23.3.3 Defined values

Parameter	Type	Description
<cid>	Number	PDP context identifier used for the DNS communication. The allowed range is product specific, see <cid>.
<index>	Number	Index of the DNS to be overridden: • 1: primary DNS • 2: secondary DNS • 3: tertiary DNS Allowed values: • LARA-R6 - 1, 2
<ip_type>	Number	Allowed values: • 0: IPv4 • 1: IPv6
<ipv4_or_ipv6_address>	String	DNS IP address, see IPv4/IPv6 addressing.

24 Internet protocol transport layer

24.1 Introduction

LARA-R6
Before using TCP/IP services, a connection profile must be defined and activated. The sockets can be managed independently and simultaneously over the same bearer (either PSD or CSD). AT commands for both reading and writing data on sockets are provided and the URC notifies the external application of incoming data and transmission result, no need for polling.

LARA-R6
If not specified, the <cid> and the <preferred_protocol_type> parameters set by means of the +UDCONF=19 AT command are used.
See +CGACT AT command for activating a PDP context.

LARA-R6001D
If not specified the default CID (<cid>=1) is used. If not specified and the protocol type is IPv4v6, then the preferred protocol type is IPv4.
See +CGACT AT command for activating a PDP context.

The maximum number of sockets that can be managed depends on the module series:

- LARA-R6 - 7

LARA-R6
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

LARA-R6
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

24.2 IPv4/IPv6 addressing

24.2.1 Introduction

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

24.2.2 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

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

Table 30: IPv4 address format examples

24.3 Create Socket +USOCR

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

24.3.1 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:

- LARA-R6 - Up to 7 sockets can be created.

It is possible to specify the local port to bind within the socket in order to send data from a specific port. The bind functionality is supported for both TCP and UDP sockets. When context is IPV4V6, it is possible to set preferred type (IPV4 or IPV6) using <preferred_protocol_type> parameter. Any socket can select context that can be used via <cid> parameter otherwise sockets are created using default CID value.

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

24.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCR=<protocol>[,<local_port>[,<preferred_protocol_type>[,<cid>]]]	+USOCR: <socket> OK	AT+USOCR=17 +USOCR: 2 OK
Test	AT+USOCR=?	+USOCR: (list of supported <protocol>s),(list of supported <local_port>s),(list of supported <preferred_protocol_type>s),(list of supported <cid>s) OK	+USOCR: (6,17),(1-65535),(0,1),(1-24) OK

24.3.3 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.
<preferred_protocol_type>	Number	Selects the specific IP type (for the required <socket>) between IPv4 and IPv6 when <PDP_type> is set to "IPV4V6" while the PDP context is created by means of +CGDCONT AT command. Allowed values: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see Internet protocol transport layer.

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

24.3.4 Notes

LARA-R6

- The <local_port> parameter must be set in a range that respects the setting of the +UEMBPF AT command to avoid filtering of socket data when the PDN context to which the socket is bound is shared between embedded applications and dial-up connection. If the parameter is omitted, the random port is automatically chosen in the range of ports defined by the +UEMBPF AT command.

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

+USOSEC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 120 s	+CME Error

24.4.1 Description

Enables or disables the use of SSL/TLS/DTLS connection (where supported) on a TCP/UDP socket. The configuration of the SSL/TLS/DTLS properties is provided with an SSL/TLS/DTLS profile managed by USECMNG.

The <usecmng_profile_id> parameter is listed in the information text response to the read command only if the SSL/TLS/DTLS is enabled on the interested socket.

☞ The enable or disable operation can be performed only after the socket has been created with +USOCR AT command.

☞ The SSL/TLS/DTLS is supported only with +USOCO command (socket connect command). The SSL/TLS/DTLS is not supported with +USOLI command (socket set listen command is not supported and the +USOSEC settings will be ignored).

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

24.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOSEC=<socket>,<ssl_tls_dtls_status>[,<usecmng_profile_id>]	OK	AT+USOSEC=0,1,1 OK
Read	AT+USOSEC=<socket>	+USOSEC: <socket>,<ssl_tls_dtls_status>[,<usecmng_profile_id>] OK	AT+USOSEC=0 +USOSEC: 0,1,1 OK
Test	AT+USOSEC=?	+USOSEC: (list of supported <socket>s),(list of supported <ssl_tls_dtls_status>s),(list of supported <usecmng_profile_id>s) OK	+USOSEC: (0-6),(0,1),(0-4) OK

24.4.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier defined by the AT+USOCR command. • LARA-R6 - The range goes from 0 to 6.
<ssl_tls_dtls_status>	Number	• 0 (default value): disable the SSL/TLS/DTLS on the socket.

Parameter	Type	Description
		• 1: enable the socket security; a USECMNG profile can be specified with the <usecmng_profile_id> parameter.
<usecmng_profile_id>	Number	Defines the USECMNG profile which specifies the SSL/TLS/DTLS properties to be used for the SSL/TLS/DTLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see USECMNG section).

24.5 Set socket option +USOSO

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

24.5.1 Description

Sets the specified standard option (type of service, local address re-use, linger time, time-to-live, etc.) for the specified socket, like the BSD setsockopt routine.

☞ Issue a set command to set each parameter.

24.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOSO=<socket>,<level>,<opt_name>,<opt_val>[,<opt_val2>]	OK	AT+USOSO=2,6,1,1 OK
Test	AT+USOSO=?	+USOSO: (list of supported <socket>s),(list of supported <level>s) OK	+USOSO: (0-6),(0,6,65535) OK

24.5.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • LARA-R6 - The range goes from 0 to 6.
<level>	Number	Allowed values: • 0: IP protocol <opt_name> for IP protocol level may be: o 1: type of service (TOS) <opt_val>: 8 bitmask that represents the flags of IP TOS. The range is 0-255 (the default value is 0). For more information, see the RFC 791 [170] o 2: time-to-live (TTL) <opt_val>: unsigned 8 bit value representing the TTL. The range is 0-255 (the default value is 255) • 6: TCP protocol <opt_name> for TCP protocol level may be: o 1: no delay option; do not delay send to coalesce packets; <opt_val>: numeric parameter, it enables/disables the "no delay" option: - 0 (default value): disabled - 1: enabled o 2: keepidle option: send keepidle probes when it is idle for <opt_val> milliseconds <opt_val>: signed 32 bit numeric parameter representing the milliseconds for "keepidle" option. The range is 0-2147483647. The default value is 7200000 (2 hours) • 65535: socket <opt_name> for socket level options may be: o 4: local address re-use. <opt_val>: numeric parameter, it configures the "local address re-use" option. - 0 (default value): disabled - 1: enabled

Parameter	Type	Description
		o 8: keep connections alive. <opt_val>: numeric parameter, it configures "keep connections alive" option. - 0 (default value): disabled - 1: enabled o 32: sending of broadcast messages. <opt_val>: numeric parameter, it configures "sending of broadcast messages". - 0 (default value): disabled - 1: enabled o 128: linger on close if data present. <opt_val>: numeric parameter, it configures the "linger" option. - 0 (default value): disabled - 1: enabled <opt_val2>: signed 16 bit numeric parameter, it sets the linger time, the range goes from 0 to 32767 in seconds. The default value is 0. o 512: local address and port re-use. <opt_val>: numeric parameter, it configures the "local address and port re-use". - 0 (default value): disabled - 1: enabled
<opt_name>	Number	Type and supported content depend on the related <level> parameter value (details are given above).
<opt_val>	Number	Type and supported content depend on the related <level> parameter value (details are given above).
<opt_val2>	Number	Type and supported content depend on the related <level> parameter value (details are given above).

24.5.4 Notes

LARA-R6

- If <level>=6 (TCP protocol) and <opt_name>=2 (keepidle option), the keepidle option range is 1000-2147483647.

24.6 Get Socket Option +USOGO

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

24.6.1 Description

Retrieves the specified standard option (type of service, local address re-use, linger time, time-to-live, etc) for the specified socket, like the BSD getsockopt routine.

24.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOGO=<socket>,<level>,<opt_name>	+USOGO: <opt_val>[,<opt_val2>] OK	AT+USOGO=0,0,2 +USOGO: 255 OK
Test	AT+USOGO=?	+USOGO: (list of supported <socket>s),(list of supported <level>s) OK	+USOGO: (0-6),(0,6,65535) OK

24.6.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • LARA-R6 - 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 [170]. 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

24.7 Close Socket +USOCL

+USOCL						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	< 120 s	+CME Error

24.7.1 Description

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

By default the command blocks the AT command interface until the the completion of the socket close operation. By enabling the <async_close> flag, the final result code is sent immediately. The following +UUSOCL URC will indicate the closure of the specified socket.

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

24.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCL=<socket>[,<async_close>]	OK	AT+USOCL=2 OK
Test	AT+USOCL=?	+USOCL: (list of supported <socket>s) OK	+USOCL: (0-6),(0-1) OK
URC		+UUSOCL: <socket>	+UUSOCL: 2

24.7.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • LARA-R6 - The range goes from 0 to 6.
<async_close>	Number	Asynchronous close flag. The flag has effect for TCP connections only. Allowed values: • 0 (default value): the operation result is returned only once the result of the TCP close becomes available, locking the AT interface until the connection closes. • 1: the final result code is returned immediately unlocking the AT interface and making it available for the execution of other AT commands. Once the result of TCP close becomes available, it is notified to the AT interface through the +UUSOCL URC.

24.7.4 Notes

LARA-R6

- The <async_close> parameter is not supported.

24.8 Get Socket Error +USOER

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

24.8.1 Description

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

24.8.2 Syntax

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

24.8.3 Defined values

Parameter	Type	Description
<cid>	Number	Retrieve error on the specific <cid> listed using +CGDCONT AT command. Minimun and maximum values depends on platform specification.
<socket_error>	Number	Code of the last error occurred in a socket operation. The allowed values are listed in Appendix A.6 • 0: no error

24.9 Connect Socket +USOCO

+USOCO						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	< 332 s	+CME Error

24.9.1 Description

Establishes a peer-to-peer connection of the socket to the specified remote host on the given remote port, like the BSD connect routine. If the socket is a TCP socket, the command will actually perform the TCP negotiation (3-way handshake) to open a connection. If the socket is a UDP socket, this function will just declare the remote host address and port for later use with other socket operations (e.g. +USOWR, +USORD). This is important to note because if <socket> refers to a UDP socket, errors will not be reported prior to an attempt to write or read data on the socket.

The estimated response time depends also by the DNS resolution. For further details about the estimated response time related to the DNS resolution, see the +UDNSRN AT command.

24.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOCO=<socket>,<remote_addr>,<remote_port>[,<async_connect>]	OK	AT+USOCO=3,"151.63.16.9",1200 OK
			AT+USOCO=2,"151.63.16.9",8200,1 OK +UUSOCO: 2,0
			AT+USOCO=2,"151.63.16.9",8230,0 OK
Test	AT+USOCO=?	+USOCO: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <async_connect>s) OK	+USOCO: (0-6),"remote_host",(1-65535),(0-1) OK
URC		+UUSOCO: <socket>,<socket_error>	+UUSOCO: 2,0

24.9.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier to be used for any future operation on that socket. • LARA-R6 - The range goes from 0 to 6.
<remote_addr>	String	Remote host IP address or domain name of the remote host. For IP address format reference see the IP addressing.
<remote_port>	Number	Remote host port, in range 1-65535
<async_connect>	Number	Asynchronous connect flag. The flag has effect for TCP connections only. Allowed values: • 0 (default value): the operation result is returned only once the TCP connection is established, locking the AT interface until the connection activity is running • 1: the final result code is returned immediately unlocking the AT interface and making it available for the execution of other AT commands. Once the result of

Parameter	Type	Description
		TCP connection becomes available, it is notified to the AT interface through the +UUSOCO URC.
<socket_error>	Number	Code of the last error occurred in a socket operation. The allowed values are listed in Appendix A.6: • 0: no error, connection successful

24.9.4 Notes

- In case of the socket connection with the asynchronous flag:
  - the socket will be closed if a further +USOCO AT command is issued before having received the +UUSOCO URC of the first AT command.
  - it is not possible to connect a second socket before the reception of the +UUSOCO URC related to the pending socket connection.

LARA-R6

- The time to establish the secure session (when using +USOSEC: <socket>,1[,<usecmng_profile_id>]) could require up to 150 s in one of these cases:
  - RoT generated PSK (+USECPRF: <profile_id>,11)
  - encrypted session resumption (+USECPRF: <profile_id>,13,2,10)

  This is due to "security heartbeat" message operation. For more details on when this scenario occurs, see the +USECCONN AT command.
- The <async_connect> parameter and the +UUSOCO URC are not available.

24.10 Write socket data +USOWR

+USOWR						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	No	No	No	< 120 s	+CME Error

24.10.1 Description

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

There are three kinds of syntax:

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

Some notes about the **TCP socket**:

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

Some notes about the **UDP socket**:

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

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

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

24.10.2 Syntax

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

24.10.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • LARA-R6 - 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.

24.10.4 Notes

- For base syntax:
  - The value of <length> and the actual length of <data> must match
- For base syntax HEX mode:
  - Only the ASCII characters 0-9, A-F and a-f are allowed.
  - The length of the <data> parameter must be two times the <length> parameter.
- For binary syntax:
  - After the command is sent, the user waits for the @ prompt. When it appears the stream of bytes can be provided. After the specified amount of bytes has been sent, the system provides the final result code. The feed process cannot be interrupted i.e. the return in the command mode can be effective only when the number of bytes provided is the declared one.
  - After the @ prompt reception, wait for a minimum of 50 ms before sending data.
  - The binary extended syntax is the only way for the system to accept control characters as data; for the AT command specifications 3GPP TS 27.005 [81], characters like <CR>, <CTRL-Z>, quotation marks, etc. have a specific meaning and they cannot be used like data in the command itself. The command is so extended with a specific acceptance state identified by the @ prompt.
  - This feature can be successfully used when there is need to send a byte stream which belongs to a protocol that has any kind of characters in the ASCII range [0x00,0xFF].
  - In binary mode the module does not display the echo of data bytes.

  - Binary syntax is not affected by HEX mode option.
- For <data> parameter not all of the ASCII charset can be used.

24.11 SendTo command (UDP only) +USOST

+USOST						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 332 s	+CME Error

24.11.1 Description

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

There are three kinds of syntax:

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

☞ If no network signal is available, outcoming UDP packet may be lost.

☞ The information text response to the test command provides the information about the binary extended syntax only where supported.

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

☞ In binary mode the command will never return if less characters than the expected length are issued after the prompt.

24.11.2 Syntax

Type	Syntax	Response	Example
Base syntax			
Set	AT+USOST=<socket>,<remote_addr>,<remote_port>,<length>,<data>,[<seq_no>]	+USOST: <socket>,<length> OK	AT+USOST=3,"151.9.34.66",449,16,"16 bytes of data" +USOST: 3,16 OK
Binary syntax			
Set	AT+USOST=<socket>,<remote_addr>,<remote_port>,<length> After the"@" prompt <length> bytes of data are entered	@<data> +USOST: <socket>,<length> OK	AT+USOST=3,"151.9.34.66",449,16 @16 bytes of data +USOST: 3,16 OK
Test	AT+USOST=?	+USOST: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <length>s),(list of supported <seq_no>s),"HEX data" +USOST: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <length>s),(list of supported <seq_no>s),"data" [+USOST: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <length>s)]	+USOST: (1-8),"remote_host",(1-65535),(1-512),(1-255),"HEX data" +USOST: (1-8),"remote_host",(1-65535),(1-1024),(1-255),"data" OK

Type	Syntax	Response	Example
		OK	
URC		+UUSOST: <socket>,<seq_no>, <UDP_result>	+USOST: 3,1,1

24.11.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • LARA-R6 - 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: • LARA-R6 o Base syntax normal mode: range 1-1024 o Base syntax HEX mode: range 1-512 o Binary syntax mode: range 1-1024
<data>	String	Data bytes to be written (not all of the ASCII charset can be used)
<seq_no>	Number	Sequence number of UDP packet, in range 1-255. The default value is 1.
<UDP_result>	Number	Supported values: • 0: fail • 1: success

24.11.4 Notes

- For base syntax:
  - The value of <length> and the actual length of <data> must match
  - For base syntax HEX mode, only ASCII characters 0-9, A-F and a-f are allowed. The length of the <data> parameter must be two times the <length> parameter
- For binary syntax:
  - After the command is sent, the user waits for the @ prompt. When it appears the stream of bytes can be provided. After the specified amount of bytes has been sent, the system returns with final result code. The feed process cannot be interrupted i.e. the return in the command mode can be effective only when the number of bytes provided is the declared one
  - That binary extended syntax is the only way for the system to accept control characters as data; for the AT command specifications [81], characters like <CR>, <CTRL-Z>, quotation marks, etc. have a specific meaning and they cannot be used like data in the command itself. The command is so extended with a specific acceptance state identified by the @ prompt
  - This feature can be successfully used when there is need to send a byte stream which belongs to a protocol that has any kind of characters in the ASCII range [0x00,0xFF]
  - In binary mode the module does not display the echo of data bytes
  - Binary syntax is not affected by HEX mode option
  - In binary mode the command response time value specified in Estimated command response time takes effect after the last expected character has been issued

24.12 SendTo command with flags (UDP only) +USOSTF

+USOSTF						
Modules	LARA-R6001 LARA-R6001D LARA-R6401 LARA-R6401D					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

24.12.1 Description

Sends a UDP datagram to the specified host:port and sets meta-data flags. It will return the socket identifier that the data was sent on and the number of bytes of data sent. If the amount of data is larger than the largest datagram that can be sent, then the information text response will indicate the data quantity that was successfully sent.

There are three kinds of syntax (see Notes for limits of permitted characters):

- **Base syntax normal**: writing simple strings to the socket (only with permitted characters, see Notes).
- **Base syntax HEX**: writing hexadecimal strings to the socket, the string will be converted in binary data and sent to the socket. To enable it, see the AT+UDCONF=1 command description.
- **Binary extended syntax**: mandatory for writing any character in the ASCII range [0x00, 0xFF].

24.12.2 Syntax

Type	Syntax	Response	Example
Base syntax			
Set	AT+USOSTF=<socket>,<remote_addr>,<remote_port>,<rai_flag>,<length>,<data>	+USOSTF: <socket>,<sent_length> OK	AT+USOSTF=3,"151.9.34.66",449,2,16,"16 bytes of data" +USOSTF: 3,16 OK
Binary syntax			
Set	AT+USOSTF=<socket>,<remote_addr>,<remote_port>,<rai_flag>,<length> After the"@" prompt <length> bytes of data are entered	@<data> +USOSTF: <socket>,<sent_length> OK	AT+USOSTF=3,"151.9.34.66",1,449,16 @16 bytes of data +USOSTF: 3,16 OK
Test	AT+USOSTF=?	+USOSTF: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <rai_flag>s),(list of supported <length>s),"HEX data" +USOSTF: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <rai_flag>s),(list of supported <length>s),"data" [+USOSTF: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <rai_flag>s),(list of supported <length>s)] OK	+USOSTF: (1-8),"remote_host",(1-65535),(0,2),(1-512),(1-255),"HEX data" +USOSTF: (1-8),"remote_host",(1-65535),(0,2),(1-1024),(1-255),"data" OK

24.12.3 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
<rai_flag>	Number	Specifies the type of message transmission. Allowed values: • 0: release assistance indication (RAI) disabled. • 1: RAI enabled; request to the network to release the connection immediately after sending/transporting this uplink message. • 2: RAI enabled; request to the network to release the connection after sending one downlink message to the module. The network does not send the radio resource control (RRC) connection release indication immediately after delivering the UDP packet to the remote server, but only after delivering one UDP packet from remote server to module.

Parameter	Type	Description
<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)
<sent_length>	Number	Amount of data successfully sent.

24.12.4 Notes

- For base syntax (normal and HEX):
  - 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 [81], 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

24.13 Read Socket Data +USORD

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

24.13.1 Description

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

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

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

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

☞ If the UART interface of the application processor has a RX FIFO of only 1 character, it is highly recommended to set the <length> parameter lower than 64.

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

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

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

24.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+USORD=<socket>,<length>	+USORD: <socket>,<length>,<data in the ASCII [0x00,0xFF] range> OK	AT+USORD=3,16 +USORD: 3,16,"16 bytes of data" OK
Test	AT+USORD=?	+USORD: (list of supported <socket>s),(list of supported <length>s) OK	+USORD: (0-6),(0-1024) OK
URC		+UUSORD: <socket>,<length>	+UUSORD: 3,16

24.13.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • LARA-R6 - 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

24.13.4 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>.

24.14 Receive From command (UDP only) +USORF

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

24.14.1 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.

24.14.2 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

24.14.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • LARA-R6 - 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 stored in buffer (if in the set command), or read from the buffer (if in the information text response to the set command), or stored in the buffer (for the URC). The allowed range when issued in the set command or returned in the information text response is: • LARA-R6 - 0-1024
<data>	String	Data bytes to be read

24.14.4 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>.

LARA-R6

- The +USORF AT command should not be used for a DTLS connection, that is when the connection has been configured using the +USOCO and the +USOSEC AT commands. For DTLS connections the +USOCO, +USOSEC, +USORD and +USOWR AT commands need to be used.

24.15 Set Listening Socket +USOLI

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

24.15.1 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.

24.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+USOLI=<socket>,<port>	OK	**TCP sockets** AT+USOLI=2,1200 OK +UUSOLI: 3,"151.63.16.7",1403,2,"82.89.67.164",1200
			UDP sockets AT+USOLI=0,1182 OK +UUSORF: 0,1024
Test	AT+USOLI=?	+USOLI: (list of supported <socket>s),(list of supported <port>s) OK	+USOLI: (0-6),(1-65535) OK
URC (TCP)		+UUSOLI: <socket>,<ip_address>,<port>,<listening_socket>,<local_ip_address>,<listening_port>	+UUSOLI: 3,"151.63.16.7",1403,0,"82.89.67.164",200
URC (UDP)		+UUSORF: <listening_socket>,<length>	+UUSORF: 1,967

24.15.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • LARA-R6 - 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.

Parameter	Type	Description
<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.

24.15.4 Notes

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

24.16 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

24.16.1 Description

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

LARA-R6
The command enables/disables the HEX mode also for the +USOSTF AT command.

24.16.2 Syntax

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

24.16.3 Defined values

Parameter	Type	Description
<enable_hex_mode>	Number	Enables/disables the HEX mode for +USOWR, +USOST, +USORD and +USORF AT commands. Allowed values: • 0 (factory-programmed value): HEX mode disabled • 1: HEX mode enabled LARA-R6 The parameter enables/disables the HEX mode also for the +USOSTF AT command.

24.17 Set socket in Direct Link mode +USODL

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

24.17.1 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.

LARA-R6
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.

24.17.2 Syntax

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

24.17.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • LARA-R6 - The range goes from 0 to 6.

24.17.4 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.

LARA-R6
See the +UDCONF=5, +UDCONF=6, +UDCONF=7, +UDCONF=8 commands description for the transmission triggers configuration.

24.17.4.1 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.

LARA-R6
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.

24.17.4.2 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.

LARA-R6
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.

24.17.4.3 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.

24.17.4.4 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.

24.17.4.5 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.

24.17.4.6 Data from the network

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

24.17.4.7 Congestion timer

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

- LARA-R6 - 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.

24.18 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

24.18.1 Description

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

24.18.2 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> OK	AT+UDCONF=5,0 +UDCONF: 5,0,500 OK

24.18.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings: • LARA-R6 - The range goes from 0 to 6.
<timer_trigger>	Number	Enhanced Direct Link sending timer trigger (in milliseconds); valid range is 0 (trigger disabled), 100-120000; • LARA-R6 - the factory-programmed value is 500 ms for UDP, 0 ms for TCP.

24.19 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

24.19.1 Description

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

24.19.2 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> OK	AT+UDCONF=6,0 +UDCONF: 6,0,1024 OK

24.19.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the UDP Direct Link settings: • LARA-R6 - The range goes from 0 to 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.

24.20 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

24.20.1 Description

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

24.20.2 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

24.20.3 Defined values

Parameter	Type	Description
<socket_id>	Number	Socket identifier; used when changing the Direct Link settings: • LARA-R6 - The range goes from 0 to 6.

Parameter	Type	Description
<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.

24.21 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

24.21.1 Description

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

24.21.2 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

24.21.3 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, 1000-72000 0; the factory-programmed value is 60000, 0 means trigger disabled

24.22 Internal IP stack TCP window scaling factor configuration +UDCONF=17

+UDCONF=17						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

24.22.1 Description

Configures the flow control for the internal IP stack, which applies to socket-related, embedded TCP/IP application related AT commands (e.g. FTP, uFOTA). The command has no effect on DUN/PPP traffic.

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

The set value is saved in NVM for the configured MNO profile. Any active MNO profile change by means of the +UMNOPROF AT command will restore to the factory-programmed configuration.

24.22.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=17,<tcp_scale_factor>	OK	AT+UDCONF=17,1 OK
Read	AT+UDCONF=17	AT+UDCONF: 17,<tcp_scale_factor>	+UDCONF: 17,1

Type	Syntax	Response	Example
			OK

24.22.3 Defined values

Parameter	Type	Description
<tcp_scale_factor>	Number	TCP window scale factor configured in internal IP stack. The TCP window scale factor is sent as TCP option in SYN segment and it is applied as the exponential of two to calculate the TCP window scale value. This is multiplied for the TCP window size sent in TCP SYN segment in order to retrieve the configured buffer window size at the TCP client side. For more details, see the RFC 7323 [178]. The allowed range goes form 0 to 4, the factory-programmed value is 0.

24.23 Direct Link disconnect DSR line handling +UDCONF=10

+UDCONF=10						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

24.23.1 Description

The Direct Link functionality changes the DSR line state according to the &S configuration. If the &S configuration = 1 (default and factory programmed value), DSR line transitions will occur as follows:

- From LOW to HIGH when the module enters into Direct Link mode
- From HIGH to LOW when the module exits from Direct Link mode

The +UDCONF=10 command allows to configure the behavior of the DSR line when the module exits from Direct Link. In fact, the transition (from HIGH to LOW) can be configured to occur prior to or after the output of the "<CR><LF>DISCONNECT<CR><LF>" string.

This command has no effect when the &S configuration = 0.

24.23.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=10,<dl_dsr_line_behavior>	OK	AT+UDCONF=10,1 OK
Read	AT+UDCONF=10	+UDCONF: 10,<dl_dsr_line_behavior> OK	AT+UDCONF=10 +UDCONF: 10,1 OK

24.23.3 Defined values

Parameter	Type	Description
<dl_dsr_line_behavior>	Number	Behavior of the DSR transition when the module exits from Direct Link. Allowed values: • 0 (default value): DSR line transition (HIGH to LOW) is performed after the output of the "<CR><LF>DISCONNECT<CR><LF>" string • 1: DSR line transition (HIGH to LOW) is performed before (~20 ms) the output of the "<CR><LF>DISCONNECT<CR><LF>" string

24.24 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

24.24.1 Description

Allows interaction with the low level socket layer.

24.24.2 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

24.24.3 Defined values

Parameter	Type	Description
<socket>	Number	Socket identifier. • LARA-R6 - The range goes from 0 to 6.
<param_id>	Number	Control request identifier: • 0: query for socket type • 1: query for last socket error • 2: get the total amount of bytes sent from the socket • 3: get the total amount of bytes received by the socket • 4: query for remote peer IP address and port • 10: query for TCP socket status (only TCP sockets) • 11: query for TCP outgoing unacknowledged data (only TCP sockets) • 5-9, 12-99: RFU Allowed values: • LARA-R6 - 0, 1, 2, 3, 4, 5-9, 10, 12-99
<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" [177]) • 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

Parameter	Type	Description
		• 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.

24.25 IP Change Notification +UIPCHGN

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

24.25.1 Description

Enable, disables or forces the IP change notification (CN) functionality. This command only works for internal PDP context activation.

The IP CN notifies a remote server about changes in the module IP address.

The following information is delivered to the destination server:

- Current IP address of the module
- IMEI of the module (optional)
- IMSI of the inserted SIM card (optional)
- Username (optional)
- MD5 hash of user password (hex format) (optional)
- Custom information (up to 128 bytes)

The notification is sent via a HTTP GET request.

The GET request format is the following:

```
GET /<path>?myip=<ip>&imei=<imei>&imsi=<imsi>&user=<username>&pass=<md5paswd>&cust=<cust_info> HTTP/1.0{CRLF}
Host: <domain_name>{CRLF}
User-Agent: u-blox IP Change Notification Agent 1.0{CRLF}
{CRLF}
```

<ip>, <imei> (if enabled) and <imsi> (if enabled) fields inside the HTTP request are automatically inserted by the module, <domain_name>, <path>, <username>, <password> and <cust_info> fields must be provided by the application through the +UIPCHGN AT command.

{CRLF} is a placeholder for hexadecimal character 0x0D (CR) and 0x0A (LF).

The HTTP response from the server is parsed to recognize the HTTP response code and the text between the <ipchgn_r> and the </ipchgn_r> tags inside the response body. This text is not mandatory and can be freely customized by the customer (up to 64 printable characters).

A real world example follows:

Request (from the module)

```
GET         /modemipnotify.php?myip=123.56.214.2&imei=992237050009739&imsi=992105301545971&user=test_user&pass=
16ec1ebb01fe02ded9b7d5447d3dfc65&cust=Product%3A+Tracker+v.1.0 HTTP/1.0{CRLF}

Host: somedomain.com {CRLF}

User-Agent: u-blox IP Change Notification Agent 1.0{CRLF}

{CRLF}
```

Where

Field	Content	Comment
server	somedomain.com	Specified via +UIPCHGN AT command
path	modemipnotify.php	Specified via +UIPCHGN AT command
myip	123.56.214.2	
imei	992237050009739	
imsi	992105301545971	
user	test_user	Specified via +UIPCHGN AT command
pass	16ec1ebb01fe02ded9b7d5447d3dfc65	MD5 hash of "test_password"Specified via +UIPCHGN AT command
cust_info	Product%3A+Tracker+v.1.0	URL encoding of the string "Product: Tracker v.1.0". Specified via +UIPCHGN AT command

Response (from the server)

```
HTTP/1.0 200 OK {CRLF}

Content-Type: text/html {CRLF}

Content-Length: 31 {CRLF}

Connection: close {CRLF}

{CRLF}

<ipchgn_r>IP_UPDATED</ipchgn_r>
```

Another real world example (without custom information, username and password):

```
GET           /modemipnotify.php?myip=123.56.214.2&imei=992237050009739&imsi=992105301545971&user=&pass=&cust=
 HTTP/1.0{CRLF}

Host: somedomain.com {CRLF}

User-Agent: u-blox IP Change Notification Agent 1.0{CRLF}

{CRLF}
```

Where:

Field	Content	Comment
server	somedomain.com	
path	modemipnotify.php	
myip	123.56.214.2	
imei	992237050009739	
imsi	992105301545971	
user		(empty)
pass		(empty)
cust_info		(empty)

Response (from the server)

```
HTTP/1.0 200 OK {CRLF}
Content-Type: text/html {CRLF}
Content-Length: 31 {CRLF}
Connection: close {CRLF}
{CRLF}
<ipchgn_r>IP_UPDATED</ipchgn_r>
```

⚠ Password hashing and URL encoding are performed by the module, so parameters < password> and <cust_info> must be inserted in plain text in the +UIPCHGN command (See command parameters below).

The command configuration is stored in the NVM; if enabled, the command automatically works after a reboot and the +UUIPCHGN: 0 URC is sent to all terminals in this case.

If the IP CN feature is enabled, the notification is performed at each PDP context activation. If the client is enabled when a PDP connection is already active, it starts to update IP address on the next PDP context activation.

☞ The custom information field (< cust_info >) is URL encoded into the HTTP request, this means that the final custom information inside the HTTP GET request may be longer than 128 bytes.

☞ The username and password are not compulsory, but it is encouraged to use them for security reasons.

24.25.2 Syntax

Type	Syntax	Response	Example
Set	AT+UIPCHGN=<action>[,<server>,<port>,<path>,<send_imei>,<send_imsi>,<username>,<password>,<cust_info>[,<cid>[,<preferred_protocol_type>]]]	OK	To enable the IP CN feature: AT+UIPCHGN=1,"somedomain.com",80,"modemipnotify.php",1,1,"test_user","test_password","Product: Tracker v.1.0",2,0 OK To force another IP CN to the remote server (CN must be previously enabled): AT+UIPCHGN=2 OK To disable the IP CN feature: AT+UIPCHGN=0 OK
Read	AT+UIPCHGN?	+UIPCHGN: <status>[,<server>,<port>,<path>,<send_imei>,<send_imsi>,<username>,<password>,<cust_info>,<[cid]>,<preferred_protocol_type>] OK	+UIPCHGN: 1,"somedomain.com",80,"/modemipnotify.php",1,1,"test_user","test_password","Product: Tracker v.1.0",2,0 OK
Test	AT+UIPCHGN=?	+UIPCHGN: (list of supported <action>s),<server>,(list of supported <port>s),<path>,(list of supported <send_imei>s),(list of supported <send_imsi>s),<username>,<password>,<cust_info>,(list of supported <cid>s),(list of supported <preferred_protocol_type>s) OK	+UIPCHGN: (0 2),"server",(1 65535),"path",(0 1),(0 1),"username","password","cust_info" OK
URC		+UUIPCHGN: <code>[,<reply_str>]	+UUIPCHGN: 200,"IP_UPDATED"

24.25.3 Defined values

Parameter	Type	Description
<action>	Number	Disable / Enable / Force the Update of IP CN feature • 0 (factory-programmed value): disable the feature • 1: enable the feature • 2: force IP notification update Note: < action > = 2 could be used when the +UUIPCHGN URC returns a code different from 200.
<server>	String	Indicates the remote host to which the HTTP GET request must be sent to notify the IP change event. It can be either a domain name (e.g. "somedomain.com") or an IP address in numeric format (e.g. "173.194.35.145"), always between double quotes. Maximum length: 64 characters Mandatory parameter with < action>=1, ignored with < action>=0 or < action>=2
<port>	Number	Indicates the server port to which the HTTP GET request must be sent. Valid range: from 1 to 65535 Mandatory parameter with < action> =1, ignored with < action> =0 or < action> =2
<path>	String	Indicates the server path to be used inside the HTTP GET request. The insertion of the starting "/" is not mandatory (the software automatically adds it if omitted). The string must be enclosed between double quotes. Maximum length: 64 characters Mandatory parameter with < action> =1, ignored with < action> =0 or < action> =2
<username>	String	Indicates the username to be sent inside the HTTP request. The string must be enclosed between double quotes. Max length: 64 characters Mandatory parameter with < action> =1, ignored with < action> =0 or < action> =2 If no username is required, this parameter must be inserted as empty string ("")
<send_imei>	Number	Indicates if the notification must send the modem IMEI inside the notification HTTP GET request • 0: do not send IMEI • 1: send IMEI Mandatory parameter with < action> =1, ignored with < action> =0 or < action> =2
<send_imsi>	Number	Indicates if the notification must send the modem IMSI inside the notification HTTP GET request Valid range: 0-1 • 0: do not send IMSI • 1: send IMSI Mandatory parameter with < action> =1, ignored with < action> =0 or < action> =2
<password>	String	Indicates the password whose MD5 hash is to be sent inside the HTTP request. The string must be enclosed between double quotes. Maximum length: 32 characters Mandatory parameter with <action>=1, ignored with <action>=0 or <action>=2 If no password is required, this parameter must be inserted as empty string ("")
<cust_info>	String	Indicates the custom information to send inside the HTTP GET request. The string must be enclosed between double quotes. Maximum length: 128 characters Mandatory parameter with <action>=1, ignored with <action>=0 or <action>=2 If no custom information is required, this parameter must be inserted as empty string ("")
<cid>	Number	PDP context identifier used for the DNS communication. The allowed range is product specific, see <cid>. For more details on the default and factory-programmed value of the parameter (where supported), see Internet protocol transport layer.
<preferred_protocol_type>	Number	Preferred protocol type to be specified when the <cid> protocol type is IPv4v6. Allowed values:

Parameter	Type	Description
		• 0: IPv4 • 1: IPv6 For more details on the default and factory-programmed value of the parameter (where supported), see Internet protocol transport layer.
<status>	Number	This value indicates the status of the IP CN feature • 0: disabled • 1: enabled
<code>	Number	This is the code returned by the +UUIPCHGN URC. Values lower than 100 should be interpreted as internal error, see UUIPGHGN Error. <code> values greater than 100 must be interpreted as HTTP server response code. If error is not present the code returned by the +UUIPCHGN should be 200. The +UUIPCHGN: 0 URC is sent to all terminals at boot if the IP CN feature is enabled from a previous working session.
<reply_str>	String	This is the text inserted between the <ipchgn_r> and </ipchgn_r> tags into the response body from the server. The string is enclosed between double quotes. The maximum length of this string is 64 bytes; if the server sends a longer string, it will be truncated. The parameter is only provided when the information is present in the HTTP response from the remote server and not if an internal error occurred.

25 Device and data security

25.1 Introduction

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

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

Some definitions are needed to understand the foundations of security:

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

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

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

The pillars of the u-blox security are:

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

The IoT device is secured through different steps:

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

25.2 Device security

25.2.1 Introduction

These AT commands maintain device integrity over the entire lifecycle.

- The **+USECCHIP** AT command queries the immutable chip ID.
- The **+USECDEVINFO** AT command allows customer programming the device profile UID into each device along with their own device serial number.
- The **+USECROTUID** AT command queries the Root of Trust (RoT) public Unique IDentifier (UID).

25.2.2 Read the module chip ID +USECCHIP

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

25.2.2.1 Description

Queries the chip ID of the module and returns it.

25.2.2.2 Syntax

Type	Syntax	Response	Example
Action	AT+USECCHIP	+USECCHIP: <chip_id> OK	+USECCHIP: "12345678" OK

25.2.2.3 Defined values

Parameter	Type	Description
<chip_id>	String	Chip ID of the module.

25.2.3 Retrieve the RoT public UID +USECROTUID

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

25.2.3.1 Description

Returns the Root of Trust (RoT) public Unique IDentifier (UID).

25.2.3.2 Syntax

Type	Syntax	Response	Example
Action	AT+USECROTUID	+USECROTUID: <rot_public_UID> OK	+USECROTUID: "00020000 89285555" OK

25.2.3.3 Defined values

Parameter	Type	Description
<rot_public_UID>	String	Root of Trust Public UID

25.2.4 Seal device information +USECDEVINFO

+USECDEVINFO						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 30 s	+CME Error

25.2.4.1 Description

Allows the device to seal the device specific information. This command writes the device information, which will be used by the security application to call the corresponding SCL functions. The read command provides a way to check if the security services registration has been completed.

25.2.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+USECDEVINFO=<device_info>, <device_serial_num>	OK	AT+USECDEVINFO="ZHIN70 dVgUWCdfNeXHkQRg","SN#4756" OK

Type	Syntax	Response	Example
Read	AT+USECDEVINFO?	+USECDEVINFO: <module_ registration>,<device_registration>, <device_activation> OK	+USECDEVINFO: 1,0,1 OK

25.2.4.3 Defined values

Parameter	Type	Description
<device_info>	String	Device information structure defined by the SCL library provider; the string is provided by u-blox on request.
<device_serial_num>	String	Device serial number. The maximum length is 16 characters.
<module_ registration>	String	Indicates the status of module registration to security services. Allowed values: • 0: not registered • 1: registered
<device_ registration>	String	Indicates the status of device registration to security services. Allowed values: • 0: not registered • 1: registered
<device_activation>	String	Device's RoT activation status. Allowed values: • 0: disabled • 1: enabled

25.2.5 Configure secure data suite features +USECMODE

+USECMODE						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	< 30 s	+CME Error

25.2.5.1 Description

Enables / disables the secure data suite features on the module. It can only be used if the module has not been sealed with the +USECDEVINFO AT command, otherwise an error result code is returned.

After a successful issuance of the command, reboot the module (e.g. by means of the +CFUN AT command) in order to apply the new configuration.

Disabling the security feature by means of the AT+USECMODE=0 command causes the failure of the LwM2M client registration with the LwM2M servers, which require the use the pre-shared key (PSK) generated by the root of trust (for more details see the +ULWM2MCONFIG AT command).

25.2.5.2 Syntax

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

25.2.5.3 Defined values

Parameter	Type	Description
<enable_security>	Number	Disables or enables the security suite features on the module. Allowed values: • 0: turn the security suite features off • 1 (factory-programmed value): turn the security suite features on

25.2.6 Security server trigger +USECCONN

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

25.2.6.1 Description

Triggers the security server by means of a "security heartbeat". An error result code will be returned if the send attempt fails, or if the server does not acknowledge.

25.2.6.2 Syntax

Type	Syntax	Response	Example
Action	AT+USECCONN	OK	OK

25.2.7 Security configuration and action command +USECOPCMD

+USECOPCMD						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	< 30 s	+CME Error

25.2.7.1 Description

Generic security command used to store some configuration values or perform actions.

25.2.7.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+USECOPCMD=<op_code>,<param1>,<param2>	OK	
Read	AT+USECOPCMD=<op_code>	+USECOPCMD: <op_code>,<param1>,<param2> OK	
Configure PDN			
Set	AT+USECOPCMD="cfgpdn",<apn_name>[,<pdn_ip_type>]	OK	AT+USECOPCMD="cfgpdn","internet",0 OK
Read PDN configuration			
Read	AT+USECOPCMD="cfgpdn"	+USECOPCMD: "cfgpdn",<apn_name>,<pdn_ip_type> OK	AT+USECOPCMD="cfgpdn" +USECOPCMD: "cfgpdn","internet",0 OK
Retrieve secure element information			
Read	AT+USECOPCMD="rotinfo",<info_id>	+USECOPCMD: "rotinfo",<info_id>,<info_string> OK	AT+USECOPCMD="rotinfo",0 +USECOPCMD: "rotinfo",0,"30312E30362E3832" OK
Retrieve secure library version and build version in hexadecimal format			
Read	AT+USECOPCMD="secvers"	+USECOPCMD: "secvers",<sec_version>,<build_version> OK	AT+USECOPCMD="secvers" +USECOPCMD: "secvers","312E382E33","492D434E57414A2D4245424149" OK
Configure E2E (end-to-end) encryption version			
Set	AT+USECOPCMD="e2e_enc",<version>	OK	AT+USECOPCMD="e2e_enc",0 OK

Type	Syntax	Response	Example
Retrieve E2E (end-to-end) encryption version			
Read	AT+USECOPCMD="e2e_enc"	+USECOPCMD: "e2e_enc",<version> OK	AT+USECOPCMD="e2e_enc" +USECOPCMD: "e2e_enc",1 OK
Backup and restore of the RoT persistent data generic syntax			
Set	AT+USECOPCMD="rotrestore", <restore_cmd>	[+USECOPCMD: "rotrestore", <restore_pending>] OK	AT+USECOPCMD="rotrestore",0 +USECOPCMD: "rotrestore",1 OK
Check if the restore of RoT persistent data and configuration from backup is pending			
Set	AT+USECOPCMD="rotrestore",0	+USECOPCMD: "rotrestore", <restore_pending> OK	AT+USECOPCMD="rotrestore",0 +USECOPCMD: "rotrestore",1 OK
Restore the RoT persistent data and configuration from backup			
Set	AT+USECOPCMD="rotrestore",1	OK	AT+USECOPCMD="rotrestore",1 OK
Backup the RoT persistent data and configuration			
Set	AT+USECOPCMD="rotbackup"	OK	AT+USECOPCMD="rotbackup" OK
Re-synchronize the RoT persistent data and configuration with the security server			
Set	AT+USECOPCMD="rotresync"	OK	AT+USECOPCMD="rotresync" OK
Configure IPv4 connection properties			
Set	AT+USECOPCMD="cfgipv4", <mode>[,<port>[,<ip_address>[, <dns_ip_address>]]]	OK	AT+USECOPCMD="cfgipv4",0 OK
Read IPv4 connection properties configuration			
Read	AT+USECOPCMD="cfgipv4"	+USECOPCMD: "cfgipv4",<mode>, <port>,<ip_address>,<dns_ip_ address> OK	AT+USECOPCMD="cfgipv4" +USECOPCMD: "cfgipv4",0,0,"","" OK
Configure IPv6 connection properties			
Set	AT+USECOPCMD="cfgipv6", <mode>[,<port>[,<ip_address>[, <dns_ip_address>]]]	OK	AT+USECOPCMD="cfgipv6",0 OK
Read IPv6 connection properties configuration			
Read	AT+USECOPCMD="cfgipv6"	+USECOPCMD: "cfgipv6",<mode>, <port>,<ip_address>,<dns_ip_ address> OK	AT+USECOPCMD="cfgipv6" +USECOPCMD: "cfgipv6",0,0,"","" OK

25.2.7.3 Defined values

Parameter	Type	Description
<op_code>	String	Type of operation: • "cfgpdn": configure the APN used for the connection • "rotinfo": retrieve secure element information such as locked FW version, FW version, RoT public UID, platform version, HW info and diagnostic data • "secvers": retrieve secure library version and build version in hexadecimal format • "e2e_enc": configure end-to-end (E2E) encryption version • "rotrestore": restore the RoT persistent data and configuration from backup • "rotbackup": backup the RoT persistent data and configuration • "rotresync": re-synchronize the RoT persistent data and configuration with security server • "cfgipv4": configure the IPv4 connection properties to use when connecting to the security server using an IPv4 or IPv4/IPV6 PDN.

Parameter	Type	Description
		• "cfgipv6": configure the IPv6 connection properties to use when connecting to the security server using an IPV6 PDN
<apn_name>	String	Network identifier. The maximum size is 100 bytes. The factory-programmed value is an empty string.
<pdn_ip_type>	Number	PDN IP type: • 0: (factory-programmed and default value): IPv4 • 1: IPv6 • 2: IPv4 and IPv6
<info_id>	Number	Identifier corresponding to the required information: • 0: version of the locked firmware • 1: version of the application firmware • 2: public UID of the RoT (8 bytes string) • 3: platform version • 4: hardware-specific data • 5: diagnostic data
<info_string>	String	Requested information according to <info_id>
<sec_version>	String	Secure library version in hexadecimal format
<build_version>	String	Secure build version in hexadecimal format
<version>	Number	E2E encryption version. Allowed values: • 0: E2E encryption V1 • 1 (factory-programmed value): E2E encryption V2
<restore_cmd>	Number	RoT restore persistent data and configuration command. Allowed values: • 0: check if a restore of RoT persistent data and configuration occurred • 1: restore the RoT persistent data and configuration from backup
<restore_pending>	Number	RoT restore persistent data and configuration pending status. Allowed values: • 0: the restore of RoT persistent data and configuration is not pending • 1: the restore of RoT persistent data and configuration is pending. A RoT re-synchronization is required (see the AT+USECOPCMD="rotresync").
<mode>	Number	Connection and fallback (see the +USECCONN AT command) configuration. Allowed values: • 0 (factory-programmed value): DNS, static IPv4/IPv6 address fallback; the handling of remaining parameters is: o The IP address to use is resolved by the DNS configured by means of the <dns_ip_address> parameter o In case of fallback, the <ip_address> value set is used as IP address. If omitted, the <ip_address> parameter will be set to the factory-programmed value. • 1: static IPv4/IPv6 address, DNS fallback o The IP address is configured by means of the <ip_address> parameter. If omitted, the <ip_address> parameter will be set to the factory-programmed value. o In case of fallback, the <dns_ip_address> value set is used as IP address. If omitted, the <dns_ip_address> parameter will be set to the factory-programmed value. • 2: DNS only o The <ip_address> parameter is not allowed o The IP address to use is resolved by the DNS configured by means of the <dns_ip_address> parameter • 3: u-blox security partner server IPv4/IPv6 address o The IP address is configured by means of the <ip_address> parameter. If omitted, the <ip_address> parameter will be set to the factory-programmed value. o The <dns_ip_address> parameter is not allowed • 4: u-blox security server IPv4/IPv6 address o The IP address is configured by means of the <ip_address> parameter. If omitted, the <ip_address> parameter will be set to the factory-programmed value. o The <dns_ip_address> parameter is not allowed
<port>	Number	Security server port; range 1-65535. It means the security server port to be used; the factory-programmed value is 38292.

Parameter	Type	Description
<ip_address>	String	Connection IP address configuration. IPv4 or IPv6 address string. The factory-programmed value depends on <mode> value: • when <mode>=0 or 1 or 3 o IPv4: 63.35.25.213 o IPv6: 2A05::D018::0E8C::9701::484A::E62C::0337::2202 • when <mode>=4 o IPv4: 10.7.0.55 o IPv6: not supported
<dns_ip_address>	String	DNS resolver IP address. IPv4 or IPv6 address string.

25.2.7.4 Notes

LARA-R6

- <op_code>="rotinfo" is not supported.

25.3 Data security

25.3.1 Introduction

25.3.1.1 SSL/TLS/DTLS

SSL/TLS/DTLS (where supported) provides a secure connection between two entities using TCP/UDP socket for communication (i.e. HTTP/FTP server and HTTP/FTP client).

The SSL/TLS/DTLS with digital certificates support provides different connection security aspects:

- **Server authentication**: use of the server certificate verification against a specific trusted certificate or a trusted certificates list;
- **Client authentication**: use of the client certificate and the corresponding private key;
- **Data security and integrity**: data encryption and Hash Message Authentication Code (HMAC) generation.

The security aspects used in the current connection depend on the SSL/TLS/DTLS configuration and features supported by the communicating entities.

u-blox cellular modules support all the described aspects of SSL/TLS/DTLS security protocol with these AT commands:

- AT+USECMNG: import, removal, list and information retrieval of certificates or private keys;
- AT+USECPRF: configuration of USECMNG (u-blox SECurity MaNaGement) profiles used for an SSL/TLS/DTLS connection.

The USECMNG provides a default SSL/TLS/DTLS profile which cannot be modified. The default USECMNG profile provides the following SSL/TLS/DTLS settings:

Setting	Value	Meaning
Certificates validation level	Level 0	The server certificate will not be checked or verified.
Minimum SSL/TLS/DTLS version	Any	The server can use any of the TLS1.0/TLS1.1/TLS1.2/DTLS1.2 versions for the connection.
Cipher suite	Automatic	The cipher suite will be negotiated in the handshake process.
Trusted root certificate internal name	"" (none)	No certificate will be used for the server authentication.
Expected server host-name	"" (none)	No server host-name is expected.
Client certificate internal name	"" (none)	No client certificate will be used.
Client private key internal name	"" (none)	No client private key will be used.
Client private key password	"" (none)	No client private key password will be used.
Pre-shared key	"" (none)	No pre-shared key key password will be used.
Server certificate pinning	"" (none)	No server certificate will be used.
Server certificate pinning level	Level 0	No server certificate will be used.

For the configuration of the settings listed above, see the +USECPRF AT command.

LARA-R6
The secure client initiated re-negotiation is not supported. The secure server re-negotiation is supported.

The default USECMNG profile does not provide the client certificate internal name and the client private key internal name; hence, when a mutual authentication is required by the server initiated re-negotiation, the client certificate internal name and the client private key internal name need to be provided.

LARA-R6
During the handshake a not-activity timer is started at every received or transmitted packet. The timeout of the not-activity timer is set to 30 s. At the timer expiration the secure connection is aborted, since the handshake has not been completed successfully.

25.3.1.2 LARA-R6 Local encryption and decryption

The **+USECDATAENC**, **+USECDATADEC**, **+USECFILEENC**, **+USECFILEDEC** AT commands provide a method for managing symmetric crypto functions via AT command and to allow device to locally encrypt/decrypt and authenticate critical data (e.g. certificates, tokens) on the device itself.

25.3.1.3 LARA-R6 Pre-Shared Keys (PSK) provisioning

The **+USECPSK** AT command allows to provision and manage a session unique PSK in the module and in the cloud for application layer security. The PSK is generated and protected by the RoT.

25.3.1.4 LARA-R6 End-to-end data encryption

The **+USECE2EDATAENC**, **+USECE2EFILEENC** AT commands allow encrypting data on a device and decrypting asynchronously in the cloud independent of protocols (legacy, etc.), servers, platforms or time before reaching the final destination.

25.3.2 SSL/TLS certificates and private keys manager +USECMNG

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

25.3.2.1 Description

Manages the X.509 certificates and private keys with the following functionalities:

- Import of certificates and private keys
- List and information retrieval of imported certificates and private keys
- Removal of certificates and private keys
- MD5 calculation of imported certificate or private key

For more details on X.509 certificates and private keys see RFC 5280 [194].

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

- LARA-R6 - certificates and private keys both in DER (Distinguished Encoding Rules) and in PEM (Privacy-Enhanced Mail) format are accepted. If the provided format is PEM, the imported certificate or private key will be automatically converted in DER format for the internal storage. It is also possible to validate certificates and private keys. Up to 16 certificates or private keys can be imported.

The certificates and private keys are kept in DER format and are not retrievable (i.e. cannot be downloaded from the module); for data validation purposes an MD5 hash string of the stored certificate or private key (stored in DER format) can be retrieved.

LARA-R6
The SSL/(D)TLS connection with Server and/or Mutual Authentication can be successfully performed using the following key size:

- for Rivest-Shamir-Adleman (RSA) keys at least 2048-bits.
- for Elliptic Curve Digital Signature Algorithm (ECDSA) keys at least 192-bits.

The same limitation is applied also to the keys used for the certificates generation.

Data for certificate or private key import can be provided with a stream of byte similar to +UDWNFILE or from a file stored on the FS.

When using the stream of byte import functionality:

- If the data transfer is stopped before its completion, a guard timer of 20 s will ensure the termination of the data transmission. In this case the prompt will switch back in AT command mode and an error result code will be returned.
- If the module shuts down during the data transfer, all the bytes are discarded.
- If any error occurs during the data transfer, all bytes are discarded.

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

☞ LARA-R6
The imported certificates and private keys are:

- PRESERVED after the module FW is upgraded using +UFWINSTALL or +UFWUPD AT commands.
- NOT PRESERVED (deleted) after a factory reset using +UFACTORY AT command.
- PRESERVED after the module FW is upgraded using EasyFlash.

☞ The USECMNG import command supports only X.509 certificate format.

☞ The X.509 certificate DN (Distinguished Name) is composed of value fields which uniquely define an entity being authenticated. For security reasons some limitations (related to DN fields) described below are applied:

- The USECMNG import functionality allows the following DN value fields:
  - commonName (http://oid-info.com/get/2.5.4.3)
  - serialNumber (http://oid-info.com/get/2.5.4.5)
  - countryName (http://oid-info.com/get/2.5.4.6)
  - localityName (http://oid-info.com/get/2.5.4.7)
  - stateOrProvinceName (http://oid-info.com/get/2.5.4.8)
  - organizationName (http://oid-info.com/get/2.5.4.10)
  - organizationalUnitName (http://oid-info.com/get/2.5.4.11)
  - userID (http://oid-info.com/get/0.9.2342.19200300.100.1.1)
  - domainComponent (http://oid-info.com/get/0.9.2342.19200300.100.1.25)
  - pkcs9_emailAddress (http://oid-info.com/get/1.2.840.113549.1.9.1)
  - pkcs9_unstructuredName (http://oid-info.com/get/1.2.840.113549.1.9.2)
- The import of an X.509 certificate with DN containing other value fields (not in the above list) will result in an import error (error result code: USECMNG invalid certificate/key format).

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

25.3.2.2 Syntax

Type	Syntax	Response	Example
Generic syntax:			
Action	AT+USECMNG=<op_code>,[<type>[,<internal_name>[,<param1>[,<param2>]]]]	OK	-
Import a certificate or private key from serial I/O:			
Action	AT+USECMNG=0,<type>,<internal_name>,<data_size>[,<password>]	> Start transfer of data ... +USECMNG: 0,<type>,<internal_name>,<md5_string> OK	AT+USECMNG=0,0,"AddTrustCA",1327 >-----BEGIN CERTIFICATE----- (...other certificate data bytes...) +USECMNG: 0,0,"AddTrustCA","77107370ec4db40a0 8a6e36a64a1435b" OK
Import a certificate or private key from a file stored on FS:			
Action	AT+USECMNG=1,<type>,<internal_name>,<filename>[,<password>]	+USECMNG: 1,<type>,<internal_name>,<md5_string> OK	AT+USECMNG=1,0,"AddTrustCA","addtrust.cert" +USECMNG: 1,0,"AddTrustCA","7710 7370ec4db40a08a6e36a64a1435b"

Type	Syntax	Response	Example
			OK
Remove an imported certificate or private key:			
Action	AT+USECMNG=2,<type>,<internal_name>	OK	AT+USECMNG=2,0,"AddTrustCA" OK
List imported certificates or private keys:			
Read	AT+USECMNG=3[,<type>]	<cert_type>,<internal_name>[,<common_name>,<expiration_date>] ... OK	AT+USECMNG=3 "CA","AddTrustCA","AddTrust External CA Root","2020/05/30" "CA","GlobalSignCA","GlobalSign", "2029/03/18" "CC","JohnDoeCC","GlobalSign","2010/01/01" "PK","JohnDoePK" OK
Retrieve the MD5 of an imported certificate or private key:			
Read	AT+USECMNG=4,<type>,<internal_name>	+USECMNG: 4,<type>,<internal_name>,<md5_string> OK	AT+USECMNG=4,0,"AddTrustCA" +USECMNG: 4,0,"AddTrustCA", "77107370ec4db40a0 8a6e36a64a1435b" OK
Test	AT+USECMNG=?	+USECMNG: (list of supported <op_code>s),(list of supported <type>s) OK	+USECMNG: (0-4),(0-2) OK

25.3.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	Type of operation: • 0: import a certificate or a private key (data provided by the stream of byte) • 1: import a certificate or a private key (data provided from a file on FS) • 2: remove an imported certificate or private key • 3: list imported certificates or private keys • 4: retrieve the MD5 of an imported certificate or private key
<type>	Number	Type of the security data: • 0: trusted root CA (certificate authority) certificate • 1: client certificate • 2: client private key • 3: server certificate • 4: signature verification certificate • 5: signature verification public key Allowed values: • LARA-R6 - 0, 1, 2, 3
<cert_type>	String	Type of the security data in verbose format: • "CA": trusted root CA (certificate authority) certificate • "CC": client certificate • "PK": client private key • "SC": server certificate • "VC": signature verification certificate • "PU": signature verification public key Allowed values: • LARA-R6 - "CA", "CC", "PK", "SC"
<internal_name>	String	Unique identifier of an imported certificate or private key. If an existing name is used the data will be overridden. • LARA-R6 - The maximum length is 200 characters.
<data_size>	Number	Size in bytes of a certificate or private key being imported. • LARA-R6 - The maximum allowed size is 8192 bytes.

Parameter	Type	Description
<password>	String	Decryption password; applicable only for PKCS8 encrypted client private keys. The maximum length is 128 characters.
<filename>	String	Name of the FS file containing the certificate or private key data to be imported. • LARA-R6 - The maximum allowed file size is 8192 bytes.
<md5_string>	String	MD5 formatted string.
<common_name>	String	Certificate subject (issued to) common name; applicable only for trusted root and client certificates.
<expiration_date>	String	Certificate expiration (valid to date); applicable only for trusted root and client certificates.
<param1>	Number/ String	Type and supported content depend on the related <op_code> parameter; see the <op_code> specification.
<param2>	Number/ String	Type and supported content depend on the related <op_code> parameter; see the <op_code> specification.

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

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

25.3.3.1 Description

Manages security profiles for the configuration of the following SSL/TLS/DTLS connections properties:

- **Certificate validation level:**
  - Level 0: no certificate validation; the server certificate will not be checked or verified. No additional certificates are needed.
  - Level 1: certificate validation against a specific or a list of imported trusted root certificates.
  - Level 2: certificate validation with an additional URL integrity check (the server certificate common name must match the server hostname).
  - Level 3: certificate validation with an additional check on the certificate validity date.

  CA certificates should be imported with the +USECMNG AT command
- **SSL/TLS version to be used:**
  - Any of the TLS versions supported by the module
  - TLS 1.0
  - TLS 1.1
  - TLS 1.2
  - TLS 1.3
- **DTLS version to be used:**
  - DTLS 1.2
- **Cipher suite to be configured using the following methods:**
  - **Legacy cipher suite** to be used. See Syntax description and Table 31 for the supported cipher suites.
  - **Additional cipher suite** to be used with Internet Assigned Numbers Authority (IANA) enumeration set command. See Syntax description and Table 31 for the supported cipher suites.
  - **List of cipher suites** to be used is configured with add / remove commands and using IANA enumeration. See Syntax description and Table 31 for the supported cipher suites.

☞ For the applicability of cipher suite depending on the series module, see Cipher suites applicability.

☞ Cipher suite configuration methods are exclusive and the last configured method is used.

☞ The cipher suite configuration read command response is related to the selected cipher suite type, see Syntax description for more details.

- **Certificate to be used for server and mutual authentication:**
  - The trusted root certificate. The CA certificate should be imported with the +USECMNG AT command.
  - The client certificate that should be imported with the +USECMNG AT command.
  - The client private key that should be imported with the +USECMNG AT command.
  - The server certificate that should be imported with the +USECMNG AT command.

- **Expected server hostname, when using certificate validation level 2 or 3.**
- **Password for the client private key, if it is password protected.**
- **Pre-shared key used for connection. Defines a pre-shared key and key-name (PSK), when a TLS_PSK_* cipher suite is used.**
- **SNI (Server Name Indication).** SNI is a feature of SSL/TLS which uses an additional SSL/TLS extension header to specify the server name to which the client is connecting to. The extension was introduced to support the certificate handling used with virtual hosting provided by the various SSL/TLS enabled servers mostly in cloud based infrastructures. With the SNI a server has the opportunity to present a different server certificate (or/and whole SSL/TLS configuration) based on the host indicated by the SNI extension. When SNI is not used the modules might receive a non host specific SSL/TLS configuration (version/cipher suites/certificate) when used with virtual hosts.
- **(D)TLS session resumption.** The session resumption feature allows to reuse the secure session data in order to reestablish a SSL/(D)TLS secure session. Since the secure session data are available, the full SSL/(D)TLS handshake is not performed during the session resumption. Once the session resumption feature is enabled, the session resumption type and the secure session data (negotiated during the SSL/(D)TLS handshake) are displayed via +UUSECPRF URC message. The session resumption feature configuration and secure session data are not stored in the NVM, hence the session resumption may be performed until power cycle. Once the session data related to the session resumption via session ticket (<sess_type>=1 or <sess_type>=11) or via the session resumption via PSK-based session ticket (<sess_type>=3 or <sess_type>=13) are properly retrieved from the server, they are directly configured in the USECPRF profile and a +UUSECPRF URC message reporting the session resumption status is issued. Conversely, once the session data related to the session resumption via session ID (<sess_type>=0 or <sess_type>=10) are properly retrieved from the server, an +UUSECPRF URC message reporting the session resumption type and an +UUSECPRF URC message reporting the session resumption data are issued, furthermore the session resumption data are not stored in the USECPRF profile.
- **ZTP-provided credentials.** The credentials to establish the secure connection will be provided by Zero Touch Provisioning (ZTP). In the specific case the credentials provided by the ZTP will be the CA certificate, or/and the client certificates and client private key. The CA certificate, and eventually the client certificate, are sent to the server during the handshake. The CA certificate and the client certificate are concatenated in a certificate chain.

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

☞ To set all the parameters in security profile, a set command for each <op_code> needs to be issued (e.g. certificate validation level, minimum SSL/TLS/DTLS version, ...).

☞ To reset (set to factory-programmed value) all the parameters of a specific security profile, issue the AT +USECPRF=<profile_id> command.

25.3.3.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+USECPRF=<profile_id>[,<op_code>[,<param_val1>[,<param_val2>[,<param_val3>]]]]	OK	AT+USECPRF=0,0,0 OK
Read	AT+USECPRF=<profile_id>,<op_code>	+USECPRF: <profile_id>,<op_code>,<param_val1> OK	AT+USECPRF=0,0 +USECPRF: 0,0,0 OK
URC		+UUSECPRF: <profile_id>,<op_code>[,<param_val1>[,<param_val2>[,<param_val3>]]] OK	+UUSECPRF: 0,13,1,0 OK
Legacy cipher suite selection			
Set	AT+USECPRF=<profile_id>,2,<legacy_cs>	OK	AT+USECPRF=0,2,2 OK
Cipher suite selection using IANA enumeration			
Set	AT+USECPRF=<profile_id>,2,99,<iana_b1>,<iana_b2>	OK	AT+USECPRF=0,2,99,"C0","2B"

Type	Syntax	Response	Example
			OK
Read	AT+USECPRF=<profile_id>,2	+USECPRF: <profile_id>,2,99,<iana_b1>,<iana_b2> OK	AT+USECPRF=0,2 +USECPRF: 0,2,99,"C0","2B" OK
Add/remove of IANA cipher suite to the configured cipher suites list			
Set	AT+USECPRF=<profile_id>,2,100,<iana_b1>,<iana_b2>,<operation>	OK	AT+USECPRF=0,2,100,"C0","2A",0 OK
Add an IANA cipher suite to the configured cipher suites list			
Set	AT+USECPRF=<profile_id>,2,100,<iana_b1>,<iana_b2>,0	OK	AT+USECPRF=0,2,100,"C0","2A",0 OK
Remove an IANA cipher suite from the configured cipher suites list			
Set	AT+USECPRF=<profile_id>,2,100,<iana_b1>,<iana_b2>,1	OK	AT+USECPRF=0,2,100,"C0","2B",1 OK
Read the list of configured cipher suites			
Read	AT+USECPRF=<profile_id>,2	+USECPRF: <profile_id>,2,100,<list of configured cipher suites separated by ";"> OK	AT+USECPRF=0,2 +USECPRF: 0,2,100,"C02A;C02C" OK
Pre-shared key configuration			
Set	AT+USECPRF=<profile_id>,8,<preshared_key>[,<string_type>]	OK	AT+USECPRF=0,8,"0sFpZ0AZqE0N6Ti9s0qt40ZP5Eqx" OK
Pre-shared key identity configuration			
Set	AT+USECPRF=<profile_id>,9,<preshared_key_id>[,<string_type>]	OK	AT+USECPRF=0,9,"0ceEZ0AZqP0K60i9o04xz0ZP8zyu0Eqx" OK
Server certificate pinning			
Set	AT+USECPRF=<profile_id>,12,<server_certificate>,<pinning_level>	OK	AT+USECPRF=0,12,"my_srv_cert",0 OK
(D)TLS session resumption generic syntax			
Set	AT+USECPRF=<profile_id>,13,<sess_tag>,<param_val1>[,<param_val2>]	OK	AT+USECPRF=0,13,0,1 OK
Read	AT+USECPRF=<profile_id>,13,<sess_tag>	+USECPRF: <profile_id>,13,<sess_tag>,<param_val1>[,<param_val2>] OK	AT+USECPRF=0,13,0 +USECPRF: 0,13,0,1 OK
URC		+UUSECPRF: <profile_id>,13,<sess_tag>,<param_val1>[,<param_val2>] OK	+UUSECPRF: 0,13,1,0 OK
(D)TLS session resumption status			
Set	AT+USECPRF=<profile_id>,13,0,<sess_status>	OK	AT+USECPRF=0,13,0,1 OK
Read	AT+USECPRF=<profile_id>,13,0	+USECPRF: <profile_id>,13,0,<sess_status> OK	AT+USECPRF=0,13,0 +USECPRF: 0,13,0,1 OK
URC		+UUSECPRF: <profile_id>,13,0,<sess_status>	+UUSECPRF: 0,13,0,2
(D)TLS session resumption session type			
Set	AT+USECPRF=<profile_id>,13,1,<sess_type>	OK	AT+USECPRF=0,13,1,0 OK
Read	AT+USECPRF=<profile_id>,13,1	+USECPRF: <profile_id>,13,1,<sess_type> OK	AT+USECPRF=0,13,1 +USECPRF: 0,13,1,0

Type	Syntax	Response	Example
			OK
URC		+UUSECPRF: <profile_id>,13,1,<sess_type>	+UUSECPRF: 0,13,1,0
(D)TLS session resumption session data having session ID as session resumption type			
Set	AT+USECPRF=<profile_id>,13,2,<session_id_b64>,<master_secret_b64>	OK	AT+USECPRF=0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo" OK
Read	AT+USECPRF=<profile_id>,13,2	+USECPRF: <profile_id>,13,2,<session_id_b64>,<master_secret_b64> OK	AT+USECPRF=0,13,2 +USECPRF: 0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo" OK
URC		+UUSECPRF: <profile_id>,13,2,<session_id_b64>,<master_secret_b64>	+UUSECPRF: 0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo"
(D)TLS session resumption session data having session ticket as session resumption type			
Set	AT+USECPRF=<profile_id>,13,3,<session_data_b64>,<session_data_b64_size>	OK	AT+USECPRF=0,13,3,"MIHOAgECAgMAzKgEMDZV [...] NuPf3pFw4tJjU2gjKg2ipCBW0rTrfTyQ==",332 OK
Read	AT+USECPRF=<profile_id>,13,3	+USECPRF: <profile_id>,13,3,<session_data_b64>,<session_data_b64_size> OK	AT+USECPRF=0,13,3 +USECPRF: 0,13,3,"MIHOAgECAgMAzKgEMDZV [...] NuPf3pFw4tJjU2gjKg2ipCBW0rTrfTyQ==",332 OK
(D)TLS session resumption session data having PSK-based session ticket as session resumption type			
Set	AT+USECPRF=<profile_id>,13,5,<session_data_b64_size> > <session_data_b64>	OK	AT+USECPRF=0,13,5,2320 > NjQwM0IwMDEzMDgyMDFB0QzAyMDEwMTAyMDEwMDAy0MDEwMTAyMDIxQzIwMDIw [...] MDAwMDAwMDAwMDAwMDAw0MDAwMDAwMDAwMDAwMDAw0MDAwMDAwMDAyMDIxMzAy OK
Read	AT+USECPRF=<profile_id>,13,5	+USECPRF: <profile_id>,13,5,<session_data_b64>,<session_data_b64_size> OK	AT+USECPRF=0,13,5 +USECPRF: 0,13,5,"Nj0QwM0IwMDEzMDgyMDFBQz0AyMDEwMTAyMDEwMDAyMD [...] AwMDAwMDAwMDAwMDAwMD0AwMDAwMDAwMDAwMDAwMD0AwMDAyMDIxMzAy",2320

Type	Syntax	Response	Example
			OK
(D)TLS session resumption session data having encrypted session ID with local encryption as session resumption type			
Set	AT+USECPRF=<profile_id>,13,12,<enc_session_data_b64>,<enc_session_data_b64_size>	OK	AT+USECPRF=0,13,12,"AAECAwQFBgcICQoLDA0ODxAREhMUFRYXGBkaGxwdHh/Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0in6aGVISJGBWCAAKJo6Qw5Q+ugXaRZFquG0O69WeHnPRBkcwY2SN4bwnDbyR+709i0pt2nlaYMSCL77MAA=",156 OK
Read	AT+USECPRF=<profile_id>,13,12	+USECPRF: <profile_id>,13,12,<enc_session_data_b64>,<enc_session_data_b64_size> OK	AT+USECPRF=0,13,12 +USECPRF: 0,13,12,"AAECAwQFBgcICQoLDA0ODxAREhMUFRYXGBkaGxwdHh/Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0in6aGVISJGBWCAAKJo6Qw5Q+ugXaRZFquG0O69WeHnPRBkcwY2SN4bwnDbyR+709i0pt2nlaYMSCL77MAA=",156 OK
URC		+UUSECPRF: <profile_id>,13,12,<enc_session_data_b64>,<enc_session_data_b64_size>	+UUSECPRF: 0,13,12,"AAECAwQFBgcICQoLDA0ODxAREhMUFRYXGBkaGxwdHh/Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0in6aGVISJGBWCAAKJo6Qw5Q+ugXaRZFquG0O69WeHnPRBkcwY2SN4bwnDbyR+709i0pt2nlaYMSCL77MAA=",156
(D)TLS session resumption session data having encrypted session ticket with local encryption as session resumption type			
Set	AT+USECPRF=<profile_id>,13,13,<enc_session_data_b64>,<enc_session_data_b64_size>	OK	AT+USECPRF=0,13,13,"MIHOAgECAgMAzKwsa64L [...] dQE2VcxYvD0VcrR2jKg2ipCBW0rTrfTyQ==",364 OK
Read	AT+USECPRF=<profile_id>,13,13	+USECPRF: <profile_id>,13,13,<enc_session_data_b64>,<enc_session_data_b64_size> OK	AT+USECPRF=0,13,13 +USECPRF: 0,13,13,"MIHOAgECAgMAzKwsa64L [...] QE2VcxYvD0VcrR2jKg2ipCBW0rTrfTyQ==",364 OK
(D)TLS session resumption session data having PSK-based session ticket with local encryption as session resumption type			
Set	AT+USECPRF=<profile_id>,13,15,<enc_session_data_b64_size> > <enc_session_data_b64>	OK	AT+USECPRF=0,13,15,2408 > MDBGMDRCREYwODYwREYw0RDFDNjk1NUU5OUY5NjAw0MDA1QjlCN0QxMUYzM0Qy [...] Njg4MkEzQzJCRjA5NEFF0QzJFQUFFOTNBNjY2RkNE0QzM3RDJERTYyRDIxNQ== OK

Type	Syntax	Response	Example
Read	AT+USECPRF=<profile_id>,13,15	+USECPRF: <profile_id>,13,15,<enc_session_data_b64>,<enc_session_data_b64_size> OK	AT+USECPRF=0,13,15 +USECPRF: 0,13,15,"M0DBGMDRCREYwODYwREYwR0DFDNjk1NUU5OUY5NjAwM [...] EzQzJCRjA5NEFFQzJFQU0FFOTNBNjY2RkNEQzM3RD0JERTYyRDIxNQ==",2408 OK
ZTP-provided credentials			
Set	AT+USECPRF=<profile_id>,14,<ZTP_tag>	OK	AT+USECPRF=0,14,0 OK
Read	AT+USECPRF=<profile_id>,14	+USECPRF: <profile_id>,14,<ZTP_tag> OK	AT+USECPRF=0,14 +USECPRF: 0,14,2 OK
Test	AT+USECPRF=?	+USECPRF: (list of supported <profile_id>s),(list of supported <op_code>s) OK	+USECPRF: (0-4),(0-14) OK

25.3.3.3 Defined values

Parameter	Type	Description
<profile_id>	Number	USECMNG security profile identifier, in range 0-4; if it is not followed by other parameters the profile settings will be reset (set to factory-programmed value).
<op_code>	Number	• 0: certificate validation level; allowed values for <param_val1> (number): o 0: level 0 - No validation; the server certificate will not be checked or verified. The server in this case is not authenticated. o 1: level 1 - Root certificate validation without URL integrity check. The server certificate will be verified with a specific trusted certificates or with each of the imported trusted root certificates. o 2: level 2 - Root certificate validation with URL integrity check. Level 1 validation with an additional URL integrity check. o 3: level 3 - Root certificate validation with check of certificate validity date. Level 2 validation with an additional check of certificate validity date. The factory-programmed value for <param_val1> is: o LARA-R6 - 1 • 1: SSL/TLS version to use; allowed values for <param_val1>(number): o 0: any; the server can use any TLS version, which is supported by the module, for the connection. For more details on the supported TLS versions, see Notes. o 1: TLS v1.0; connection allowed only to TLS/SSL servers which support TLS v1.0 o 2: TLS v1.1; connection allowed only to TLS/SSL servers which support TLS v1.1 o 3: TLS v1.2; connection allowed only to TLS/SSL servers which support TLS v1.2 o 4: TLS v1.3; connection allowed only to TLS/SSL servers which support TLS v1.3 The factory-programmed value for <param_val1> is: o LARA-R6 - 3 • 2: cipher suite; allowed values for <legacy_cs> (number) legacy cipher suites are listed in Table 31. The factory-programmed value for <legacy_cs> is 0. For <legacy_cs>=0 a list of default cipher suites is proposed at the beginning of handshake process, and a cipher suite will be negotiated among the cipher suites proposed in the list. For <legacy_cs>=99 the cipher suite selection is performed with IANA enumeration, <iana_b1> and <iana_b2> are strings containing the 2 bytes that compose the IANA enumeration, see Table 31. For <legacy_cs>=100 the list of cipher suites is configured using IANA enumeration, <iana_b1> and <iana_b2> are strings containing the 2 bytes that compose the IANA enumeration, see Table 31. ☞ The cipher suite configuration read command response is related to the selected cipher suite type. In the case of <legacy_cs>=99 the configured <byte_1> and <byte_2> are reported in the information text response to the read command. In the case of <legacy_cs>=100 a ";" separated list with configured cipher suites is reported in the information text response to the read command.

Parameter	Type	Description
		For <legacy_cs>=100, when all added cipher suites are removed the cipher suite is automatically set to 0 (factory-programmed value). For the applicability of default cipher suite lists depending on the series module, see Cipher suites applicability. • 3: trusted root certificate internal name; o <param_val1> (string) is the internal name identifying a trusted root certificate; the maximum length is 200 characters. The factory-programmed value is an empty string. • 4: expected server hostname; o <param_val1> (string) is the hostname of the server, used when certificate validation level is set to Level 2; the maximum length is 256 characters. The factory-programmed value is an empty string. • 5: client certificate internal name; o <param_val1> (string) is the internal name identifying a client certificate to be sent to the server; the maximum length is 200 characters. The factory-programmed value is an empty string. • 6: client private key internal name; o <param_val1> (string) is the internal name identifying a private key to be used; the maximum length is 200 characters. The factory-programmed value is an empty string. • 7: client private key password; o <param_val1> (string) is the password for the client private key if it is password protected; the maximum length is 128 characters. The factory-programmed value is an empty string. • 8: pre-shared key; o <preshared_key> (string) is the pre-shared key used for connection; the factory-programmed value is an empty string. The accepted string type and length depends on the <string_type> value. o <string_type> (number) defines the type and the maximum length of the <preshared_key> string. Allowed values for <string_type>: - 0 (default value): <preshared_key> is an ASCII string and its maximum length is 64 characters - 1: <preshared_key> is an hexadecimal string and its maximum length is 128 characters • 9: pre-shared key identity; o <preshared_key_id> (string) is the pre-shared key identity used for connection; the factory-programmed value is an empty string. The accepted string type and length depends on the <string_type> value. o <string_type> (number) defines the type of the <preshared_key_id> string. Allowed values for <string_type>: - 0 (default value): <preshared_key_id> is an ASCII string and its maximum length is 128 characters - 1: <preshared_key_id> is an hexadecimal string and its maximum length is 256 characters • 10: SNI (Server Name Indication); o <param_val1> (string) value for the additional negotiation header SNI (Server Name Indication) used in SSL/TLS connection negotiation; the maximum length is 128 characters. The factory-programmed value is an empty string. • 11: PSK key and PSK key identity generated by RoT (Root of trust); allowed values for <param_val1> (number): o 0 (factory-programmed value): OFF - The PSK and PSK key ID are NOT generated by RoT o 1: ON - The PSK and PSK key ID are generated by RoT in the process of SSL/TLS connection negotiation • 12: server certificate pinning; o <server_certificate> (string) internal name identifying a certificate configured to be used for server certificate pinning; the maximum length is 200 characters. The factory-programmed value is an empty string. o <pinning_level> (number) defines the certificate pinning information level. Allowed values for <pinning_level>: - 0: pinning based on information comparison of received and configured certificate public key - 1: pinning based on binary comparison of received and configured certificate public key - 2: pinning based on binary comparison of received and configured certificate • 13: (D)TLS session resumption;

Parameter	Type	Description
		• 14: ZTP-provided credentials; o <ZTP_tag> (number) defines the ZTP-provided credentials level. Allowed values for <ZTP_tag>: - 0: no credentials are obtained via ZTP - 1: CA certificate and client certificate/key are obtained via ZTP. The CA certificate and client certificate will be concatenated together in a certificate chain and provided to the server - 2: client certificate/key are provided via ZTP. The client certificate will be provided to the server Allowed values: • LARA-R6 - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
<legacy_cs>	Number	Legacy cipher suite enumeration
<iana_b1>	String	First byte of IANA cipher suite enumeration
<iana_b2>	String	Second byte of IANA cipher suite enumeration
<operation>	Number	Operation to execute when using <legacy_cs>=100 configuration using a list of IANA enumeration. Allowed values for <operation>: • 0: add cipher suite defined by <iana_b1> and <iana_b2> to the list • 1: remove cipher suite defined by <iana_b1> and <iana_b2> from the list
<sess_tag>	Number	Configures the (D)TLS session resumption. Allowed values: • 0: session resumption status • 1: session resumption type • 2: session resumption data when the session resumption type is session ID • 3: session resumption data when the session resumption type is session ticket. • 5: session resumption data when the session resumption type is PSK-based session ticket. TLS v1.3 must be enabled (+USECPRF: <profile_id>,1,4). • 12: session resumption data when the session resumption type is encrypted session ID with local encryption • 13: session resumption data when the session resumption type is encrypted session ticket with local encryption • 15: session resumption data when the session resumption type is encrypted PSK-based session ticket with local encryption. TLS v1.3 must be enabled (+USECPRF: <profile_id>,1,4). Allowed values: • LARA-R6 - 0, 1, 2, 3, 5, 12, 13, 15
<sess_status>	Number	(D)TLS session resumption status. Allowed values: • 0 (factory-programmed value): disabled • 1: enabled • 2: session data configured Allowed values: • LARA-R6 - 0, 1, 2
<sess_type>	Number	(D)TLS session resumption type. Allowed values: • 0: session ID • 1: session ticket • 3: PSK-based session ticket. TLS v1.3 must be enabled (+USECPRF: <profile_id>,1,4) • 10: encrypted session ID with local encryption • 11: encrypted session ticket with local encryption • 13: encrypted PSK-based session ticket with local encryption. TLS v1.3 must be enabled (+USECPRF: <profile_id>,1,4) Allowed values: • LARA-R6 - 0, 1, 3, 10, 11, 13
<session_id_b64>	String	Base64 encoded session ID value. The maximum length is 44 characters.
<master_secret_b64>	String	Base64 encoded session master key. The maximum length is 64 characters.
<session_data_b64_size>	Number	Length of base64 encoded session data value. The maximum size is 8192.
<session_data_b64>	String	Base64 encoded session data value. The string length is determined by <session_data_b64_size>.

Parameter	Type	Description
<enc_session_data_b64>	String	Base64 encoded session data value encrypted with local encryption. The string length is determined by <enc_session_data_b64_size>
<enc_session_data_b64_size>	Number	Length of base64 encoded session data value encrypted with local encryption. The maximum size is 8192.
<param_val1>	String	Type and supported content depend on related <op_code> (details are given above)
<param_val2>	String	Type and supported content depend on related <op_code> (details are given above)
<param_val3>	String	Type and supported content depend on related <op_code> (details are given above)

25.3.3.4 Notes

LARA-R6

- If <op_code>=9 (pre-shared key identity) the <string_type> parameter is not supported. The <preshared_key_id> parameter is an ASCII string (maximum length 128 characters).
- The unique minimum SSL/TLS version (<op_code>=1) is not supported when used with UDP connection. With UDP connection only the DTLS version 1.2 is supported and is automatically configured.
- If <op_code>=11 (PSK key and PSK key identity generated by RoT) and the corresponding <param_val1>=1 (ON), the DTLS/TLS subsystem will use the SCL/RoT to generate the PSK secret, therefore the security suite features must be enabled (+USECMODE: 1). The connection time could be up to 150 s due to "security heartbeat" message operation. For more details on when this scenario occurs, see the +USECCONN AT command.
- If <op_code>=13 ((D)TLS session resumption), <sess_tag>=1 (session resumption type) and <sess_type>=10 (encrypted session ID with local encryption), the DTLS/TLS subsystem will use the SCL/RoT to encrypt/decrypt the session resumption data, therefore the security suite features must be enabled (+USECMODE: 1). The connection time could be up to 150 s due to "security heartbeat" message operation. For more details on when this scenario occurs, see the +USECCONN AT command.
- If <op_code>=13 ((D)TLS session resumption) and <sess_tag>=1 (session resumption type), <sess_type>=0 (session ID) and <sess_type>=10 (encrypted session ID with local encryption) are supported.

LARA-R6

- If <op_code>=1 (SSL/TLS version) and <param_val1>=0 (any) the server can use only TLS v1.2 or TLS v1.3 for the connection.
- If <op_code>=13 ((D)TLS session resumption), <sess_tag>=1 (session resumption type) and <sess_type>=11 (encrypted session ticket with local encryption), the DTLS/TLS subsystem will use the SCL/RoT to encrypt/decrypt the session resumption data, therefore the security suite features must be enabled (+USECMODE: 1). The connection time could be up to 150 s due to "security heartbeat" message operation. For more details on when this scenario occurs, see the +USECCONN AT command.
- If <op_code>=13 ((D)TLS session resumption), <sess_tag>=1 (session resumption type), and <sess_type>=13 (encrypted PSK-based session ticket with local encryption), the DTLS/TLS subsystem will use the SCL/RoT to encrypt/decrypt the session resumption data, therefore the security suite features must be enabled (+USECMODE: 1). The connection time could be up to 150 s due to "security heartbeat" message operation. For more details on when this scenario occurs, see the +USECCONN AT command.

25.3.3.5 List of the supported cipher suites

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
0x0000	TLS_NULL_WITH_NULL_NULL		"00"	"00"
0x000A	TLS_RSA_WITH_3DES_EDE_CBC_SHA	5	"00"	"0A"
0x0013	TLS_DHE_DSS_WITH_3DES_EDE_CBC_SHA		"00"	"13"
0x0015	TLS_DHE_RSA_WITH_DES_CBC_SHA		"00"	"15"
0x0016	TLS_DHE_RSA_WITH_3DES_EDE_CBC_SHA		"00"	"16"
0x001A	TLS_DH_anon_WITH_DES_CBC_SHA		"00"	"1A"
0x001B	TLS_DH_anon_WITH_3DES_EDE_CBC_SHA		"00"	"1B"
0x002F	TLS_RSA_WITH_AES_128_CBC_SHA	1	"00"	"2F"
0x0032	TLS_DHE_DSS_WITH_AES_128_CBC_SHA		"00"	"32"
0x0033	TLS_DHE_RSA_WITH_AES_128_CBC_SHA		"00"	"33"

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
0x0034	TLS_DH_anon_WITH_AES_128_CBC_SHA		"00"	"34"
0x0035	TLS_RSA_WITH_AES_256_CBC_SHA	3	"00"	"35"
0x0039	TLS_DHE_RSA_WITH_AES_256_CBC_SHA		"00"	"39"
0x003A	TLS_DH_anon_WITH_AES_256_CBC_SHA		"00"	"3A"
0x003C	TLS_RSA_WITH_AES_128_CBC_SHA256	2	"00"	"3C"
0x003D	TLS_RSA_WITH_AES_256_CBC_SHA256	4	"00"	"3D"
0x0040	TLS_DHE_DSS_WITH_AES_128_CBC_SHA256		"00"	"40"
0x0041	TLS_RSA_WITH_CAMELLIA_128_CBC_SHA		"00"	"41"
0x0045	TLS_DHE_RSA_WITH_CAMELLIA_128_CBC_SHA		"00"	"45"
0x0067	TLS_DHE_RSA_WITH_AES_128_CBC_SHA256		"00"	"67"
0x006B	TLS_DHE_RSA_WITH_AES_256_CBC_SHA256		"00"	"6B"
0x006C	TLS_DH_anon_WITH_AES_128_CBC_SHA256		"00"	"6C"
0x006D	TLS_DH_anon_WITH_AES_256_CBC_SHA256		"00"	"6D"
0x0084	TLS_RSA_WITH_CAMELLIA_256_CBC_SHA		"00"	"84"
0x0088	TLS_DHE_RSA_WITH_CAMELLIA_256_CBC_SHA		"00"	"88"
0x008A	TLS_PSK_WITH_RC4_128_SHA		"00"	"8A"
0x008B	TLS_PSK_WITH_3DES_EDE_CBC_SHA	8	"00"	"8B"
0x008C	TLS_PSK_WITH_AES_128_CBC_SHA	6	"00"	"8C"
0x008D	TLS_PSK_WITH_AES_256_CBC_SHA	7	"00"	"8D"
0x008E	TLS_DHE_PSK_WITH_RC4_128_SHA		"00"	"8E"
0x008F	TLS_DHE_PSK_WITH_3DES_EDE_CBC_SHA		"00"	"8F"
0x0090	TLS_DHE_PSK_WITH_AES_128_CBC_SHA		"00"	"90"
0x0091	TLS_DHE_PSK_WITH_AES_256_CBC_SHA		"00"	"91"
0x0092	TLS_RSA_PSK_WITH_RC4_128_SHA		"00"	"92"
0x0093	TLS_RSA_PSK_WITH_3DES_EDE_CBC_SHA	11	"00"	"93"
0x0094	TLS_RSA_PSK_WITH_AES_128_CBC_SHA	9	"00"	"94"
0x0095	TLS_RSA_PSK_WITH_AES_256_CBC_SHA	10	"00"	"95"
0x009C	TLS_RSA_WITH_AES_128_GCM_SHA256		"00"	"9C"
0x009D	TLS_RSA_WITH_AES_256_GCM_SHA384		"00"	"9D"
0x009E	TLS_DHE_RSA_WITH_AES_128_GCM_SHA256		"00"	"9E"
0x009F	TLS_DHE_RSA_WITH_AES_256_GCM_SHA384		"00"	"9F"
0x00A8	TLS_PSK_WITH_AES_128_GCM_SHA256	16	"00"	"A8"
0x00A9	TLS_PSK_WITH_AES_256_GCM_SHA384	17	"00"	"A9"
0x00AA	TLS_DHE_PSK_WITH_AES_128_GCM_SHA256		"00"	"AA"
0x00AB	TLS_DHE_PSK_WITH_AES_256_GCM_SHA384		"00"	"AB"
0x00AC	TLS_RSA_PSK_WITH_AES_128_GCM_SHA256	18	"00"	"AC"
0x00AD	TLS_RSA_PSK_WITH_AES_256_GCM_SHA384	19	"00"	"AD"
0x00AE	TLS_PSK_WITH_AES_128_CBC_SHA256	12	"00"	"AE"
0x00AF	TLS_PSK_WITH_AES_256_CBC_SHA384	13	"00"	"AF"
0x00B2	TLS_DHE_PSK_WITH_AES_128_CBC_SHA256		"00"	"B2"
0x00B3	TLS_DHE_PSK_WITH_AES_256_CBC_SHA384		"00"	"B3"
0x00B6	TLS_RSA_PSK_WITH_AES_128_CBC_SHA256	14	"00"	"B6"
0x00B7	TLS_RSA_PSK_WITH_AES_256_CBC_SHA384	15	"00"	"B7"
0x00BA	TLS_RSA_WITH_CAMELLIA_128_CBC_SHA256		"00"	"BA"
0x00BE	TLS_DHE_RSA_WITH_CAMELLIA_128_CBC_SHA256		"00"	"BE"
0x00C0	TLS_RSA_WITH_CAMELLIA_256_CBC_SHA256		"00"	"C0"
0x00C4	TLS_DHE_RSA_WITH_CAMELLIA_256_CBC_SHA256		"00"	"C4"
0xC002	TLS_ECDH_ECDSA_WITH_RC4_128_SHA		"C0"	"02"
0xC003	TLS_ECDH_ECDSA_WITH_3DES_EDE_CBC_SHA		"C0"	"03"
0xC004	TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA		"C0"	"04"
0xC005	TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA		"C0"	"05"
0xC007	TLS_ECDHE_ECDSA_WITH_RC4_128_SHA		"C0"	"07"

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
0xC008	TLS_ECDHE_ECDSA_WITH_3DES_EDE_CBC_SHA	20	"C0"	"08"
0xC009	TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA	21	"C0"	"09"
0xC00A	TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA	22	"C0"	"0A"
0xC00C	TLS_ECDH_RSA_WITH_RC4_128_SHA		"C0"	"0C"
0xC00D	TLS_ECDH_RSA_WITH_3DES_EDE_CBC_SHA		"C0"	"0D"
0xC00E	TLS_ECDH_RSA_WITH_AES_128_CBC_SHA		"C0"	"0E"
0xC00F	TLS_ECDH_RSA_WITH_AES_256_CBC_SHA		"C0"	"0F"
0xC010	TLS_ECDHE_RSA_WITH_NULL_SHA		"C0"	"10"
0xC011	TLS_ECDHE_RSA_WITH_RC4_128_SHA		"C0"	"11"
0xC012	TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA	23	"C0"	"12"
0xC013	TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA	24	"C0"	"13"
0xC014	TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA	25	"C0"	"14"
0xC017	TLS_ECDH_anon_WITH_3DES_EDE_CBC_SHA		"C0"	"17"
0xC018	TLS_ECDH_anon_WITH_AES_128_CBC_SHA		"C0"	"18"
0xC019	TLS_ECDH_anon_WITH_AES_256_CBC_SHA		"C0"	"19"
0xC023	TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256	26	"C0"	"23"
0xC024	TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384	27	"C0"	"24"
0xC025	TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA256		"C0"	"25"
0xC026	TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA384		"C0"	"26"
0xC027	TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256	28	"C0"	"27"
0xC028	TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384	29	"C0"	"28"
0xC029	TLS_ECDH_RSA_WITH_AES_128_CBC_SHA256		"C0"	"29"
0xC02A	TLS_ECDH_RSA_WITH_AES_256_CBC_SHA384		"C0"	"2A"
0xC02B	TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256	30	"C0"	"2B"
0xC02C	TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384	31	"C0"	"2C"
0xC02D	TLS_ECDH_ECDSA_WITH_AES_128_GCM_SHA256		"C0"	"2D"
0xC02E	TLS_ECDH_ECDSA_WITH_AES_256_GCM_SHA384		"C0"	"2E"
0xC02F	TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256	32	"C0"	"2F"
0xC030	TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384	33	"C0"	"30"
0xC031	TLS_ECDH_RSA_WITH_AES_128_GCM_SHA256		"C0"	"31"
0xC032	TLS_ECDH_RSA_WITH_AES_256_GCM_SHA384		"C0"	"32"
0xC033	TLS_ECDHE_PSK_WITH_RC4_128_SHA		"C0"	"33"
0xC034	TLS_ECDHE_PSK_WITH_3DES_EDE_CBC_SHA		"C0"	"34"
0xC035	TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA		"C0"	"35"
0xC036	TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA		"C0"	"36"
0xC037	TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA256		"C0"	"37"
0xC038	TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA384		"C0"	"38"
0xC072	TLS_ECDHE_ECDSA_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"72"
0xC073	TLS_ECDHE_ECDSA_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"73"
0xC074	TLS_ECDH_ECDSA_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"74"
0xC075	TLS_ECDH_ECDSA_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"75"
0xC076	TLS_ECDHE_RSA_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"76"
0xC077	TLS_ECDHE_RSA_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"77"
0xC078	TLS_ECDH_RSA_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"78"
0xC079	TLS_ECDH_RSA_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"79"
0xC07A	TLS_RSA_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"7A"
0xC07B	TLS_RSA_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"7B"
0xC07C	TLS_DHE_RSA_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"7C"
0xC07D	TLS_DHE_RSA_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"7D"
0xC086	TLS_ECDHE_ECDSA_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"86"

Cipher suite IANA code	Cipher suite name	Legacy cipher suite configuration	IANA enumeration cipher suite configuration	
		<legacy_cs>	<iana_b1>	<iana_b2>
0xC087	TLS_ECDHE_ECDSA_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"87"
0xC088	TLS_ECDH_ECDSA_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"88"
0xC089	TLS_ECDH_ECDSA_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"89"
0xC08A	TLS_ECDHE_RSA_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"8A"
0xC08B	TLS_ECDHE_RSA_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"8B"
0xC08C	TLS_ECDH_RSA_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"8C"
0xC08D	TLS_ECDH_RSA_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"8D"
0xC08E	TLS_PSK_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"8E"
0xC08F	TLS_PSK_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"8F"
0xC090	TLS_DHE_PSK_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"90"
0xC091	TLS_DHE_PSK_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"91"
0xC092	TLS_RSA_PSK_WITH_CAMELLIA_128_GCM_SHA256		"C0"	"92"
0xC093	TLS_RSA_PSK_WITH_CAMELLIA_256_GCM_SHA384		"C0"	"93"
0xC094	TLS_PSK_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"94"
0xC095	TLS_PSK_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"95"
0xC096	TLS_DHE_PSK_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"96"
0xC097	TLS_DHE_PSK_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"97"
0xC098	TLS_RSA_PSK_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"98"
0xC099	TLS_RSA_PSK_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"99"
0xC09A	TLS_ECDHE_PSK_WITH_CAMELLIA_128_CBC_SHA256		"C0"	"9A"
0xC09B	TLS_ECDHE_PSK_WITH_CAMELLIA_256_CBC_SHA384		"C0"	"9B"
0xC09C	TLS_RSA_WITH_AES_128_CCM		"C0"	"9C"
0xC09D	TLS_RSA_WITH_AES_256_CCM		"C0"	"9D"
0xC09E	TLS_DHE_RSA_WITH_AES_128_CCM		"C0"	"9E"
0xC09F	TLS_DHE_RSA_WITH_AES_256_CCM		"C0"	"9F"
0xC0A0	TLS_RSA_WITH_AES_128_CCM_8		"C0"	"A0"
0xC0A1	TLS_RSA_WITH_AES_256_CCM_8		"C0"	"A1"
0xC0A2	TLS_DHE_RSA_WITH_AES_128_CCM_8		"C0"	"A2"
0xC0A3	TLS_DHE_RSA_WITH_AES_256_CCM_8		"C0"	"A3"
0xC0A4	TLS_PSK_WITH_AES_128_CCM		"C0"	"A4"
0xC0A5	TLS_PSK_WITH_AES_256_CCM		"C0"	"A5"
0xC0A6	TLS_DHE_PSK_WITH_AES_128_CCM		"C0"	"A6"
0xC0A7	TLS_DHE_PSK_WITH_AES_256_CCM		"C0"	"A7"
0xC0A8	TLS_PSK_WITH_AES_128_CCM_8		"C0"	"A8"
0xC0A9	TLS_PSK_WITH_AES_256_CCM_8		"C0"	"A9"
0xC0AA	TLS_PSK_DHE_WITH_AES_128_CCM_8		"C0"	"AA"
0xC0AB	TLS_PSK_DHE_WITH_AES_256_CCM_8		"C0"	"AB"
0xC0AC	TLS_ECDHE_ECDSA_WITH_AES_128_CCM		"C0"	"AC"
0xC0AD	TLS_ECDHE_ECDSA_WITH_AES_256_CCM		"C0"	"AD"
0xC0AE	TLS_ECDHE_ECDSA_WITH_AES_128_CCM_8		"C0"	"AE"
0xC0AF	TLS_ECDHE_ECDSA_WITH_AES_256_CCM_8		"C0"	"AF"
0xCCA8	TLS_ECDHE_RSA_WITH_CHACHA20_POL1305_SHA256		"CC"	"A8"
0xCCA9	TLS_ECDHE_ECDSA_WITH_CHACHA20_POL1305_SHA256		"CC"	"A9"
0xCCAA	TLS_DHE_RSA_WITH_CHACHA20_POL1305_SHA256		"CC"	"AA"
0xCCAB	TLS_PSK_WITH_CHACHA20_POL1305_SHA256		"CC"	"AB"
0xCCAC	TLS_ECDHE_PSK_WITH_CHACHA20_POL1305_SHA256		"CC"	"AC"
0xCCAD	TLS_DHE_PSK_WITH_CHACHA20_POL1305_SHA256		"CC"	"AD"
0xCCAE	TLS_RSA_PSK_WITH_CHACHA20_POL1305_SHA256		"CC"	"AE"
0x1301	TLS_AES_128_GCM_SHA256		"13"	"01"
0x1302	TLS_AES_256_GCM_SHA384		"13"	"02"
0x1303	TLS_CHACHA20_POLY1305_SHA256		"13"	"03"

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

Table 31: Supported cipher suite

25.3.4 AT+USECMNG command example

25.3.5 Notes

Due to significant memory fingerprint of an SSL/TLS connection, the number of concurrent SSL/TLS connections is limited. The USECMNG and the underlying SSL/TLS infrastructure allows 4 concurrent SSL/TLS connections (i.e. 4 HTTPS requests or 2 HTTPS and 2 FTPS request).

25.3.6 Pre-Shared Key (PSK) generation +USECPSK

+USECPSK						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 30 s	+CME Error

25.3.6.1 Description

Generate a PSK identity and key.

25.3.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+USECPSK=<psk_size>	+USECPSK: <psk_id>,<psk> OK	AT+USECPSK=16 +USECPSK: "010203040A0B0C0D0E0F10111213","01020304050607080 9000A0B0C0D0E0F" OK
Test	AT+USECPSK=?	+USECPSK: (list of supported <psk_size>s) OK	+USECPSK: (16,32) OK

25.3.6.3 Defined values

Parameter	Type	Description
<psk_size>	Number	Size requested for the <psk> parameter expressed in bytes. The allowed values are 16 and 32.
<psk_id>	String	PSK key identity in hexadecimal format. The maximum size is 32 hex (64 bytes). For more details, see the +USECPRF (<op_code>=9) AT command.
<psk>	String	PSK key in hexadecimal format. For more details, see the +USECPRF (<op_code>=8) AT command.

25.3.7 Local encryption from AT interface +USECDATAENC

+USECDATAENC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 30 s	+CME Error

25.3.7.1 Description

Executes the local encryption of the plain data provided by the AT interface. The <payload_length> parameter defines the data length which will be provided via the AT interface and is limited to 8192 bytes. The stream of bytes can be entered after the '>' prompt has been provided to the user. The data transfer is terminated

exactly when <payload_length> bytes have been sent. Once the specified number of bytes have been sent, and the encryption is finished, the AT interface is used to output the encrypted data.

If the <filename> parameter is given then the encrypted data will be written to the file in the file system. If the file already exists the existing file will be overwritten. If the data transfer over the AT interface is stopped or paused for some reason, the interface waits 20 s before aborting the data encryption.

☞ A total of a hundred local encryption/decryption sessions are granted for free as trial period, unless the module has already successfully registered with the security server. If the hundred sessions are used and the module is not registered with the security server, an error result code is returned when local encryption or decryption are used.

25.3.7.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+USECDATAENC=<payload_length>[,<filename>] > <unencrypted_data>	< [+USECDATAENC: <enc_data_length>,<encrypted_data>] OK	AT+USECDATAENC=512 > 512 bytes of data to be encrypted < +USECDATAENC: 512,"512 bytes of encrypted data" OK
AT interface syntax			
Set	AT+USECDATAENC=<payload_length> > <unencrypted_data>	< +USECDATAENC: <enc_data_length>,<encrypted_data> OK	AT+USECDATAENC=512 > 512 bytes of data to be encrypted < +USECDATAENC: 512,"512 bytes of encrypted data" OK
File system syntax			
Set	AT+USECDATAENC=<payload_length>,<filename> > <unencrypted_data>	< OK	AT+USECDATAENC=512,"encfile" > 512 bytes of data to be encrypted < OK
Test	AT+USECDATAENC=?	+USECDATAENC: (list of supported <payload_length>s) OK	+USECDATAENC: (1-8192) OK

25.3.7.3 Defined values

Parameter	Type	Description
<payload_length>	Number	Number of bytes to be sent.
<filename>	String	Filename where to store the encrypted data. See File system limits.
<unencrypted_data>	String	Stream of bytes.
<enc_data_length>	Number	Number of encrypted bytes returned.
<encrypted_data>	String	Stream of the encrypted data of <enc_data_length> bytes.

25.3.8 Local encryption from a file +USECFILEENC

+USECFILEENC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 30 s	+CME Error

25.3.8.1 Description

Executes the local encryption of the plain data stored in a file. The file size is limited to 8192 bytes. Once the file has been read and the encryption is finished the AT interface is used to output the encrypted data.

If the <out_file> parameter is given then the encrypted data will be written to the file in the file system. If the file already exists the existing file will be overwritten.

☞ A total of a hundred local encryption/decryption sessions are granted for free as trial period, unless the module has already successfully registered with the security server. If the hundred sessions are used and the module is not registered with the security server, an error result code is returned when local encryption or decryption are used.

25.3.8.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+USECFILEENC=<filename>[, <out_file>]	[+USECFILEENC: <enc_data_ length>,<encrypted_data>] OK	AT+USECFILEENC="file_to_ encrypt" +USECFILEENC: 512,"512 bytes of encrypted data" OK
AT interface syntax			
Set	AT+USECFILEENC=<filename>	+USECFILEENC: <enc_data_ length>,<encrypted_data> OK	AT+USECFILEENC="file_to_ encrypt" +USECFILEEC: 512,"512 bytes of encrypted data" OK
File system syntax			
Set	AT+USECFILEENC=<filename>, <out_file>	OK	AT+USECFILEENC="file_to_ encrypt","file_to_store_data" OK

25.3.8.3 Defined values

Parameter	Type	Description
<filename>	String	Filename of the file containing the plain data.
<out_file>	String	Filename where to store the encrypted data. For more details on file system limitations, see File system limits.
<enc_data_length>	Number	Number of encrypted bytes returned.
<encrypted_data>	String	Stream of the encrypted data of <enc_data_length> bytes.

25.3.9 Local decryption from AT interface +USECDATADEC

+USECDATADEC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 30 s	+CME Error

25.3.9.1 Description

Executes the local decryption of the encrypted data provided by the AT interface. The <payload_length> parameter defines the data length which will be provided via the AT interface and is limited to 8224 bytes. The stream of bytes can be entered after the '>' prompt has been provided to the user. The data transfer is terminated exactly when <payload_length> bytes have been sent. Once the specified number of bytes have been sent, and the decryption is finished, the AT interface is used to output the decrypted data.

If the <filename> parameter is given then the decrypted data will be written to the file in the file system. If the file already exists the existing file will be overwritten. If the data transfer over the AT interface is stopped or paused for some reason, the interface waits 20 s before aborting the data encryption.

A total of a hundred local encryption/decryption sessions are granted for free as trial period, unless the module has already successfully registered with the security server. If the hundred sessions are used and the module is not registered with the security server, an error result code is returned when local encryption or decryption are used.

25.3.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+USECDATADEC=<payload_length>[,<filename>] > <encrypted_data>	< [+USECDATADEC: <dec_data_length>,<decrypted_data>] OK	AT+USECDATADEC=512 > 512 bytes of data to be decrypted < +USECDATADEC: 512,"512 bytes of decrypted data" OK
AT interface syntax			
Set	AT+USECDATADEC=<payload_length> > <encrypted_data>	< +USECDATADEC: <dec_data_length>,<decrypted_data> OK	AT+USECDATADEC=512 > 512 bytes of data to be decrypted < +USECDATADEC: 512,"512 bytes of decrypted data" OK
File system syntax			
Set	AT+USECDATADEC=<payload_length>,<filename> > <encrypted_data>	< OK	AT+USECDATADEC=512,"decfile" > 512 bytes of data to be decrypted < OK
Test	AT+USECDATADEC=?	+USECDATADEC: (list of supported <payload_length>s) OK	+USECDATADEC: (1-8224) OK

25.3.9.3 Defined values

Parameter	Type	Description
<payload_length>	Number	Number of bytes to be decrypted.
<filename>	String	Filename where to store the decrypted data. For more details on file system limitations, see File system limits.
<encrypted_data>	String	Stream of bytes to be decrypted.
<dec_data_length>	Number	Number of decrypted bytes returned.
<decrypted_data>	String	Stream of the decrypted data of <dec_data_length> bytes.

25.3.10 Local decryption from a file +USECFILEDEC

+USECFILEDEC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 30 s	+CME Error

25.3.10.1 Description

Executes the local decryption of the encrypted data stored in a file. The file size is limited to 8192 bytes. Once the file has been read and the decryption is finished the AT interface is used to output the decrypted data.

If the <out_file> parameter is given then the decrypted data will be written to the file in the file system. If the file already exists the existing file will be overwritten.

☞ A total of a hundred local encryption/decryption sessions are granted for free as trial period, unless the module has already successfully registered with the security server. If the hundred sessions are used and the module is not registered with the security server, an error result code is returned when the local encryption or decryption are used.

25.3.10.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+USECFILEDEC=<filename>[,<out_file>]	[+USECFILEDEC: <dec_data_length>,<decrypted_data>] OK	AT+USECFILEDEC="file_to_decrypt" +USECFILEDEC: 512,"512 bytes of decrypted data" OK
AT interface syntax			
Set	AT+USECFILEDEC=<filename>	+USECFILEDEC: <dec_data_length>,<decrypted_data> OK	AT+USECFILEDEC="file_to_decrypt" +USECFILEDEC: 512,"512 bytes of decrypted data" OK
File system syntax			
Set	AT+USECFILEDEC=<filename>,<out_file>	OK	AT+USECFILEDEC="file_to_decrypt","file_to_store_data" OK

25.3.10.3 Defined values

Parameter	Type	Description
<filename>	String	Filename of the file containing the encrypted data.
<out_file>	String	Filename where to store the decrypted data. For more details on file system limitations, see File system limits.
<dec_data_length>	Number	Number of decrypted bytes returned.
<decrypted_data>	String	Stream of the decrypted data of <dec_data_length> bytes.

25.3.11 End-to-end encryption from AT interface +USECE2EDATAENC

+USECE2EDATAENC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 30 s	+CME Error

25.3.11.1 Description

Executes an end-to-end encryption of the plain data provided by the AT interface. The <payload_length> parameter defines the data length which will be provided via the AT interface and is limited to 8192 bytes. The stream of bytes can be entered after the '>' prompt has been provided to the user. The data transfer is terminated exactly when <payload_length> bytes have been sent. Once the specified number of bytes have been sent, and the encryption is finished, the AT interface is used to output the encrypted data.

If the <filename> parameter is given then the encrypted data is written to the indicated file system file. If the file already exists the existing file will be overwritten.

If the data transfer over the AT interface is stopped or paused for some reasons, the interface waits 20 s before aborting the data encryption.

25.3.11.2 Syntax

Type	Syntax	Response	Example
Generic syntax			

Type	Syntax	Response	Example
Set	AT+USECE2EDATAENC=<payload_length>[,<filename>] > <unencrypted_data>	< [+USECE2EDATAENC: <enc_data_length>,<encrypted_data>] OK	AT+USECE2EDATAENC=512 > 512 bytes of data to be encrypted < +USECE2EDATAENC: 544,"544 bytes of encrypted data" OK
AT interface syntax			
Set	AT+USECE2EDATAENC=<payload_length> > <unencrypted_data>	< +USECE2EDATAENC: <enc_data_length>,<encrypted_data> OK	AT+USECE2EDATAENC=512 > 512 bytes of data to be encrypted < +USECE2EDATAENC: 544,"544 bytes of encrypted data" OK
File system syntax			
Set	AT+USECE2EDATAENC=<payload_length>,<filename> > <unencrypted_data>	< OK	AT+USECE2EDATAENC=512, "encfile" > 512 bytes of data to be encrypted < OK
Test	AT+USECE2EDATAENC=?	+USECE2EDATAENC: (list of supported <payload_length>s) OK	+USECE2EDATAENC: (1-8192) OK

25.3.11.3 Defined values

Parameter	Type	Description
<payload_length>	Number	Number of bytes to be encrypted.
<filename>	String	Filename where to store the encrypted data. For more details on file system limitations, see File system limits.
<unencrypted_data>	String	Stream of bytes to be encrypted.
<enc_data_length>	Number	Number of encrypted bytes returned.
<encrypted_data>	String	String of the end-to-end encrypted data of <enc_data_length> bytes.

25.3.12 End-to-end encryption from a file +USECE2EFILEENC

+USECE2EFILEENC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	< 30 s	+CME Error

25.3.12.1 Description

Executes an end-to-end encryption of the plain data stored in a file. The file size is limited to 8192 bytes. Once the file has been read and the encryption is finished the AT interface is used to output the encrypted data.

If the <out_file> parameter is given then the encrypted data is written to the indicated file system file. If the file already exists the existing file will be overwritten.

25.3.12.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+USECE2EFILEENC=<filename>[,<out_file>]	[+USECE2EFILEENC: <enc_data_length>,<encrypted_data>]	AT+USECE2EFILEENC="file_to_encrypt"

Type	Syntax	Response	Example
		OK	+USECE2EFILEENC: 512,"512 bytes of encrypted data" OK
AT interface syntax			
Set	AT+USECE2EFILEENC=<filename>	+USECE2EFILEENC: <enc_data_length>,<encrypted_data> OK	AT+USECE2EFILEENC="file_to_encrypt" +USECE2EFILEEC: 512,"512 bytes of encrypted data" OK
File system syntax			
Set	AT+USECE2EFILEENC=<filename>,<out_file>	OK	AT+USECE2EFILEENC="file_to_encrypt","file_to_store_data" OK

25.3.12.3 Defined values

Parameter	Type	Description
<filename>	String	Filename of the file containing the plain data.
<out_file>	String	Filename where to store the encrypted data. For more details on file system limitations, see File system limits.
<enc_data_length>	Number	Number of encrypted bytes returned.
<encrypted_data>	String	String of the end-to-end encrypted data of <enc_data_length> bytes.

25.3.13 Cipher suite applicability

25.3.13.1 Cipher suite applicability accordingly to the modules

This section provides a list of cipher suites that are available on the series modules. The allowed cipher suites can be selected when <op_code>=2 (cipher suite) with:

- the <legacy_cs> parameter
- the <legacy_cs>=99 specifying <iana_b1> and <iana_b2> parameters
- the <legacy_cs>=100 specifying <iana_b1> and <iana_b2> parameters

For proper <legacy_cs> value, see the +USECPRF AT command.

The cipher suites marked with (D) are the default cipher suites that are proposed to the server when <op_code>=2 (cipher suite) and <legacy_cs>=0. The secure connection will be established if the server supports at least one of the proposed cipher suites.

LARA-R6

The available cipher suites are presented in the following list:

- (0x000A) TLS_RSA_WITH_3DES_EDE_CBC_SHA
- (0x0013) TLS_DHE_DSS_WITH_3DES_EDE_CBC_SHA
- (0x0015) TLS_DHE_RSA_WITH_DES_CBC_SHA
- (0x0016) TLS_DHE_RSA_WITH_3DES_EDE_CBC_SHA
- (0x001A) TLS_DH_anon_WITH_DES_CBC_SHA
- (0x001B) TLS_DH_anon_WITH_3DES_EDE_CBC_SHA
- (0x002F) TLS_RSA_WITH_AES_128_CBC_SHA
- (0x0032) TLS_DHE_DSS_WITH_AES_128_CBC_SHA
- (0x0033) TLS_DHE_RSA_WITH_AES_128_CBC_SHA
- (0x0034) TLS_DH_anon_WITH_AES_128_CBC_SHA
- (0x0035) TLS_RSA_WITH_AES_256_CBC_SHA
- (0x0039) TLS_DHE_RSA_WITH_AES_256_CBC_SHA
- (0x003A) TLS_DH_anon_WITH_AES_256_CBC_SHA
- (0x003C) TLS_RSA_WITH_AES_128_CBC_SHA256
- (0x003D) TLS_RSA_WITH_AES_256_CBC_SHA256
- (0x0040) TLS_DHE_DSS_WITH_AES_128_CBC_SHA256 (D)
- (0x0067) TLS_DHE_RSA_WITH_AES_128_CBC_SHA256

- (0x006B) TLS_DHE_RSA_WITH_AES_256_CBC_SHA256
- (0x006C) TLS_DH_anon_WITH_AES_128_CBC_SHA256
- (0x006D) TLS_DH_anon_WITH_AES_256_CBC_SHA256
- (0x008B) TLS_PSK_WITH_3DES_EDE_CBC_SHA
- (0x008C) TLS_PSK_WITH_AES_128_CBC_SHA
- (0x008D) TLS_PSK_WITH_AES_256_CBC_SHA
- (0x008F) TLS_DHE_PSK_WITH_3DES_EDE_CBC_SHA
- (0x0090) TLS_DHE_PSK_WITH_AES_128_CBC_SHA
- (0x0091) TLS_DHE_PSK_WITH_AES_256_CBC_SHA
- (0x0093) TLS_RSA_PSK_WITH_3DES_EDE_CBC_SHA
- (0x0094) TLS_RSA_PSK_WITH_AES_128_CBC_SHA
- (0x0095) TLS_RSA_PSK_WITH_AES_256_CBC_SHA
- (0x009C) TLS_RSA_WITH_AES_128_GCM_SHA256 (D)
- (0x009D) TLS_RSA_WITH_AES_256_GCM_SHA384 (D)
- (0x009E) TLS_DHE_RSA_WITH_AES_128_GCM_SHA256 (D)
- (0x009F) TLS_DHE_RSA_WITH_AES_256_GCM_SHA384 (D)
- (0x00A8) TLS_PSK_WITH_AES_128_GCM_SHA256 (D)
- (0x00A9) TLS_PSK_WITH_AES_256_GCM_SHA384 (D)
- (0x00AA) TLS_DHE_PSK_WITH_AES_128_GCM_SHA256 (D)
- (0x00AB) TLS_DHE_PSK_WITH_AES_256_GCM_SHA384 (D)
- (0x00AC) TLS_RSA_PSK_WITH_AES_128_GCM_SHA256 (D)
- (0x00AD) TLS_RSA_PSK_WITH_AES_256_GCM_SHA384 (D)
- (0x00AE) TLS_PSK_WITH_AES_128_CBC_SHA256 (D)
- (0x00AF) TLS_PSK_WITH_AES_256_CBC_SHA384 (D)
- (0x00B2) TLS_DHE_PSK_WITH_AES_128_CBC_SHA256 (D)
- (0x00B3) TLS_DHE_PSK_WITH_AES_256_CBC_SHA384 (D)
- (0x00B6) TLS_RSA_PSK_WITH_AES_128_CBC_SHA256 (D)
- (0x00B7) TLS_RSA_PSK_WITH_AES_256_CBC_SHA384 (D)
- (0xC003) TLS_ECDH_ECDSA_WITH_3DES_EDE_CBC_SHA
- (0xC004) TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA
- (0xC005) TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA
- (0xC008) TLS_ECDHE_ECDSA_WITH_3DES_EDE_CBC_SHA
- (0xC009) TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA
- (0xC00A) TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA
- (0xC00D) TLS_ECDH_RSA_WITH_3DES_EDE_CBC_SHA
- (0xC00E) TLS_ECDH_RSA_WITH_AES_128_CBC_SHA
- (0xC00F) TLS_ECDH_RSA_WITH_AES_256_CBC_SHA
- (0xC012) TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA
- (0xC013) TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA
- (0xC014) TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA
- (0xC017) TLS_ECDH_anon_WITH_3DES_EDE_CBC_SHA
- (0xC018) TLS_ECDH_anon_WITH_AES_128_CBC_SHA
- (0xC019) TLS_ECDH_anon_WITH_AES_256_CBC_SHA
- (0xC023) TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 (D)
- (0xC024) TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384
- (0xC025) TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA256
- (0xC026) TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA384
- (0xC027) TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256
- (0xC028) TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384
- (0xC029) TLS_ECDH_RSA_WITH_AES_128_CBC_SHA256
- (0xC02A) TLS_ECDH_RSA_WITH_AES_256_CBC_SHA384
- (0xC02B) TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
- (0xC02C) TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384

- (0xC02D) TLS_ECDH_ECDSA_WITH_AES_128_GCM_SHA256
- (0xC02E) TLS_ECDH_ECDSA_WITH_AES_256_GCM_SHA384
- (0xC02F) TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
- (0xC030) TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
- (0xC031) TLS_ECDH_RSA_WITH_AES_128_GCM_SHA256
- (0xC032) TLS_ECDH_RSA_WITH_AES_256_GCM_SHA384
- (0xC034) TLS_ECDHE_PSK_WITH_3DES_EDE_CBC_SHA
- (0xC035) TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA
- (0xC036) TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA
- (0xC037) TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA256 (D)
- (0xC038) TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA384 (D)
- (0xC0A4) TLS_PSK_WITH_AES_128_CCM (D)
- (0xC0A5) TLS_PSK_WITH_AES_256_CCM (D)
- (0xC0A6) TLS_DHE_PSK_WITH_AES_128_CCM (D)
- (0xC0A7) TLS_DHE_PSK_WITH_AES_256_CCM (D)
- (0xC0A8) TLS_PSK_WITH_AES_128_CCM_8 (D)
- (0xC0A9) TLS_PSK_WITH_AES_256_CCM_8 (D)
- (0xC0AA) TLS_PSK_DHE_WITH_AES_128_CCM_8
- (0xC0AB) TLS_PSK_DHE_WITH_AES_256_CCM_8
- (0xC0AC) TLS_ECDHE_ECDSA_WITH_AES_128_CCM (D)
- (0xC0AD) TLS_ECDHE_ECDSA_WITH_AES_256_CCM (D)
- (0xC0AE) TLS_ECDHE_ECDSA_WITH_AES_128_CCM_8 (D)
- (0xC0AF) TLS_ECDHE_ECDSA_WITH_AES_256_CCM_8 (D)
- (0xCCA8) TLS_ECDHE_RSA_WITH_CHACHA20_POL1305_SHA256 (D)
- (0xCCA9) TLS_ECDHE_ECDSA_WITH_CHACHA20_POL1305_SHA256 (D)
- (0xCCAA) TLS_DHE_RSA_WITH_CHACHA20_POL1305_SHA256 (D)
- (0xCCAB) TLS_PSK_WITH_CHACHA20_POL1305_SHA256 (D)
- (0xCCAC) TLS_ECDHE_PSK_WITH_CHACHA20_POL1305_SHA256 (D)
- (0xCCAD) TLS_DHE_PSK_WITH_CHACHA20_POL1305_SHA256 (D)
- (0xCCAE) TLS_RSA_PSK_WITH_CHACHA20_POL1305_SHA256 (D)
- (0x1301) TLS_AES_128_GCM_SHA256 (D)
- (0x1302) TLS_AES_256_GCM_SHA384 (D)
- (0x1303) TLS_CHACHA20_POLY1305_SHA256 (D)
- (0x1304) TLS_AES_128_CCM_SHA256 (D)
- (0x1305) TLS_AES_128_CCM_8_SHA256 (D)

26 FTP

Proprietary u-blox AT commands. FTP AT commands set can be used for sending and receiving files over the available bearer, transparently retrieving and storing them in the file system. Standard file and directory management operations on the remote FTP server are as well possible. The FTP client requires an active connection to work. Some products require additional commands to provide connectivity to the application.

☞ LARA-R6
If not specified, the <cid> and the <preferred_protocol_type> parameters set by means of the +UDCONF=19 AT command are used.
See +CGACT AT command for activating a PDP context.

☞ LARA-R6001D
If not specified the default CID (<cid>=1) is used. If not specified and the protocol type is IPv4v6, then the preferred protocol type is IPv4.
See +CGACT AT command for activating a PDP context.

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.

26.1 FTP service configuration +UFTP

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

26.1.1 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.

26.1.2 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

Type	Syntax	Response	Example
Account			
Set	AT+UFTP=4[,<account>]	OK	AT+UFTP=4,"test" OK
Inactivity timeout			
Set	AT+UFTP=5,<timeout>[,[<linger_cmd>],[<linger_data>]]	OK	AT+UFTP=5,0,0,0 OK
FTP mode			
Set	AT+UFTP=6[,<FTP_mode>]	OK	AT+UFTP=6,1 OK
FTP server port			
Set	AT+UFTP=7[,<FTP_server_port>]	OK	AT+UFTP=7,30 OK
FTP control connection security			
Set	AT+UFTP=8[,<FTP_secure>[,<USECMNG_profile>]]	OK	AT+UFTP=8,1,2 OK
Timer trigger configuration for Direct Link			
Set	AT+UFTP=9,<timer_trigger>	OK	AT+UFTP=9,500 OK
Data length trigger configuration for Direct Link			
Set	AT+UFTP=10,<data_length_trigger>	OK	AT+UFTP=10,1024 OK
Character trigger configuration for Direct Link			
Set	AT+UFTP=11,<character_trigger>	OK	AT+UFTP=11,13 OK
FTP data connection security			
Set	AT+UFTP=12[,<FTP_secure>[,<USECMNG_profile>]]	OK	AT+UFTP=12,1,2 OK
FTP context id			
Set	AT+UFTP=20,<cid>[,<preferred_protocol_type>]	OK	AT+UFTP=20,2 OK
Read	AT+UFTP?	+UFTP: 0,<IP_address> +UFTP: 1,<server_name> +UFTP: 2,<username> +UFTP: 4,<account> +UFTP: 5,<timeout>,<linger_cmd>,<linger_data> +UFTP: 6,<FTP_mode> +UFTP: 7,<FTP_server_port> +UFTP: 8,<FTP_secure>[,<USECMNG_profile>] +UFTP: 9,<timer_trigger> +UFTP: 10,<data_length_trigger> +UFTP: 11,<character_trigger> +UFTP: 12,<FTP_secure>[,<USECMNG_profile>] +UFTP: 20,<cid>[,<preferred_protocol_type>] OK	+UFTP: 0,"216.239.59.147" +UFTP: 1,"" +UFTP: 2,"username" +UFTP: 4,"account" +UFTP: 5,0,0,0 +UFTP: 6,0 +UFTP: 7,21 +UFTP: 8,0 +UFTP: 9,500 +UFTP: 10,1024 +UFTP: 11,13 +UFTP: 12,0 +UFTP: 20,2 OK
Test	AT+UFTP=?	+UFTP: (list of supported <param_tag>s)	+UFTP: (0-12,20) OK

Type	Syntax	Response	Example
		OK	

26.1.3 Defined values

Parameter	Type	Description
<op_code>	String	FTP parameter: • 0: FTP server IP address • 1: FTP server name • 2: FTP username • 3: FTP password • 4: FTP additional user account • 5: FTP inactivity timeout period and linger time • 6: FTP mode • 7: remote FTP server listening port • 8: control connection security • 9: timer trigger • 10: data length trigger • 11: character trigger • 12: data connection security • 20: PDP context id Allowed values: • LARA-R6 - 0, 1, 2, 3, 4, 5, 6, 7, 8, 12, 20
<IP_address>	String	FTP server IP address. The default value is an empty string. For IP address format reference see the IP addressing.
<server_name>	String	FTP server name (e.g. "ftp.server.com"). The maximum length is 128 characters. The default value is an empty string.
<username>	String	User name (the maximum length is 30 characters) for the FTP login procedure. The default value is an empty string.
<password>	String	Password (the maximum length is 30 characters) for the FTP login procedure. The default value is an empty string.
<account>	String	Additional user account (if required) for the FTP login procedure. The maximum length is 30 characters. The default value is an empty string.
<timeout>	Number	Inactivity timeout period in seconds. The range goes from 0 to 86400 s; 0 means no timeout (the FTP session will not be terminated in the absence of incoming traffic). The default value is 30 s.
<linger_cmd>	Number	Linger time for command socket in seconds. The range goes from 0 to 120 s; 0 means linger time is not set. The default value is 60 s.
<linger_data>	Number	Linger time for data socket in seconds. The range goes from 0 to 120 s; 0 means linger time is not set. The default value is 60 s.
<FTP_mode>	Number	FTP mode: • 0 (default value): active • 1: passive
<FTP_server_port>	Number	Remote FTP server listening port; it must be a valid TCP port value. The range goes from 1 to 65535; the default value is 21.
<FTP_secure>	Number	Enables / disables the secure option of FTP client service: • 0 (default value): no SSL encryption • 1: enable SSL encryption of FTP (control connection or data connection). Only the explicit FTPS mode is supported.
<USECMNG_profile>	Number	USECMNG profile (number). Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see USECMNG section).
<timer_trigger>	Number	Enhanced direct link sending timer trigger (in milliseconds); valid range is 0 (factory-programmed value), 100-120000; 0 means trigger disabled.
<data_length_trigger>	Number	Enhanced direct link data length trigger in bytes, valid range is 0 (factory-programmed value), 3-2048; 0 means trigger disabled.
<character_trigger>	Number	Enhanced direct link character trigger, the value represents the ASCII code (in base 10) of the character to be used as character trigger. The allowed range is -1, 0-255, the factory-programmed value is -1; -1 means trigger disabled.

Parameter	Type	Description
<cid>	Number	Specifies the PDP context that will be used for the FTP data. For the parameter range see product <cid> number. For more details on the default value of the parameter (where supported), see FTP.
<preferred_protocol_type>	Number	In the case of a context id with IPv4v6 PDP type, this value specifies which IP protocol type will be used: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see FTP.
<param1>	Number / String	Type and supported content depend on related <op_code> (details are given above). If <param1> is not specified the value of the corresponding parameter <op_code> is reset to default value.
<param2>	Number / String	Type and supported content depend on related <op_code> (details are given above). If <param2> is not specified the value of the corresponding parameter <op_code> is reset to default value.

26.1.4 Notes

- The information text response to the read command does not display the password.
- The FTP server IP address and the FTP server name are mutually exclusive. If value for <op_code>=0 is specified by user, then value for <op_code>=1 is reset or vice versa.
- Some network operators do not allow incoming connections. Due to these limitations introduced by network operators it is possible to encounter problems using FTP active mode. If the FTP active mode fails to exchange files, try the passive mode to solve the problem.
- Some network operators do not allow FTPS. In this case the AT+UFTPC=1 command (FTP login) will return a failure response via +UUFTPCR URC after an SSL timeout of 30 s.

LARA-R6

- <timer_trigger>, <data_length_trigger> and <character_trigger> parameters are not supported.
- Enable the control connection security (<op_code>=8), before enabling the data connection security (<op_code>=12).

26.2 FTP command +UFTPC

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

26.2.1 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.

LARA-R6
If the SSL option is enabled and the network operator does not allow FTPS, the +UUFTPCR URC notifies the command failure after an SSL timeout of 30 s.

LARA-R6
The +UUFTPCD URC is displayed only on the AT terminal that issued the +UFTPC related command.

The timing before the +UUFTPCR URC is issued on the AT terminal also depends by the DNS resolution. For further details about the estimated response time related to the DNS resolution, see the +UDNSRN AT command.

26.2.2 Syntax

Type	Syntax	Response	Example
General syntax			

Type	Syntax	Response	Example
Set	AT+UFTPC=<op_code>[,<param1>[,<param2>[,<param3>]]]	OK	AT+UFTPC=4,"data.zip","data.zip" OK
FTP logout			
Set	AT+UFTPC=0	OK	AT+UFTPC=0 OK
FTP login			
Set	AT+UFTPC=1	OK	AT+UFTPC=1 OK
Delete the file from the FTP server			
Set	AT+UFTPC=2,<filename>	OK	AT+UFTPC=2,"mytest" OK
Rename a file of FTP server			
Set	AT+UFTPC=3,<filename>,<new_filename>	OK	AT+UFTPC=3,"old_name","final_name" OK
Retrieve the file from the FTP server			
Set	AT+UFTPC=4,<remote_filename>,<local_filename>[,<retrieving_mode>]	OK	AT+UFTPC=4,"data.zip","data.zip" OK
Store the file on the FTP server			
Set	AT+UFTPC=5,<local_filename>,<remote_filename>[,<number_of_byte>]	OK	AT+UFTPC=5,"data.zip","data.zip",30 OK
Retrieve a file from the FTP server using direct link mode			
Set	AT+UFTPC=6,<remote_filename>[,<number_of_byte>]	OK	AT+UFTPC=6,"data.zip",30 OK
Send a file to the FTP server using the direct link mode			
Set	AT+UFTPC=7,<remote_filename>[,<number_of_byte>]	OK	AT+UFTPC=7,"data.zip",30 OK
Change the working directory to the specified one			
Set	AT+UFTPC=8,<directory_name>	OK	AT+UFTPC=8,"data_folder" OK
Create a directory on the FTP host			
Set	AT+UFTPC=10,<directory_name>	OK	AT+UFTPC=10,"new_data_folder" OK
Remove the directory from the remote FTP server			
Set	AT+UFTPC=11,<directory_name>	OK	AT+UFTPC=11,"data_folder" OK
Information of a file or a directory			
Set	AT+UFTPC=13[,<file_directory_name>]	OK	AT+UFTPC=13,"data_folder" OK
List the filenames in a specified directory			
Set	AT+UFTPC=14[,<file_directory_name>]	OK	AT+UFTPC=14,"data.zip" OK
Retrieve the FOTA update file			
Set	AT+UFTPC=100,<remote_filename>[,<fw_download_status>]	OK	AT+UFTPC=100,"data.zip" OK
URC		+UUFTPCR: 100,<stored_byte> / <total_byte>	+UUFTPCR: 100,202752 / 1103692
Test	AT+UFTPC=?	+UFTPC: (list of supported <op_code>s) OK	+UFTPC: (0-5,8,10,11,13,14,100) OK

Type	Syntax	Response	Example
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

26.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	FTP command request. Allowed values: • 0: FTP logout; terminates the FTP session by performing a logout. • 1: FTP login; connects to the FTP server using the parameters of the current FTP profile (set via AT+UFTP command). • 2: deletes the file from the FTP server. • 3: renames the file. This AT command just sends requests to the FTP process. • 4: retrieves the file from the FTP server. • 5: stores the file on the FTP server. • 6: retrieves a file from the FTP server using direct link mode. This command handles the initial steps of the FTP protocol for retrieving a file; after that it will establish a transparent end-to-end communication with the data connection TCP socket via the serial interface. After the CONNECT result code, the file content will be directly sent to the serial interface. When the data transfer is completed, the module will automatically exit from direct link mode (no need to send +++ sequence). • 7: sends a file to the FTP server using the direct link mode. This command handles the initial steps of the FTP protocol for sending a file; after that it will establish a transparent end-to-end communication with the data connection TCP socket via the serial interface. After the CONNECT result code, the user can send the file content via the serial interface. Once finished, the user must wait at least 2 s before sending the +++ sequence to switch off the direct link mode. This operation may take a few seconds because the command also handles the final steps of the FTP protocol. • 8: changes the working directory to the specified one. • 9: RFU. • 10: creates a directory on the FTP host. • 11: removes the directory from the remote FTP server. • 12: RFU. • 13: information of a file or a directory. The URC +UUFTPCD returns the information of the specified file or directory from the FTP server. • 14: lists the filenames in a specified directory. The URC +UUFTPCD returns the list of the filenames received from FTP server. If the directory name is omitted, the list of the files names of current working directory is requested. • 100: retrieves the FOTA update file. The downloaded file will not be accessible to the user. During the download of the FOTA update file the +UUFTPCR: 100,<stored_byte> / <total_byte> URC (where supported) will provide the status of the download. At the end of the download file the +UUFTPCR: 100,<ftp_result>[,<md5_sum>] URC will provide the operation result. The <md5_sum> parameter will display the MD5 checksum of the downloaded file.
<filename>	String	Filename to be deleted/renamed from the FTP host. For the limit of the length of the string, see Command line.
<new_filename>	String	New filename. For the limit of the length of the string, see Command line.
<remote_filename>	String	Remote filename to be retrieved from the FTP host or stored in it. The maximum parameter length is 256 characters.
<local_filename>	String	Local filename (module file system) text string to be stored/sent on the file system. For the limit of the length of the string, see the File system limits.
<retrieving_mode>	Number	Allowed values: • 0 (default value): the file is retrieved from beginning. • 1: restart the data retrieving from the last data received during the previous download interrupted due to error.
<number_of_byte>	Number	Represents the number of bytes already sent to the FTP server or received from it. • During a file retrieval the server writes the file from the offset indicated with this parameter.

Parameter	Type	Description
		• During a file storing the server sends the data from the value indicated with this parameter.
<directory_name>	String	Directory name on the FTP server. For the limit of the length of the string, see Command line.
<file_directory_name>	String	Path file/directory name to be listed. If not specified, the current directory list is requested. For the limit of the length of the string, see Command line. • <param1> optional parameter; the text string of the path (file or directory) to be name listed. If not specified, the list of the files names of current working directory is requested.
<fw_download_status>	Number	Manages the firmware package download status: • if omitted trigger the firmware package download from an FTP server • 0: cancel the firmware package download from an FTP server • 1: resume the firmware package download from an FTP server
<ftp_data_len>	Number	Amount of data in bytes
<ftp_data>	String	Data available from the FTP server in the ASCII [0x00,0xFF] range. The starting quotation mark shall not be taken into account like data, the first byte of data starts after the first quotation mark. The total number of bytes is <ftp_data_len>. At the end of the byte stream, another quotation mark is provided for user convenience and visualization purposes.
<ftp_result>	Number	Allowed values: • 0: fail • 1: success
<md5_sum>	String	MD5 checksum of the FOTA update file downloaded via +UFTPC=100 AT command. This parameter is issued only for +UFTPC=100 AT command.
<stored_byte>	Number	Amount of stored bytes
<total_byte>	Number	Amount of total bytes of the FOTA update file to be stored
<param1>	String	Content depend on related <op_code> (details are given above)
<param2>	String	Content depend on related <op_code> (details are given above)
<param3>	String	Content depend on related <op_code> (details are given above)

26.2.4 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.

LARA-R6

- The+UUFTPCR: 100,<stored_byte> / <total_byte> URC is not supported.
- The time to establish the secure session (when using +UFTP: 8,1[,<USECMNG_profile>] or +UFTP: 12,1[,<USECMNG_profile>]) could require up to 150 s in one of these cases:
  - RoT generated PSK (+USECPRF: <profile_id>,11)
  - encrypted session resumption (+USECPRF: <profile_id>,13,2,10)

  This is due to "security heartbeat" message operation. For more details on when this scenario occurs, see the +USECCONN AT command.

26.3 FTP error +UFTPER

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

26.3.1 Description

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

26.3.2 Syntax

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

26.3.3 Defined values

Parameter	Type	Description
<error_class>	Number	Value of error class. Values are listed in Appendix A.7.
<error_code>	Number	Value of class-specific error code (reply code if <error_class> is 0). The values are listed in Appendix A.7.1.

27 HTTP

The section describes the u-blox proprietary AT commands that can be used for sending requests to a remote HTTP server, receiving the server response and transparently storing it in the file system. The supported methods are: HEAD, GET, DELETE, PUT, POST file and POST data. The HTTP client requires an active connection to work. Some products require additional commands to provide connectivity to the application.

LARA-R6
If not specified, the <cid> and the <preferred_protocol_type> parameters set by means of the +UDCONF=19 AT command are used.
See +CGACT AT command for activating a PDP context.

LARA-R6001D
If not specified the default CID (<cid>=1) is used. If not specified and the protocol type is IPv4v6, then the preferred protocol type is IPv4.
See +CGACT AT command for activating a PDP context.

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

27.1 HTTP control +UHTTP

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

27.1.1 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>

27.1.2 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			

Type	Syntax	Response	Example
Set	AT+UHTTP=<profile_id>,1,<HTTP_server_name>	OK	AT+UHTTP=2,1,"www.u-blox.com" OK
Read	AT+UHTTP=<profile_id>,1	+UHTTP: <profile_id>,1,<HTTP_server_name> OK	AT+UHTTP=2,1 +UHTTP: 2,1,"www.u-blox.com" OK
Username			
Set	AT+UHTTP=<profile_id>,2,<username>	OK	AT+UHTTP=2,2,"my_user" OK
Read	AT+UHTTP=<profile_id>,2	+UHTTP: <profile_id>,2,<username> OK	AT+UHTTP=2,2 +UHTTP: 2,2,"my_user" OK
Password			
Set	AT+UHTTP=<profile_id>,3,<password>	OK	AT+UHTTP=2,3,"pwd" OK
Read	AT+UHTTP=<profile_id>,3	+UHTTP: <profile_id>,3,<password> OK	AT+UHTTP=2,3 +UHTTP: 2,3,"pwd" OK
Authentication type			
Set	AT+UHTTP=<profile_id>,4,<HTTP_authentication>	OK	AT+UHTTP=2,4,1 OK
Read	AT+UHTTP=<profile_id>,4	+UHTTP: <profile_id>,4,<HTTP_authentication> OK	AT+UHTTP=2,4 +UHTTP: 2,4,1 OK
HTTP server port			
Set	AT+UHTTP=<profile_id>,5,<HTTP_port>	OK	AT+UHTTP=2,5,30 OK
Read	AT+UHTTP=<profile_id>,5	+UHTTP: <profile_id>,5,<HTTP_port> OK	AT+UHTTP=2,5 +UHTTP: 2,5,30 OK
HTTP secure option			
Set	AT+UHTTP=<profile_id>,6,<HTTP_secure>[,<USECMNG_profile>]	OK	AT+UHTTP=2,6,1 OK
Read	AT+UHTTP=<profile_id>,6	+UHTTP: <profile_id>,6,<HTTP_secure>[,<USECMNG_profile>] OK	AT+UHTTP=2,6 +UHTTP: 2,6,1 OK
HTTP request timeout and TCP socket linger timer			
Set	AT+UHTTP=<profile_id>,7,<HTTP_timeout>[,<linger_timer>]	OK	AT+UHTTP=2,7,150,5 OK
Read	AT+UHTTP=<profile_id>,7	+UHTTP: <profile_id>,7,<HTTP_timeout>,<linger_timer> OK	AT+UHTTP=2,7 +UHTTP: 2,7,150,5 OK
HTTP add custom request headers			
Set	AT+UHTTP=<profile_id>,9,<custom_request_header>	OK	AT+UHTTP=2,9,"0:hdr0:val0" OK
Read	AT+UHTTP=<profile_id>,9	+UHTTP: <profile_id>,9,<custom_request_header> OK	AT+UHTTP=2,9 +UHTTP: 2,9,"0:hdr0:val0" OK
HTTP context id			
Set	AT+UHTTP=<profile_id>,20,<cid>[,<preferred_protocol_type>]	OK	AT+UHTTP=2,20,2

Type	Syntax	Response	Example
			OK
Read	AT+UHTTP=<profile_id>,20	+UHTTP: <profile_id>,20,<cid>,<preferred_protocol_type> OK	AT+UHTTP=2,20 +UHTTP: 2,20,2,0 OK
Read	AT+UHTTP=<profile_id>	OK	AT+UHTTP=2 OK
Test	AT+UHTTP=?	+UHTTP: (list of supported <profile_id>s),(list of supported <op_code>s) OK	+UHTTP: (0-3),(0-9,20) OK

27.1.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<op_code>	Number	Allowed values: • 0: HTTP server IP address; • 1: HTTP server name; • 2: username • 3: password • 4: authentication type • 5: HTTP server port • 6: HTTP Secure option (SSL encryption) • 7: HTTP request timeout and TCP socket linger timer • 8: reserved for internal use only • 9: HTTP add custom request headers • 20: HTTP context id and preferred IP type Allowed values: • LARA-R6 - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 20
<HTTP_server_IP_address>	String	HTTP server IP address; The factory-programmed value is an empty text string. For IP address format reference see the IP addressing.
<HTTP_server_name>	String	HTTP server name (e.g. "http.server.com"). The factory-programmed value is an empty text string. The maximum length is: • LARA-R6 - 1009 characters
<username>	String	User name; the maximum length is 30 characters; it is used for the HTTP login procedure if the authentication is used. The factory-programmed value is an empty text string.
<password>	String	Password; the maximum length is 30 characters; it is used for the HTTP login procedure if the authentication is used. The factory-programmed value is an empty text string.
<HTTP_authentication>	Number	HTTP authentication method; the allowed values are: • 0 (factory-programmed value): no authentication • 1: basic authentication (the password and username must be set)
<HTTP_port>	Number	HTTP server port; range 1-65535. It means the HTTP server port to be used in a HTTP request; the factory-programmed value is 80.
<HTTP_secure>	Number	HTTP Secure option (SSL encryption). It enables or disables the HTTPS (SSL secured connection for HTTP application) usage: • 0 (factory-programmed value): HTTPS (SSL encryption) disabled and the HTTP server port set to 80 • 1: HTTPS (SSL encryption) enabled and the HTTP server port set to 443; an USECMNG profile can be specified with an additional parameter.
<USECMNG_profile>	Number	Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used
<HTTP_timeout>	Number	HTTP request timeout in seconds (number); the range is 30 - 180. It is the timeout in seconds to be used for all the HTTP requests with the specified profile. The factory-programmed value is 180 s.
<linger_timer>	Number	TCP linger timer for socket close expressed in seconds (number).

Parameter	Type	Description
		• LARA-R6 - The range is 0 - 120 s, the default value is 30 s. With 0 value the linger option is disabled.
<custom_request_header>	String	Sets/clears the custom request header (string); the custom header option follows a defined format "hdr_id:hdr_name:hdr_value"; the hdr_id is a number in the range [0-4]; the hdr_name and hdr_value are strings having a maximum length of 512 characters (see examples below). • "0:hdr0:val0": set header 0 with name hdr0 and value val0 • "0:": clear header 0 • "1:hdr1:val1": set header 1 with name hdr1 and value val1 • "1:": clear header 1 • "2:hdr2:val2": set header 2 with name hdr2 and value val2 • "2:": clear header 2 • "3:hdr3:val3": set header 3 with name hdr3 and value val3 • "3:": clear header 3 • "4:hdr4:val4": set header 4 with name hdr4 and value val4 • "4:": clear header 4 The following character is not allowed in the <custom_request_header> parameter: • 0x3A (:)
<cid>	Number	Specifies the PDP context that will be used for the HTTP data. For the parameter range, see <cid>. For more details on the default value of the parameter (where supported), see HTTP.
<preferred_protocol_type>	Number	In case of a context id with IPv4v6 PDP type it is possible to select: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see HTTP.
<param_val>	Number / String	Type and supported content depend on the related <op_code> parameter; details are given above
<param_val1>	Number / String	Type and supported content depend on the related <op_code> parameter; details are given above.

27.1.4 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.

LARA-R6

- The read command for <op_code>=9 (HTTP add custom request headers) is not supported.
- In custom HTTP header, configured with <op_code>=9, the maximum combined length of hdr_name and hdr_value strings is 1006 characters.

27.2 HTTP advanced control+UHTTPAC

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

27.2.1 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.

27.2.2 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

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

27.2.3 Defined values

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

27.2.4 Examples and use cases

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

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

27.3 HTTP command +UHTTPC

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

27.3.1 Description

Triggers the HTTP command specified with <http_command> parameter, using the HTTP application profile parameters (previously set up by +UHTTP AT command), specified with <profile_id>. The response indicates if sending the command request to HTTP process was successful or not. The final result of HTTP command will be returned to the user via the +UUHTTPCR URC.

☞ The timing before the +UUHTTPCR URC is issued on the AT terminal also depends by the DNS resolution. For further details about the estimated response time related to the DNS resolution, see the +UDNSRN AT command.

27.3.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UHTTPC=<profile_id>,<http_command>,<path>,<filename>[,<param1>[,<param2>[,<param3>]]]	OK	AT+UHTTPC=0,1,"/path/file.html","responseFilename" OK
HEAD command			
Set	AT+UHTTPC=<profile_id>,0,<path>,<filename>	OK	AT+UHTTPC=0,0,"/path/file.html","responseFilename" OK
GET command			
Set	AT+UHTTPC=<profile_id>,1,<path>,<filename>	OK	AT+UHTTPC=0,1,"/path/file.html","responseFilename" OK
DELETE command			
Set	AT+UHTTPC=<profile_id>,2,<path>,<filename>	OK	AT+UHTTPC=0,2,"/path/file.html","responseFilename" OK
PUT command			
Set	AT+UHTTPC=<profile_id>,3,<path>,<filename>,<filesystem_name>[,<HTTP_content_type>[,<user_defined_content_type>]]	OK	AT+UHTTPC=0,3,"/path/file.html","responseFilename","filesystemName" OK
POST file command			
Set	AT+UHTTPC=<profile_id>,4,<path>,<filename>,<filesystem_name>,<HTTP_content_type>[,<user_defined_content_type>]	OK	AT+UHTTPC=0,4,"/path/file.html","responseFilename","filesystemName",0 OK
POST data command			
Set	AT+UHTTPC=<profile_id>,5,<path>,<filename>,<data>,<HTTP_content_type>[,<user_defined_content_type>]	OK	AT+UHTTPC=0,5,"/path/file.html","responseFilename","data",0 OK
GET FOTA update file			
Set	AT+UHTTPC=<profile_id>,100,<path>	OK	AT+UHTTPC=0,100,"/path/file.html" OK
Test	AT+UHTTPC=?	+UHTTPC: (list of supported <profile_id>s),(list of supported <http_command>s) OK	+UHTTPC: (0-3),(0-5),100 OK
URC		+UUHTTPCR: <profile_id>,<http_command>,<http_result>[,<http_status_code>,<md5_sum>]	+UUHTTPCR: 0,1,1

27.3.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<http_command>	Number	• 0: HEAD command; issue an HEAD request to the HTTP server • 1: GET command; perform a GET request to the HTTP server • 2: DELETE command; send a DELETE request to the HTTP server • 3: PUT command; perform a PUT request to the HTTP server. • 4: POST a file command; issue a POST request for sending a file to the HTTP server • 5: POST data command; send a POST request to the HTTP server using the data specified in <data> parameter • 100: GET FOTA update file; download the FOTA update file
<path>	String	Path of HTTP server resource; the maximum length is:

Parameter	Type	Description
		• LARA-R6 - 1024 characters
<filename>	String	Filename where the HTTP server response will be stored. If the file already exists, it will be overwritten. If the parameter is an empty string (""), the default "http_last_response_<profile_id>" filename will be used. For file system file name and data size limits see File system limits.
<filesystem_name>	String	File system filename representing the file system filename to be sent to the HTTP server within the POST / PUT request. For file system file name and data size limits see File system limits.
<HTTP_content_type>	Number	HTTP Content-Type identifier. It represents the HTTP Content-Type identifier. Allowed values: • 0: application/x-www-form-urlencoded • 1: text/plain • 2: application/octet-stream • 3: multipart/form-data • 4: application/json (supported only for PUT and POST file command) • 5: application/xml • 6: user defined with <user_defined_content_type>
<user_defined_content_type>	Number	Used only when <HTTP_content_type>=6 (user defined Content-Type). The maximum length is 64 characters.
<data>	String	It represents the data to be sent to the HTTP server with the POST request. The maximum length is 128 bytes. The data must be formatted according to the Content-Type specified in <HTTP_content_type> parameter.
<param1>	String	Content depends on the related <http_command> (see above).
<param2>	Number	Content depends on the related <http_command> (see above).
<param3>	String	Content depends on the related <http_command> (see above).
<http_result>	Number	• 0: fail • 1: success
<http_status_code>	Number	HTTP status code reported in the server response header after a GET FOTA update file request. This parameter is issued only for AT+UHTTPC=<profile_id>,100,<path> AT command.
<md5_sum>	String	MD5 checksum of the FOTA update file. This parameter is issued only for AT +UHTTPC=<profile_id>,100,<path> AT command.

27.3.4 Notes

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

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

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

LARA-R6

- The time to establish the secure session (when using +UHTTP: <profile_id>,6,1[,<USECMNG_profile>]) could require up to 150 s in one of these cases:

- RoT generated PSK (+USECPRF: <profile_id>,11)
- encrypted session resumption (+USECPRF: <profile_id>,13,2,10)

This is due to "security heartbeat" message operation. For more details on when this scenario occurs, see the +USECCONN AT command.

27.4 HTTP protocol error +UHTTPER

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

27.4.1 Description

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

27.4.2 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

27.4.3 Defined values

Parameter	Type	Description
<profile_id>	Number	HTTP profile identifier, in range 0-3
<error_class>	Number	List of the allowed values is available in Appendix A.7
<error_code>	Number	Value of class-specific error codes (reply code if class is 0). When <error_class>=10 (wrong HTTP API usage), the allowed <error_code>; values are listed in Appendix A.7.2

28 Ping

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

LARA-R6
If not specified, the <cid> and the <preferred_protocol_type> parameters set by means of the +UDCONF=19 AT command are used.
See +CGACT AT command for activating a PDP context.

LARA-R6001D
If not specified the default CID (<cid>=1) is used. If not specified and the protocol type is IPv4v6, then the preferred protocol type is IPv4.
See +CGACT AT command for activating a PDP context.

28.1 Ping command +UPING

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

28.1.1 Description

The ping command is the common method to know if a remote host is reachable on the internet.

The ping functionality is based on the ICMP protocol (Internet Control Message Protocol), it is part of the Internet Protocol Suite as defined in RFC 792 [173]. ICMP messages are typically generated in response to errors in IP datagrams or for diagnostic / routing purposes.

The ping command sends an ICMP echo request to the remote host and waits for its ICMP echo reply. If the echo reply packet is not received, it might mean that the remote host is not reachable.

The ping command could be used also to measure e.g. the RTT (Round Trip Time, the time needed by a packet to go to the remote host and come back) and the TTL (Time To Live, it is a value to understand how many gateway a packet has gone through).

The set command allows the user to execute a ping command from the module to a remote peer. The results of the ping command execution is notified by means of these URCs:

- **+UUPING**: it reports the +UPING command result when no error occurred.
- **+UUPINGER**: it is raised if an error is occurred while processing the +UPING command. The URC reports the code of occurred error (see Ping error codes to get the meanings of the error result codes).

Some network operators may disallow ICMP packets traffic on their network, this means that the +UPING command may not work.

Some remote hosts might not reply to ICMP echo request for security reasons (e.g. firewall settings).

Some remote hosts might not reply to ICMP echo request if the data size of the echo request is too big.

If a remote peer does not reply to an ICMP echo request, it does not mean that for sure the peer cannot be reached in another way.

28.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UPING=<remote_host>[,<retry_num>,<p_size>,<timeout>,<ttl>[,<cid>[,<preferred_protocol_type>]]]	OK	AT+UPING="www.google.com" OK
Test	AT+UPING=?	+UPING: "remote_host",(list of supported <retry_num>),(list of supported <p_size>),(list of	+UPING: "remote_host",(1-64),(4-1460),(10-60000),(1-255) OK

Type	Syntax	Response	Example
		supported <timeout>),(list of supported <ttl>,(list of supported <cid>),(list of supported <preferred_protocol_type>) OK	
URC		+UUPING: <retry_num>,<p_size>,<remote_hostname>,<remote_ip>,<ttl>,<rtt>	+UUPING: 1,32,"www.l-google.com","72.14.234.104",55,768
URC		+UUPINGER: <error_code>	+UUPINGER: 12

28.1.3 Defined values

Parameter	Type	Description
<remote_host>	String	IP address (dotted decimal representation) or domain name of the remote host: • Maximum length: 128 characters
<retry_num>	Number	Indicates how many times iterate the ping command: • Range: 1-64 • Default value: 4
<p_size>	Number	Size in bytes of the echo packet payload: • LARA-R6 - The range goes from 4 to 1460. The default value is 32.
<timeout>	Number	The maximum time in milliseconds to wait for an echo reply response: • Range: 10-60000 • Default value: 5000
<ttl>	Number	The value of TTL to be set for the outgoing echo request packet. In the URC it provides the TTL value received in the incoming packet: • Range: 1-255 • Default value: 32
<cid>	Number	PDP context identifier used for the PING communication. The allowed range is product specific, see <cid>. For more details on the default value of the parameter (where supported), see PING.
<preferred_protocol_type>	Number	Preferred protocol type to be specified when the <cid> protocol type is IPv4v6. Allowed values: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see PING.
<remote_hostname>	String	String representing the domain name (if available) of the remote host. It this information is not available, it will be an empty string (i.e. "").
<remote_ip>	String	String representing the remote host IP address in dotted decimal form.
<rtt>	Number	RTT value, the time elapsed in milliseconds before receiving the echo reply response from the remote host.
<error_code>	Number	The error occurred while processing the +UPING command. See Ping error codes for the list of the allowed error result codes.

28.1.4 Notes

- If the +UUPING URC reports <rtt> = -1 the timeout is elapsed (no response received).
- If the first +UUPING URC reports <rtt> = -2 the TTL used in the ping request is too low.
- Some network operators may return an ICMP time exceeded message when the remote host is not reachable. In these cases the first +UUPING URC reports <rtt> = -1 and the subsequent +UUPING URC report <rtt> = -2.

LARA-R6

- The <ttl> parameter is not supported however it must be specified:
  - The set command expects a value either empty or in the defined range.
  - In the +UUPING URC output the value is empty.
- The "+CME ERROR: operation not allowed" error result code (if +CMEE: 2) is returned when the +UPING AT command is entered before a previous +UPING AT command is completed. In a subsequent re-entry of the command the error result code will no longer be present.

29 Positioning

29.1 NMEA

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

Before being able to read a specific NMEA string, it is necessary to activate the storage of the last value of that particular NMEA string. If storing a particular NMEA string was not activated, the information text response to the query will be "0,NULL". The last value of a specific NMEA string is saved in RAM and is made available even after the GNSS receiver switch off.

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

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

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

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

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

29.2 AssistNow services

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

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

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

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

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

☞ UDP protocol for the AssistNow Online service is deprecated.

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

AssistNow Autonomous feature provides a functionality similar to AssistNow Offline without the need for a host and a connection. Based on a broadcast ephemeris downloaded from the satellite the receiver can

autonomously generate an accurate satellite orbit representation («AssistNow Autonomous data») that is usable for navigation much longer than the underlying broadcast ephemeris was intended for.

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

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

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

Table 32 summarizes the GNSS AT commands related with AssistNow services:

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

Table 32: AssistNow services Overview

29.3 GNSS

29.3.1 GNSS power management +UGPS

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

29.3.1.1 Description

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

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

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

☞ LARA-R6
To establish a PSD connection see the +CGDCONT and +CGACT AT commands.

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

It is possible to combine different aiding modes: to enable them the sum of the <mode> value of the interested aiding modes is needed (e.g.: aiding <aid_mode>=3 means local aiding plus AssistNow Offline). Moreover it is also possible to switch from one aiding mode to another one without powering off the GNSS receiver. If the following sequence is provided (AT+UGPS=1,1 and then AT+UGPS=1,5) at the beginning the GNSS receiver will

power on with local aiding support and after the second command will be added the AssistNow Online. After the second command the local aiding is not restarted, therefore the +UUGIND URC for it will not be sent again.

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

29.3.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPS=<mode>[,<aid_mode>[,<GNSS_systems>]]	OK	AT+UGPS=1,0,1 OK
Read	AT+UGPS?	+UGPS: <mode>[,<aid_mode>[,<GNSS_systems>]] OK	+UGPS: 1,0,1 OK
Test	AT+UGPS=?	+UGPS: (list of supported <mode>s),(list of supported <aid_mode>),(list of supported <GNSS_systems>) OK	+UGPS: (0-1),(0-15),(1-127) OK

29.3.1.3 Defined values

Parameter	Type	Description
<mode>	Number	• 0 (default value): GNSS receiver powered off • 1: GNSS receiver powered on
<aid_mode>	Number	Supported aiding modes; the parameter is mandatory if <mode>=1; all these allowed values can be combined together: • 0 (default value): no aiding • 1: automatic local aiding • 2: AssistNow Offline • 4: AssistNow Online • 8: AssistNow Autonomous
<GNSS_systems>	Number	Bitmask for combining the supported GNSS types; the parameter is optional and the allowed values can be combined together. The default value is 3 (GPS+SBAS): • 1: GPS • 2: SBAS • 4: Galileo • 8: BeiDou • 16: IMES • 32: QZSS • 64: GLONASS

29.3.1.4 Notes

- If <GNSS_systems> type is not supported by the GNSS receiver, the set command turns on the GNSS receiver with built-in supported type. The current <GNSS_systems> can be queried by means of the read command or the +UUGIND URC.
- An error result code is provided in the following cases:
  - <mode>, <aid_mode> or <GNSS_systems> values are out of range
  - <mode> is set to 1 without <aid_mode> value
  - Attempt to power off the GNSS when it is already off
  - The value of <aid_mode> to be set is equal to the current GNSS aiding mode and the value of <GNSS_systems> to be set is equal to the last requested <GNSS_systems>

29.3.2 Assisted GNSS unsolicited indication +UGIND

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

29.3.2.1 Description

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

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

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

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

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

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

29.3.2.2 Syntax

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

29.3.2.3 Defined values

Parameter	Type	Description
<mode>	Number	URC configuration: • 0 (default value): disabled • 1: enabled
<aid_mode>	Number	Provides the supported aiding mode: • 0: GNSS system(s) • 1: automatic local aiding • 2: AssistNow Offline • 4: AssistNow Online • 8: AssistNow Autonomous
<GNSS_systems>	Number	Current activated GNSS types; the allowed values can be combined together: • 1: GPS • 2: SBAS • 4: Galileo • 8: BeiDou • 16: IMES • 32: QZSS

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

29.3.2.4 Notes

LARA-R6

- The command setting is not stored in the NVM.

29.3.3 GNSS profile configuration +UGPRF

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

29.3.3.1 Description

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

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

☞ LARA-R6
To establish a PSD connection see the +CGDCONT and +CGACT AT commands.

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

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

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

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

29.3.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGPRF=<GNSS_I/O_ configuration>[,<IP Port>,<server address string>]	OK	AT+UGPRF=0 OK
Read	AT+UGPRF?	+UGPRF: <GNSS_I/O_ configuration>,<IP port>,<server address string> OK	+UGPRF: 0,0,"" OK
Test	AT+UGPRF=?	+UGPRF: (list of supported <GNSS_I/O_configuration>),(list of supported <IP port>),<server address string> OK	+UGPRF: (0-127),(0-65535),"addr" OK

29.3.3.3 Defined values

Parameter	Type	Description
<GNSS_IO_ configuration>	Number	• 0: no data flow to multiplexer, file or IP address • 1: GNSS data flow to and from USB (or alternatively AUX UART) • 2: GNSS data flow to and from multiplexer • 4: GNSS data flow saved to file • 8: GNSS data flow over the air to an internet host • 16: GNSS data ready function • 32: GNSS RTC sharing function • 64: reserved • 128: reset the GNSS after the GNSS power on (see AT+UGPS command description) • 256: reserved Allowed values: • LARA-R6 - 0 (factory-programmed value), 1, 2, 4, 8, 16, 64, 128
<IP port>	Number	IP port of the server where the GNSS data are sent (default and factory-programmed value: 0). If GNSS data flow over the air is enabled the parameter is mandatory otherwise is forbidden.
<server address string>	String	Address string of the server where the GNSS data are sent (default and factory-programmed value: ""). If GNSS data flow over the air is enabled the parameter is mandatory otherwise is forbidden. The address could be provided in both URL or IP format and the maximum length of the string is 47 characters.

29.3.4 Aiding server configuration +UGSRV

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

29.3.4.1 Description

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

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

LARA-R6
If not specified, the <cid> parameter set by means of the +UDCONF=19 AT command is used.
See +CGACT AT command for activating a PDP context.

LARA-R6001D

If not specified the default CID (<cid>=1) is used. If not specified and the protocol type is IPv4v6, then the preferred protocol type is IPv4.
See +CGACT AT command for activating a PDP context.

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

29.3.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGSRV=[<mga_primary_server>],[<mga_secondary_server>],<auth_token>[,<days>[,<period>[,<resolution>[,<GNSS_types>[,<mode>[,<datatype>[,<cid>]]]]]]]	OK	AT+UGSRV="cell-live1.services.u-blox.com","cell-live2.services.u-blox.com","123456789abcdefghijklm",14,4,1,65,0,1,1 OK
Read	AT+UGSRV?	+UGSRV: <mga_primary_server>,<mga_secondary_server>,<auth_token>,<days>,<period>,<resolution>,<GNSS_types>,<mode>,<datatype>,<cid> OK	+UGSRV: "cell-live1.services.u-blox.com","cell-live2.services.u-blox.com","123456789abcdefghijklm",14,4,1,65,0,1,1 OK
Test	AT+UGSRV=?	+UGSRV: <mga_primary_server>,<mga_secondary_server>,<auth_token>,(list of supported <days>s),(list of supported <period>s),(list of supported <resolution>s),(list of supported <GNSS_types>s),(list of supported <mode>s),(list of supported <datatype>s),(list of supported <cid>s) OK	+UGSRV: "srv1","srv2","token",(1,2,3,5,7,10,14),(1-5),(1-3),(1,64,65),(0-2),(0-15),(0,254) OK

29.3.4.3 Defined values

Parameter	Type	Description
<mga_primary_server>	String	Host name of the primary MGA server; the maximum length is 254 characters. Empty string is not allowed. The default and factory-programmed value is "cell-live1.services.u-blox.com". If the primary MGA server is omitted, the current stored value is preserved.
<mga_secondary_server>	String	Host name of the secondary MGA server; the maximum length is 254 characters. Empty string is not allowed. The default and factory-programmed value is "cell-live2.services.u-blox.com". If the secondary MGA server is omitted, the current stored value is preserved.
<auth_token>	String	Authentication Token for MGA server access.
<days>	Number	The number of days into the future the Offline data for u-blox 7 and previous version should be valid for. The allowed values are: 1, 2, 3, 5, 7, 10 and 14. The default and factory-programmed value is 14.
<period>	Number	The number of weeks into the future the Offline data for u-blox M8 should be valid for. The range of the allowed values goes from 1 to 5. The default and factory-programmed value is 4.
<resolution>	Number	Resolution of offline data for u-blox M8. Allowed values: • 1 (default and factory-programmed value): every day • 2: every other day • 3: every third day
<GNSS_types>	Number	Bitmask for combining the desired GNSS for the (offline) aiding • 1: GPS • 64: GLONASS The default and factory-programmed value is all (65). If the parameter is omitted, the current stored value is preserved.
<mode>	Number	Mode of operation of AssistNow Online data management • 0 (default and factory-programmed value): AssistNow Online data are downloaded at GNSS receiver power up • 1: AssistNow Online data automatically kept alive

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

29.3.5 GNSS aiding request command +UGAOS

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

29.3.5.1 Description

Triggers the manual download of AssistNow Online and AssistNow Offline data from the configured server in case automatic AssistNow operation is not enabled. The command returns only when the received data from the server are valid or an error occurs.

The command is also used to trigger the manual upload of local aiding data (e.g. ephemeris, almanac, last position, time, etc) from a u-blox GNSS receiver prior to shutting it down and to restore it into the receiver after the power up of the GNSS receiver (for more details, see the +UGPS AT command).

29.3.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGAOS=<aid_mode>	OK	AT+UGAOS=0 OK
Test	AT+UGAOS=?	AT+UGAOS: (list of supported <aid_mode>s) OK	+UGAOS: (0-8) OK

29.3.5.3 Defined values

Parameter	Type	Description
<aid_mode>	Number	Allowed values: • 0: upload of local aiding data from GNSS receiver to cellular module • 1: download of local aiding data from the cellular module to the GNSS receiver • 2: AssistNow Offline file download request (file loaded into cellular module) • 4: AssistNow Online data download request (data loaded into the GNSS receiver). This is only needed if AssistNow Online is not used with automatic operation • 8: AssistNow autonomous • Other values are reserved for future use

29.3.6 Send of UBX string +UGUBX

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

29.3.6.1 Description

Sends UBX protocol messages, embedded in an AT command, to a u-blox GNSS receiver. The command is transparent, that is the data is sent to the GNSS receiver without any check: it is up to the user to control if the UBX data is valid. The checksum in +UGUBX command string is ignored, this is calculated when the data is sent to the GNSS receiver.

When the GNSS receiver is off the UBX string is saved in cellular module RAM and, later, passed to the GNSS as configuration for "GNSS data ready" function when the GNSS receiver is used. In this case the UBX checksum bytes must be filled correctly.

☞ It is recommended to not send UBX messages to reset the GNSS receiver while it is in use, this will cause a misalignment between the cellular system configuration and the one of the GNSS system.

☞ UBX messages of "input" type do not provide back information messages to the cellular module. In this case the information text response to set command is +UGUBX: "no message" followed by the final result code.

29.3.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGUBX=<UBX_string>	+UGUBX: <UBX_string_response> OK	AT+UGUBX="B562060108000106000100000000017DA" +UGUBX: "B5620501020006010F38" OK

29.3.6.3 Defined values

Parameter	Type	Description
<UBX_string>	String	UBX message in hexadecimal format. The messages can include spaces to simplify copy/paste from u-center separated with spaces, e.g. AT+UGUBX="B5 62 06 01 08 0 0 01 06 00 01 00 00 00 00 17 DA" (this is important when copying messages from u-center). • LARA-R6 - For the limit of the length of the string, see Command line.
<UBX_string_response>	String	The response message depends by the request sent: query/poll UBX messages will return the requested data in hexadecimal format, while the configuration message will return the corresponding acknowledge or not-acknowledge. See the UBX protocol specification

29.3.6.4 Notes

- If a +UGUBX command triggers multiple strings answer only a single UBX string is returned. E. g. polling GPS Aiding Ephemeris Data (AID-EPH) is done by sending a single message to the receiver but returns 32 messages; only the first one is sent to AT interface.
- The answer can be split in multiple information text responses all starting with "+UGUBX:".

29.3.7 GNSS indications timer +UGTMR

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

29.3.7.1 Description

Sets the date and time format. With the <time_zone> parameter is possible to set the time zone value; the time and the date will be updated as the local time. With the action command is possible to synchronize the UTC timing.

29.3.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGTMR=<time_zone>	OK	AT+UGTMR=-1 OK
Read	AT+UGTMR?	+UGTMR: <time_zone> OK	+UGTMR: -1 OK
Test	AT+UGTMR=?	+UGTMR: (list of supported <time_zone>s) OK	+UGTMR: (-96 - 96) OK

29.3.7.3 Defined values

Parameter	Type	Description
<time_zone>	Number	Indicates the time zone value set by the user; the module can provide an error result code if the offset has not been calculated. The factory-programmed time zone value is 0. • -96, 96: defined range

29.3.7.4 Notes

- The time zone is expressed in quarters of hour.
- The time is updated with the current UTC time plus the time zone and the time zone is unchanged, for example:

Command	Response	Remarks
AT+UGTMR=-36	OK	The command returns the "OK" final result code and sets the new date and time if the GNSS has this information, otherwise a generic error result code is returned.
AT+CCLK?	+CCLK: "12/05/23,21:54:21+00"	

29.3.8 Get GNSS time and date +UGZDA

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

29.3.8.1 Description

Enables/disables the storing of the last value of NMEA $ZDA messages, and get the current messaging state. If the <state> parameter is enabled, the last value of NMEA $ZDA messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $ZDA messages are volatile.

29.3.8.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGZDA=<state>	OK	AT+UGZDA=1 OK
Read	AT+UGZDA?	+UGZDA: <state>,<$ZDA msg> OK	+UGZDA: 1,$GPZDA,142351.00,12,12,2013,00,00*66 OK +UGZDA: 0,NULL OK
Test	AT+UGZDA=?	+UGZDA: (list of supported <state>s) OK	+UGZDA: (0-1) OK

29.3.8.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): disable the NMEA $ZDA messages • 1: enable the NMEA $ZDA messages
<$ZDA msg>	String	NMEA $ZDA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

29.3.9 Get GNSS fix data +UGGGA

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

29.3.9.1 Description

Enables/disables the storing of the last value of NMEA $GGA messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $GGA messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GGA messages are volatile.

29.3.9.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGGA=<state>	OK	AT+UGGGA=1 OK
Read	AT+UGGGA?	+UGGGA: <state>,<$GGA msg> OK	+UGGGA: 1,$GPGGA,142351.00,,,,,0,00,99.99,,,,,,*66 OK +UGGGA: 0,NULL OK
Test	AT+UGGGA=?	+UGGGA: (list of supported <state>s) OK	+UGGGA: (0-1) OK

29.3.9.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GGA messages • 1: to enable the NMEA $GGA messages
<$GGA msg>	String	NMEA $GGA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

29.3.10 Get geographic position +UGGLL

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

29.3.10.1 Description

Enables/disables the storing of the last value of NMEA $GLL messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $GLL messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GLL messages are volatile.

29.3.10.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGLL=<state>	OK	AT+UGGLL=1

Type	Syntax	Response	Example
			OK
Read	AT+UGGLL?	+UGGLL: <state>,<$GLL msg> OK	+UGGLL: 1,$GPGLL,,,,,142351.00,V,N*4A OK +UGGLL: 0,NULL OK
Test	AT+UGGLL=?	+UGGLL: (list of supported <state>s) OK	+UGGLL: (0-1) OK

29.3.10.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GLL messages • 1: to enable the NMEA $GLL messages
<$GLL msg>	String	NMEA $GLL messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

29.3.11 Get number of GNSS satellites in view +UGGSV

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

29.3.11.1 Description

Enable/disables the storing of the last value of NMEA $GSV messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $GSV messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GSV messages are volatile.

29.3.11.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGSV=<state>	OK	AT+UGGSV=1 OK
Read	AT+UGGSV?	+UGGSV: <state>,<$GSV msg> OK	+UGGSV: 1,$GPGSV,3,1,11,03,67,298,22,06,88,149,29,07,06,302,,08,05,332,25*73 $GPGSV,3,2,11,09,02,334,25,14,02,141,,15,10,041,43,16,46,209,16*7D $GPGSV,3,3,11,18,48,066,35,21,26,070,35,27,80,314,25*40 $GLGSV,1,1,03,73,13,248,,74,23,298,20,75,09,348,19*51 OK +UGGSV: 0,NULL OK
Test	AT+UGGSV=?	+UGGSV: (list of supported <state>s) OK	+UGGSV: (0-1) OK

29.3.11.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GSV messages • 1: to enable the NMEA $GSV messages

Parameter	Type	Description
<$GSV msg>	String	NMEA $GSV messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

29.3.11.4 Notes

- Since the $GSV message reports satellite information, the output of the different GNSS systems is not combined, but it is reported in sequence as in the example above with GPS and GLONASS.

29.3.12 Get recommended minimum GNSS data +UGRMC

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

29.3.12.1 Description

Enable/disables the storing of the last value of NMEA $RMC messages, and gets the current messaging state. If the <state> parameter is enabled, the last value of NMEA $RMC messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $RMC messages are volatile.

29.3.12.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGRMC=<state>	OK	AT+UGRMC=1 OK
Read	AT+UGRMC?	+UGRMC: <state>,<$RMC msg> OK	+UGRMC: 1,$GPRMC,142351.00,V,,,,,,,121213,,,N*7F OK +UGRMC: 0,NULL OK
Test	AT+UGRMC=?	+UGRMC: (list of supported <state>s) OK	+UGRMC: (0-1) OK

29.3.12.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $RMC messages • 1: to enable the NMEA $RMC messages
<$RMC msg>	String	NMEA $RMC messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

29.3.13 Get course over ground and ground speed +UGVTG

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

29.3.13.1 Description

Enables/disables the storing of the last value of NMEA $VTG messages, and gets know the current messaging state. If the <state> parameter is enabled, the last value of NMEA $VTG messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $VTG messages are volatile.

29.3.13.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGVTG=<state>	OK	AT+UGVTG=1 OK
Read	AT+UGVTG?	+UGVTG: <state>,<$VTG msg> OK	+UGVTG: 1,$GPVTG,,,,,,,,,N*30 OK +UGVTG: 0,NULL OK
Test	AT+UGVTG=?	+UGVTG: (list of supported <state>s) OK	+UGVTG: (0-1) OK

29.3.13.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $VTG messages • 1: to enable the NMEA $VTG messages
<$VTG msg>	String	NMEA $VTG messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

29.3.14 Get satellite information +UGGSA

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

29.3.14.1 Description

Enables/disables the storing of the last value of NMEA $GSA messages, and gets the current messaging state. If <state> parameter is enabled, the last value of NMEA $GSA messages can be retrieved with the read command even when the GNSS is switched off.

The NMEA $GSA messages are volatile.

29.3.14.2 Syntax

Type	Syntax	Response	Example
Set	AT+UGGSA=<state>	OK	AT+UGGSA=1 OK
Read	AT+UGGSA?	+UGGSA: <state>,<$GSA msg> OK	+UGGSA: 1,$GPGSA,A,1,,,,,,,,,,,,99.99,99.99,99.99*30 OK +UGGSA: 0,NULL OK
Test	AT+UGGSA=?	+UGGSA: (list of supported <state>s) OK	+UGGSA: (0-1) OK

29.3.14.3 Defined values

Parameter	Type	Description
<state>	Number	• 0 (factory-programmed value): to disable the NMEA $GSA messages • 1: to enable the NMEA $GSA messages
<$GSA msg>	String	NMEA $GSA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user.

29.3.15 Configure deep cells scan for database feeding in AssistNow Online operation+UDCONF=121

+UDCONF=121						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	NVM	No	-	+CME Error

29.3.15.1 Description

Enables or disables the deep cells scan for database feeding in AssistNow Online operation.

29.3.15.2 Syntax

Type	Syntax	Response	Example
Set	AT+UDCONF=121,<deep_scan_enabled>	OK	AT+UDCONF=121,0 OK
Read	AT+UDCONF=121	+UDCONF: 121,<deep_scan_enabled> OK	AT+UDCONF=121 +UDCONF: 121,1 OK

29.3.15.3 Defined values

Parameter	Type	Description
<integrity_check_enabled>	Number	Deep scan on AssistNow operation configuration. Allowed values: • 0: deep scan for DB feeding on AssistNow Online operation is disabled • 1 (factory-programmed value): deep scan for DB feeding on AssistNow Online operation is enabled

29.4 CellLocate® and hybrid positioning

29.4.1 Ask for localization information +ULOC

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

29.4.1.1 Description

Requests cellular module to provide the location data; the location can be determined using:

- GNSS receiver
- CellLocate® (location based on network cells data)
- Combination of both technologies (hybrid)

The final result code indicates if sending the command request to the localization information process was successful or not. The URC is issued to provide the requested information via +ULOC set command.

In order to use simultaneously GNSS interface and CellLocate®, the GNSS shall not be a sensor for +ULOC: if the GNSS sensor is reserved to another interface (e.g. +UGPS) and is selected as a sensor also for +ULOC, an error result code is provided ("+CME ERROR: GPS busy" if +CMEE: 2).

It is possible to configure the hybrid positioning through +ULOCGNSS and +ULOCCELL AT commands even if it is running: the parameters are stored in NVM and will be applied at the next +ULOC command.

☞ If the +ULOC command is sent while a previous +ULOC activity is still in progress the previous activity is aborted, the available position is immediately output and the next +ULOC request is served.

☞ The data connection cannot be immediately dropped at the +ULOC timeout expiration. This could lead to a delay in the expected response time.

☞ Depending on the aiding chosen, a data connection could be required; see the +UGPS AT command description.

☞ If no position is available (no GNSS coverage, no network information and no previous data available) then the <lat> latitude and <long> longitude will be set to '0'.

☞ If the previous position degradated by the elapsed time satisfies the desired accuracy then the sensor '0' is reported in the information text response.

☞ If multi-hypothesis is required the GNSS solution and the CellLocate® solutions are reported, if available. If no GNSS or CellLocate® solutions are present, the previous position degradated is used instead.

☞ If a valid GNSS fix with an accuracy below the required value (<accuracy>) occurs before the end of the network scan, the GNSS-only solution will be available, even if multi-hypothesis has been required.

☞ LARA-R6
To establish a PSD connection see the +CGDCONT and +CGACT AT commands.

29.4.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULOC=<mode>,<sensor>,<response_type>,<timeout>,<accuracy>[,<num_hypothesis>]	OK	AT+ULOC=2,3,0,120,1 OK
Read	AT+ULOC?	+ULOC: <mode>,<sensor>,<response_type>,<timeout>,<accuracy>,<num_hypotesis> OK	+ULOC: 2,3,1,0,20,0 OK
Test	AT+ULOC=?	+ULOC: (list of supported <mode>s),(list of supported <sensor>s),(list of supported <response_type>s),(list of supported <timeout>s),(list of supported <accuracy>s),(list of supported <num_hypotesis>s) OK	+ULOC: (0-2),(0-3),(0-2),(1-999),(1-999999),(1-16) OK
URC		**If <response_type>=0:** +UULOC: <date>,<time>,<lat>,<long>,<alt>,<uncertainty>	+UULOC: 13/04/2011,09:54:51.000,45.6334520,13.0618620,49,1
		If <response_type>=1: +UULOC: <date>,<time>,<lat>,<long>,<alt>,<uncertainty>,<speed>,<direction>,<vertical_acc>,<sensor_used>,<SV_used>,<antenna_status>,<jamming_status>	+UULOC: 25/09/2013,10:13:29.000,45.7140971,13.7409172,266,17,0,0,18,1,6,3,9
		If <response_type>=2, <sensor_used>= 1 and <num_hypothesis>= N: +UULOC: <sol>,<num>,<sensor_used>,<date>,<time>,<lat>,<long>,<alt>,<uncertainty>,<speed>,<direction>,<vertical_acc>,<SV_used>,<antenna_status>,<jamming_status>	+UULOC: 1,2,1,08/04/2015,09:02:32.000,45.7141652,13.7410666,266,47,0,0,40,3,0,0
		If <response_type>=2, <sensor_used> = 2 and <num_hypothesis>= N: +UULOC: <sol>,<num>,<sensor_used>,<date>,<time>,<lat>,<long>,<alt>,<lat50>,<long50>,<major50>,<minor50>,<orientation50>,<confidence50>[,<lat95>,<long95>,<major95>,<minor95>,<orientation95>,<confidence95>]	+UULOC: 2,2,2,08/04/2015,09:02:19.000,45.7140665,13.7411681,0,45.7240260,13.7511276,113,10,0,50,45.7240260,13.7511276,143,41,0,95
		If <response_type>=2, <sensor_used>= 0:	+UULOC: 1,1,0,08/04/2015,09:03:45.000,45.7140290,13.7410695,0,32

Type	Syntax	Response	Example
		+UULOC: <sol>,<num>,<sensor_used>,<date>,<time>,<lat>,<long>,<alt>,<uncertainty>	

29.4.1.3 Defined values

Parameter	Type	Description
<mode>	Number	Allowed values: • 0: reserved • 1: reserved • 2: single shot position
<sensor>	Number	Sensor selection: it is possible to combine different sensors summing <sensor> values of the selected sensors: • 0: use the last fix in the internal database and stop the GNSS receiver • 1: use the GNSS receiver for localization • 2: use cellular CellLocate® location information
<response_type>	Number	Type of response: • 0: standard (single-hypothesis) response • 1: detailed (single-hypothesis) response • 2: multi-hypotheses response
<timeout>	Number	Timeout period in seconds (1 - 999)
<accuracy>	Number	Target accuracy in meters (1 - 999999)
<num_hypothesis>	Number	Maximum desired number of responses from CellLocate® (up to 16): multiple positions followed by their ellipsoidal uncertainties. This value has to be increased by 1 (GNSS solution) to get the maximum number of possible solutions. This optional parameter can be used only if <response_type>=2. The default value is 1.
<date>	String	GPS date[3] (DD/MM/YY) of the estimated position
<time>	String	GPS time[3] (hh:mm:ss.sss) of the estimated position
<lat>	String	Estimated latitude, in degrees
<long>	String	Estimated longitude, in degrees
<alt>	Number	Estimated altitude, in meters[4]
<uncertainty>	Number	Estimated 50% confidence level error, in meters (0 - 20000000)
<speed>	Number	Speed over ground m/s[4]
<direction>	Number	Course over ground in degree (0 deg - 360 deg)(4)
<vertical_acc>	Number	Vertical accuracy, in meters[4]
<sensor_used>	Number	Sensor used for the position calculation
<SV_used>	Number	Number of satellite used to calculate the position[4]
<sol>	Number	Solution index (between 1 and <num>)
<num>	Number	Total number of the available hypotheses (less than or equal to <num_hypothesis>)
<lat50>/<lat95>	String	Estimated latitude (50/95% confidence levels), in degrees
<long50>/<long95>	String	Estimated longitude (50/95% confidence levels), in degrees
<major50>/<major95>	Number	Semi-major axis of the ellipse (50/95% confidence levels), in meters
<minor50>/<minor95>	Number	Semi-minor axis of the ellipse (50/95% confidence levels), in meters
<orientation50>/<orientation95>	Number	Orientation of the ellipse (50/95% confidence levels), in degrees
<confidence50>/<confidence95>	Number	50/95% confidence levels, in percentage
<antenna_status>	Number	Antenna status (0 - 4)(4). For more details, see the u-blox GNSS receiver protocol specification
<jamming_status>	Number	Jamming status[4]. For more details, see the u-blox GNSS receiver protocol specification

[3] Coming either from the CellLocate® server or the GNSS receiver (GPS time)
[4] only for GNSS positioning, 0 in case of CellLocate®

29.4.1.4 Notes

- If AssistNow Online aiding data has been configured by means of the <aiding> parameter of +ULOCGNSS AT command, the +ULOC request using <sensor>=1 (GNSS receiver only) can provide a +UULOC URC reporting a CellLocate® solution (<sensor_used>=2). This can happen if:
  - a GNSS fix is not available.
  - the CellLocate® solution is more accurate (i.e. CellLocate® solution's uncertainty is better than the GNSS's one).
- If <sensor>=1 (use the GNSS receiver for localization), <response_type>=2 (multi-hypotheses response) is not supported.
- The <jamming_status> value must be ignored if the jamming is disabled through +ULOCGNSS command.
- The <date>, <time>, <lat>, <long> values are not enclosed in double quotes in the URC.

29.4.2 Localization information request status unsolicited indication +ULOCIND

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

29.4.2.1 Description

Configures sending of URCs from MT to TE in the case of +ULOC operations. The URC provides the result of the steps of an +ULOC operation.

29.4.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULOCIND=<mode>	OK	AT+ULOCIND=1 OK
Read	AT+ULOCIND?	+ULOCIND: <mode> OK	+ULOCIND: 1 OK
Test	AT+ULOCIND=?	+ULOCIND: (list of supported <mode>'s) OK	+ULOCIND: (0-1) OK
URC		+UULOCIND: <step>,<result> OK	+UULOCIND: 1,0 OK

29.4.2.3 Defined values

Parameter	Type	Description
<mode>	Number	URC configuration: • 0 (default value): disabled • 1: enabled
<step>	Number	Informs the user about the operation in progress: • 0: network scan start • 1: network scan end • 2: requesting data to the server • 3: received data from the server • 4: sending feedback to the server
<result>	Number	Represents the result of the aiding operation: • 0: no error • 1: wrong URL • 2: HTTP error • 3: create socket error • 4: close socket error • 5: write to socket error • 6: read from socket error • 7: connection/DNS error

Parameter	Type	Description
		• 8: authentication token missing or wrong (required for aiding for u-blox M8 and future versions) • 9: generic error • 10: user terminated • 11: no data from server

29.4.2.4 Notes

LARA-R6

- The command setting is not stored in the NVM.

29.4.3 Specify the device autonomous solution +ULOCAID

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

29.4.3.1 Description

The user has the possibility to specify its state (position and velocity) at a given time to select one of the multi-hypothesis provided in the previous +ULOC request (<sol> parameter) or to insert a location estimate provided by other sensors. These information will be sent to the server with the next +ULOC command.

This command influences the amount of data exchanged with the server.

If the parameters of the autonomous solution have to be specified (<index> = 0), the RTC time must have a correct value prior to using the +ULOCAID command.

Speed and direction parameters can be inserted (optionally) also if one of the multi-hypotheses has been selected (<index> > 0). Default values are those contained in the hypothesis selected (equal to 0 for CellLocate® solutions).

29.4.3.2 Syntax

Type	Syntax	Response	Example
Location estimate from other sensors			
Set	AT+ULOCAID=0,<date>,<time>,<lat>,<long>,<major>,<minor>,<orientation>[,<speed>,<direction>]	OK	AT+ULOCAID=0,"10/03/2015","11:37:32.000","45.23456","11.12345",1300,789,34,34,121 OK
Read	AT+ULOCAID?	+ULOCAID: <index>,<date>,<time>,<lat>,<long>,<major>,<minor>,<orientation>[,<speed>,<direction>] OK	If <speed> and <direction> set: +ULOCAID: 0,"10/03/2015","11:37:32.000","45.23456","11.12345",1300,789,34,34,121 OK
			If <speed> and <direction> unknown: +ULOCAID: 0,"10/03/2015","11:37:32.000","45.23456","11.12345",1300,789,34 OK
Location estimate from hypothesis selected (<index> greater than 0)			
Set	AT+ULOCAID=<index>[,,,,,,,,<speed>,<direction>]	OK	If <speed> and <direction> unknown: AT+ULOCAID=1 OK
			If <speed> and <direction> set: AT+ULOCAID=1,,,,,,,,34,121 OK

Type	Syntax	Response	Example
Read	AT+ULOCAID?	+ULOCAID: <index>,<date>,<time>,<lat>,<long>,<major>,<minor>,<orientation>[,<speed>,<direction>] OK	If <speed> and <direction> unknown: +ULOCAID: 1,"0/0/0","0:0:0.000","0.0000000","0.0000000",0,0,0 OK
			If <speed> and <direction> set: +ULOCAID: 1,"0/0/0","0:0:0.000","0.0000000","0.0000000",0,34,121 OK
Test	AT+ULOCAID=?	+ULOCAID: (list of supported <index>s),(list of supported <date>s),(list of supported <time>),(list of supported <lat>),(list of supported <long>),(list of supported <major>),(list of supported <minor>),(list of supported <orientation>),(list of supported <speed>s),(list of supported <direction>s) OK	+ULOCAID: (0-17),"","","","",(0-6300000),(0-6300000),(0-179),(0-255),(0-359) OK

29.4.3.3 Defined values

Parameter	Type	Description
<index>	Number	Multi-hypotesis index: • 0: location estimate from other sensors (following fields are used) • n: index of the previous CellLocate® solution
<date>	String	Date (DD/MM/YY) of the estimated position.
<time>	String	Time (hh:mm:ss.sss) of the estimated position.
<lat>	String	Estimated latitude expressed in degrees.
<long>	String	Estimated longitude expressed in degrees.
<major>	Number	Semi-major axis of the uncertainty ellipse in meters.
<minor>	Number	Semi-minor axis of the uncertainty ellipse in meters.
<orientation>	Number	Orientation of the semi-major axis of the ellipse in degrees.
<speed>	Number	Estimated speed in meters per second. Default value is 0.
<direction>	Number	Direction of the motion in degrees. Default value is 0.

29.4.4 GNSS sensor configuration +ULOCGNSS

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

29.4.4.1 Description

Configures the GNSS sensor that can be used with the +ULOC AT command.

29.4.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULOCGNSS=<aiding>[,<psv_mode>[,<minSV>[,<minCNO>[,<ini_3d_fix>[,<staticHoldMode>[,<SBAS>[,<jamming>[,<antenna>[,<BBthreshold>[,<CWthreshold>[,<GNSS_system>[,<reserved1>[,<reserved2>]]]]]]]]]]]]]	OK	AT+ULOCGNSS=15 OK
Read	AT+ULOCGNSS?	+ULOCGNSS: <aiding>,<psv_mode>,<minSV>,<minCNO>,<ini_3d_fix>,<staticHoldMode>,	+ULOCGNSS: 15,1,6,8,0,1,1,1,1,1,1,0,0,0 OK

Type	Syntax	Response	Example
		<SBAS>,<jamming>,<antenna>, <BBthreshold>,<CWthreshold>, <GNSS_system>,<reserved1>, <reserved2> OK	
Test	AT+ULOCGNSS=?	+ULOCGNSS: (list of supported <aiding>),(list of supported <psv_mode>),(list of supported <minSV>), (list of supported <minCNO>),(list of supported <ini_3d_fix>),(list of supported <staticHoldMode>), (list of supported <SBAS>),(list of supported <jamming>),(list of supported <antenna>),(list of supported <BBthreshold>),(list of supported <CWthreshold>),(list of supported <GNSS_system>),(0),(0) OK	+ULOCGNSS: (0-15),(0-1),(3-32),(0-50),(0-1),(0-255),(0-1),(0-1),(0-2),(0-15),(0-31),(1-127),(0),(0) OK

29.4.4.3 Defined values

Parameter	Type	Description
<aiding>	Number	GNSS aiding mode configuration; it is possible the combination of different aiding modes: to enable more aiding modes it is needed to sum the <mode> value of the interested aiding modes: • 1: local aiding (including RTC sharing) • 2: AssistNow Offline • 4: AssistNow Online • 8: AssistNow Autonomous All the modes (15) are enabled as a factory programmed setting.
<psv_mode>	Number	Power Save Mode (UBX-CFG-RXM): • 0 (factory-programmed value): disabled • 1: enabled
<minSV>	Number	• Minimum number of satellites for navigation (UBX-CFG-NAVX5). The range goes from 3 to 32. (factory-programmed value: 3)
<minCNO>	Number	• Minimum satellite signal level for navigation (UBX-CFG-NAVX5). The range goes from 0 to 50. (factory-programmed value: 7)
<ini_3d_fix>	Number	Initial Fix must be 3D flag (UBX-CFG-NAVX5): • 0 (factory-programmed value): disabled • 1: enabled
<staticHoldMode>	Number	Static Hold Mode (UBX-CFG-NAV5). The range goes from 0 to 255 cm/s. (factory-programmed value: 0). If the parameter is omitted, the Static Hold Mode threshold will not be configured to GNSS.
<SBAS>	Number	SBAS configuration: • 0 (factory-programmed value): disabled • 1: enabled
<jamming>	Number	Jamming indicator (UBX-CFG-ITFM): • 0 (factory-programmed value): disabled • 1: enabled
<antenna>	Number	Antenna setting: • 0 (factory-programmed value): unknown • 1: passive • 2: active
<BBthreshold>	Number	Broadband jamming detection threshold (dB) (UBX-CFG- ITFM). The range goes from 0 to 15. (factory-programmed value: 0)
<CWthreshold>	Number	Continuous wave jamming detection threshold (dB) (UBX-CFG- ITFM). The range goes from 0 to 31. (factory-programmed value: 0)
<GNSS_systems>	Number	Bitmask for combining the supported GNSS types; the parameter is optional and the allowed values can be combined together (e.g. 3 means GPS+SBAS):

Parameter	Type	Description
		• 1 (factory-programmed value): GPS • 2: SBAS • 4: Galileo • 8: BeiDou • 16: IMES • 32: QZSS • 64: GLONASS
<Reserved1>	Number	0 (reserved value)
<Reserved2>	Number	0 (reserved value)

29.4.4.4 Notes

- To enable SBAS system opportunely configure both <SBAS> and <GNSS_systems> parameters.
- If a parameter is omitted, the current set value is kept.
- For more details on parameter description see the corresponding u-blox-GNSS receiver description.

29.4.5 Configure cellular location sensor (CellLocate®) +ULOCCELL

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

29.4.5.1 Description

Configures the cellular location sensor (CellLocate®) used with the +ULOC command.

☞ This command influences the amount of data exchanged with the server.

☞ LARA-R6001D
The deep scan (<scan_mode>=1) is not supported in UTRAN RAT mode.

29.4.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULOCCELL=<scan_mode>[,<reserved1>[,<reserved2>[,<reserved3>[,<reserved4>[,<reserved5>]]]]]	OK	AT+ULOCCELL=0 OK
Read	AT+ULOCCELL?	+ULOCCELL: <scan_mode>,<reserved1>,<reserved2>,<reserved3>,<reserved4>,<reserved5> OK	+ULOCCELL: 0,0,"","",0,0 OK
Test	AT+ULOCCELL=?	+ULOCCELL: (list of supported <scan_mode>s),(list of supported <reserved1>),(list of supported <reserved2>),(list of supported <reserved3>),(list of supported <reserved4>),(list of supported <reserved5>) OK	+ULOCCELL: (0-1),(0),"","",(0),(0) OK

29.4.5.3 Defined values

Parameter	Type	Description
<scan_mode>	Number	Network scan mode: • 0 (factory-programmed value): normal • 1: deep scan
<reserved1>	Number	RFU
<reserved2>	String	RFU
<reserved3>	String	"" (reserved value)
<reserved4>	Number	0 (reserved value)

Parameter	Type	Description
<reserved5>	Number	0 (reserved value)

29.4.5.4 Notes

LARA-R6

- It is temporarily not possible to perform a network scan via the AT+COPS=? command when a location information +ULOC request is ongoing and the deep scan (<scan_mode>=1) has been enabled.
- The location information +ULOC request may be performed with the normal scan mode (<scan_mode>=0) despite the deep scan mode (<scan_mode>=1) has been set when jamming detection, enabled via the AT+UJAD=1 AT command, is active.
- When the deep scan (<scan_mode>=1) is enabled its accuracy is affected by any simultaneous +UCFSCAN cell full scan request.

30 DTMF

30.1 In-band DTMF and Contact ID tones detection +UDTMFCFG

+UDTMFCFG						
Modules	LARA-R6001 LARA-R6401 LARA-R6801					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

30.1.1 Description

Allows to:

- Enable/disable the DTMF detector and the related URCs for the current AT terminal
- Configure the DTMF detector
- Enable/disable the Contact ID (CID) detector
- Enable/disable the BURST detection mode
- Enable/disable support for RTP DTMF events
- Enable/disable DTMF regeneration
- Enable/disable the PCM recording on GNSS binary port
- Enable/disable URCs

During a voice call, the DTMF detector recognizes the presence of DTMF tones in the RX voice channel. The tones are generated by remote party e.g. digit press on a DTMF keypad. The +UUDTMFD URC returns the recognized DTMF digits (set {0-9,#,*A,B,C,D}), also the received RTP DTMF digits in VoLTE. The DTMF detection algorithm can be chosen between the legacy and MODA which has the capability of decoding 50 ms tones with low bit rate NB AMR codecs.

During a voice call, the CID detector recognizes the presence of a handshake sequence tone (HS) or a kiss off tone (KO) in the RX voice channel. The +UUDTMFD URC returns the recognized CID tone(set {H,K}), according to Ademco Contact ID protocol.

During a voice call, the BURST detection mode outputs, with a single URC, a burst of contiguous tones. To output a collection of DTMF digits it uses a DTMF detector therefore it must be enabled.

The DTMF engine is started and stopped automatically at call setup/call drop respectively. URCs are issued at any DTMF digit or CID tone sequence detection on the current AT terminal by default. Furthermore this command can be used to enable/disable the URCs on the current AT terminal. The CID detector allows, together with MODA and BURST, to implement the Contact ID protocol.

The PCM can be recorded on the file system through the GNSS binary port.

The RTP DTMF support can be enabled/disabled for VoLTE calls. If the support is disabled, any sent or received DTMF event will be transmitted as an in-band audio tone.

The DTMF regeneration generates DTMF tones for local playback on loudspeaker at the RTP DTMF event detection.

The URC indication issued when a DTMF digit is detected can show only the DTMF digit (+UUDTMFD: <DTMF_digit>) or the DTMF digit followed by the method used by the network to delivery the DTMF or the DTMF digit followed by the method used by the network to delivery the DTMF and the tone duration for RTP DTMF tones (+UUDTMFD: <DTMF_digit>,<event_info>), according to the <urc_mode> parameter configuration.

☞ **QUICK START for DTMF detection:** AT+UDTMFCFG="algo","moda".

☞ Issue the enabling command for the DTMF decoder, CID decoder and recorder before the call setup, otherwise the detectors and the recorder are not started and the command immediately provides the +UUDTMFDE: 2 URC.

☞ A direct switch between MODA and legacy algorithm is not allowed. To enable one of the DTMF detection algorithms, the other one must be already disabled.

☞ The <smart_decoder> parameter optimizes the DTMF detection performance with respect to the used codec/codec bit rate. When enabled the value of the immunity set from the AT interface is not applied.

☞ The BURST detection mode can be enabled and configured in any state.

☞ For the complete description of the DTMF detection functionality, see the corresponding module audio application note.

30.1.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UDTMFCFG=<op_name>[,<param1>[,<param2>[,<param3>[,<param4>[,<param5>[,<param6>][,<param7>[,<param8>[,<param9>[,<param10>[,<param11>[,<param12>[,<param13>[,<param14>[,<param15>]]]]]]]]]]]]]]	OK	AT+UDTMFCFG="algo","moda" OK
Test	AT+UDTMFCFG=?	+UDTMFCFG: "algo",(list of supported <algo_type>s) +UDTMFCFG: "moda",(list of supported <scale_cfg>s),(list of supported <threshold>s),(list of supported <immunity>s),(list of supported <tone_length>s),(list of supported <pause_length>s),(list of supported <moda_thr>s),(list of supported <vsc_thr>s),(list of supported <not_moda_thr>s),(list of supported <not_vsc>s),(list of supported <ov_add_factor>s),(list of supported <immunity_dtmf_bank>s),(list of supported <sd_cfg>s),(list of supported <smart_decoder>s) +UDTMFCFG: "legacy",(list of supported <mode>s),(list of supported <scale_cfg>s),(list of supported <threshold>s),(list of supported <immunity>s),(list of supported <max_int>s),(list of supported <sd_cfg>s),(list of supported <immunity_dtmf_bank>s) +UDTMFCFG: "urc",(list of supported <urc_mode>s) +UDTMFCFG: "record",(list of supported <enable_record>s) +UDTMFCFG: "cid",(list of supported <cid_algo>s) +UDTMFCFG: "cidthr",(list of supported <thr>s) +UDTMFCFG: "burst",(list of supported <burst_mode>s),(list of supported <timeout>s) +UDTMFCFG: "rtp",(list of supported <enable_rtp>s) +UDTMFCFG: "regen",(list of supported <enable_regen>s) OK	+UDTMFCFG: "algo",("moda","legacy","off") +UDTMFCFG: "moda",(0-15),(100-10000),(0-20),(0-100),(0-100),(0-100),(0-100),(0-100),(0-100),(0-100),(0-20),(0-6),(0,1) +UDTMFCFG: "legacy",(0-10),(0-15),(100-10000),(0-20),(0-255),(0-6),(0-20) +UDTMFCFG: "urc",(0-2) +UDTMFCFG: "record",(0-1) +UDTMFCFG: "cid",(0-3) +UDTMFCFG: "cidthr",(0-100000) +UDTMFCFG: "burst",(0-16),(0-32767) +UDTMFCFG: "rtp",(0-1) +UDTMFCFG: "regen",(0-1) OK

Type	Syntax	Response	Example
URC		+UUDTMFD: <DTMF_digit>[,<event_info>]	+UUDTMFD: #,1
URC		+UUDTMFD: <CID>	+UUDTMFD: H
URC		+UUDTMFD: <burst>	+UUDTMFD: 1234567890
URC		+UUDTMFDE: <errid>	+UUDTMFDE: 1
Algorithm selection/enable			
Set	AT+UDTMFCFG="algo",<algo_type>	OK	AT+UDTMFCFG="algo","moda" OK
Read	AT+UDTMFCFG="algo"	+UDTMFCFG: "algo",<algo_type> OK	+UDTMFCFG: "algo","moda" OK
MODA algorithm configuration			
Set	AT+UDTMFCFG="moda"[,<scale_cfg>[,<threshold>[,<immunity>[,<tone_length>[,<pause_length>[,<moda_thr>[,<vsc_thr>[,<not_moda_thr>[,<not_vsc>[,<ov_add_factor>[,<immunity_dtmf_bank>[,<sd_cfg>[,<smart_decoder>]]]]]]]]]]]]	OK	AT+UDTMFCFG="moda",3,200,5,23,23,18,14,22,15,10,6,3,1 OK
Read	AT+UDTMFCFG="moda"	+UDTMFCFG: "moda",<scale_cfg>,<threshold>,<immunity>,<tone_length>,<pause_length>,<moda_thr>,<vsc_thr>,<not_moda_thr>,<not_vsc>,<ov_add_factor>,<immunity_dtmf_bank>,<sd_cfg>,<smart_decoder> OK	+UDTMFCFG: "moda",3,200,5,23,23,18,14,22,10,10,6,3,1 OK
Legacy algorithm configuration			
Set	AT+UDTMFCFG="legacy"[,<mode>[,<scale_cfg>[,<threshold>[,<immunity>[,<max_int>[,<sd_cfg>[,<immunity_dtmf_bank>]]]]]]]	OK	AT+UDTMFCFG="legacy",3,800,5,2,3,6 OK
Read	AT+UDTMFCFG= "legacy"	+UDTMFCFG: "legacy",<mode>,<scale_cfg>,<threshold>,<immunity>,<max_int>,<sd_cfg>,<immunity_dtmf_bank>,<att> OK	+UDTMFCFG: "legacy",3,800,5,2,3,6,3 OK
Speech discriminator algorithm configuration			
Set	AT+UDTMFCFG="sd",<sd_algo_type>[,<dft_thr200>[,<dft_thr270>[,<dft_thr330>[,<dft_thr375>[,<dft_thr437>[,<dft_thr500>[,<dft_thr545>[,<dft_thr1000>[,<dft_thr50>[,<ar>[,<af>[,<aLf>[,<aLr>[,<ppl>]]]]]]]]]]]]]	OK	AT+UDTMFCFG="sd","moda",20,15,14,12,8,6,5,-2,15,0,30000,0,32750,3 OK
Read	AT+UDTMFCFG="sd",<sd_algo_type>	+UDTMFCFG: "sd",<sd_algo_type>,<dft_thr200>,<dft_thr270>,<dft_thr330>,<dft_thr375>,<dft_thr437>,<dft_thr500>,<dft_thr545>,<dft_thr1000>,<dft_thr50>,<ar>,<af>,<aLf>,<aLr>,<ppl> OK	+UDTMFCFG: "sd","moda",20,15,14,12,8,6,5,-2,15,0,30000,0,32750,3 OK
CID			
Set	AT+UDTMFCFG="cid",<cid_algo>	OK	AT+UDTMFCFG="cid",3 OK
Read	AT+UDTMFCFG="cid"	+UDTMFCFG: "cid",<cid_algo> OK	+UDTMFCFG: "cid",3 OK
CID threshold			
Set	AT+UDTMFCFG="cidthr",<thr>	OK	AT+UDTMFCFG="cidthr",1000

Type	Syntax	Response	Example
			OK
Read	AT+UDTMFCFG="cidthr"	+UDTMFCFG: "cidthr",<thr>	+UDTMFCFG: "cidthr",1000
		OK	OK
BURST			
Set	AT+UDTMFCFG="burst",<burst_mode>,<timeout>	OK	AT+UDTMFCFG="burst",16,140
			OK
Read	AT+UDTMFCFG="burst"	+UDTMFCFG: "burst",<burst_mode>,<timeout>	+UDTMFCFG: "burst",16,140
			OK
		OK	
RTP			
Set	AT+UDTMFCFG="rtp",<enable_rtp>	OK	AT+UDTMFCFG="rtp",1
			OK
Read	AT+UDTMFCFG="rtp"	+UDTMFCFG: "rtp",<enable_rtp>	+UDTMFCFG: "rtp",1
		OK	OK
DTMF regeneration			
Set	AT+UDTMFCFG="regen",<enable_regen>	OK	AT+UDTMFCFG="regen",1
			OK
Read	AT+UDTMFCFG="regen"	+UDTMFCFG: "regen",<enable_regen>	+UDTMFCFG: "regen",1
			OK
		OK	
PCM recording			
Set	AT+UDTMFCFG="record",<enable_record>	OK	AT+UDTMFCFG="record",1
			OK
Read	AT+UDTMFCFG="record"	+UDTMFCFG: "record",<enable_record>	+UDTMFCFG: "record",1
			OK
		OK	
URC enabling			
Set	AT+UDTMFCFG="urc",<urc_mode>	OK	AT+UDTMFCFG="urc",1
			OK
Read	AT+UDTMFCFG="urc"	+UDTMFCFG: "urc",<urc_mode>	+UDTMFCFG: "urc",1
		OK	OK

30.1.3 Defined values

Parameter	Type	Description
Common parameters		
<op_name>	String	Type of operation: • "algo": enables/selects the DTMF decoder • "moda": configures MODA detection algorithm • "legacy": configures legacy detection algorithm • "sd": configures the speech discriminator algorithm • "cid": enable/disable and configure the CID detector • "cidthr": set or get the threshold used by CID decoder • "rtp": enable/disable the support for RTP DTMF events • "regen": enable/disable the support for DTMF regeneration • "record": PCM recording on GNSS binary port • "urc": enables/disables URCs on the current AT terminal
<DTMF_digit>	String	Detected DTMF digits; from the set {0-9,#,*,A-D}
<event_info>	Number	Method used by the network to delivery the DTMF. Allowed values: • 0: DTMF has ben received as RTP event, RTP tone start • 1: DTMF has ben received as In-Band tone • 2: DTMF has ben received as RTP event, RTP tone stop

Parameter	Type	Description
		The parameter is returned only if <urc_mode>=2 or 3 (URCs with in band/RTP indication enabled).<event_type> = 2 is returned only if <urc_mode>=3 (URCs with in band/RTP and duration indications enabled).
<errid>	Number	DTMF error code: • 1: arithmetic overflow/DTMF detection failure • 2: enabling the algorithm during a call • 3: parallel enabling of algorithms • 4: RTP timeout • 5: RTP late
<scale_cfg>	Number	Attenuation applied on the signal at decoder input to manage arithmetic operations. The range goes from 0 to 15, 6 dB attenuation each step: • The factory-programmed value is 3 (18 dB attenuation)
<threshold>	Number	Threshold to detect DTMF tones. The range goes from 100 to 10000: • The factory-programmed value for <op_name>="moda" is 200. • The factory-programmed value for <op_name>="legacy" is 800.
<immunity>	Number	Speech immunity level. The higher the level, the higher the immunity to speech. The range goes from 0 (minimum immunity) to 20 (maximum immunity). • The factory-programmed value for <op_name>="moda" is 4. • The factory-programmed value for <op_name>="legacy" is 8.
<immunity_dtmf_bank>	Number	Speech immunity level in each DTMF bank. The higher the level, the higher the immunity to speech. The range goes from 0 (minimum immunity) to 20 (maximum immunity). The factory-programmed value is 6.
<sd_cfg>	Number	Enables/disables the speech discriminator (SD), the analysis of the stationarity (AS) and the noise reduction (NR) algorithms: • 0: SD disabled • 1: SD enabled / NR disabled • 2: SD enabled / NR enabled • 3: (factory-programmed value): SD enabled / NR enabled and configured • 4: SD and AS enabled / NR disabled • 5: SD and AS enabled / NR enabled • 6: SD and AS enabled / NR enabled and configured
Algorithm selection/enable		
<algo_type>	String	Identifies the detection algorithm: • "off" (factory-programmed value): DTMF detector disabled • "moda": MODA algorithm enabled • "legacy": legacy algorithm enabled • "default": default algorithm enabled
MODA configuration		
<tone_length>	Number	Size of the analysis window for the DTMF digit recognition. The range goes from 0 to 100. The factory-programmed value is 23. For real values of <tone_length>, see TOBY-R2 / LARA-R2 "03B" audio application note [43].
<pause_length>	Number	Size of the analysis window for the pause recognition. The range goes from 0 to 100 . The factory-programmed value is 23. For real values of <pause_length>, see TOBY-R2 / LARA-R2 "03B" audio application note [43].
<moda_thr>	Number	Number of equal elements required in the tone analysis window. The range goes from 0 to 100. The factory-programmed value is 18. For real values of <moda_thr>, see TOBY-R2 / LARA-R2 "03B" audio application note [43].
<vsc_thr>	Number	Number of valid elements required in the tone analysis window. The range goes from 0 to 100. The factory-programmed value is 14. For real values of <vsc_thr>, see TOBY-R2 / LARA-R2 "03B" audio application note [43].
<not_moda_thr>	Number	Number of equal elements required in the pause analysis window. The range goes from 0 to 100. The factory-programmed value is 22. For real values of <not_moda_thr>, see TOBY-R2 / LARA-R2 "03B" audio application note [43].
<not_vsc_thr>	Number	Number of valid elements required in the pause analysis window. The range goes from 0 to 100. The factory-programmed value is 15. For real values of <not_vsc_thr>, see TOBY-R2 / LARA-R2 "03B" audio application note [43].
<ov_add_factor>	Number	Sliding window parameter. The range goes from 0 to 100. The factory-programmed value is 10. For real values of <ov_add_factor>, see TOBY-R2 / LARA-R2 "03B" audio application note [43].
<smart_decoder>	Number	Enable/disable the smart decoder. Allowed values:

Parameter	Type	Description
		• 0: disabled • 1 (factory-programmed value): enabled
Legacy configuration		
<mode>	Number	DTMF detector configuration: • 0: disabled • 1: not supported • 2 (factory-programmed value): configuration for short tones • 3: configuration for long tones • 4-10: reserved
<max_int>	Number	Maximum interruption that a detected DTMF tone may have, such that it is still interpreted as a single digit. In multiples of 20 ms; the range goes from 1 to 255. The factory-programmed value is 2 (40 ms).
<att>	Number	Actual attenuation applied on the signal at decoder input. The starting value is <scale_cfg>. If an arithmetic overflow occurs, it is automatically increased.
SD configuration		
<sd_algo_type>	String	Configuration for the selected detection algorithm: • "moda": MODA algorithm selected • "legacy": legacy algorithm selected
<dft_thr200>	Number	Immunity applied to the first SD filter. The range goes from 0 to 32767. The factory-programmed value is 20.
<dft_thr270>	Number	Immunity applied to the second SD filter. The range goes from 0 to 32767. The factory-programmed value is 15.
<dft_thr330>	Number	Immunity applied to the third SD filter. The range goes from 0 to 32767. The factory-programmed value is 14.
<dft_thr375>	Number	Immunity applied to the fourth SD filter. The range goes from 0 to 32767. The factory-programmed value is 12.
<dft_thr437>	Number	Immunity applied to the fifth SD filter. The range goes from 0 to 32767. The factory-programmed value is 8.
<dft_thr500>	Number	Immunity applied to the sixth SD filter. The range goes from 0 to 32767. The factory-programmed value is 6.
<dft_thr545>	Number	Immunity applied to the seventh SD filter. The range goes from 0 to 32767. The factory-programmed value is 5.
<dft_thr1000>	Number	Immunity applied to the eighth SD filter. The range goes from 0 to 32767. The factory-programmed value is -2.
<dft_thr50>	Number	Immunity applied to the nineth SD filter. The range goes from 0 to 32767. The factory-programmed value is 15.
<ar>	Number	Alpha rising parameter. The range goes from 0 to 32767. The factory-programmed value is 0.
<af>	Number	Alpha falling parameter. The range goes from 0 to 32767. The factory-programmed value is 30000 for MODA and 12055 for legacy.
<aLf>	Number	Alpha falling parameter for long term estimation. The range goes from 0 to 32767. The factory-programmed value is 0.
<aLr>	Number	Alpha rising parameter for long term estimation. The range goes from 0 to 32767. The factory-programmed value is 32750 for MODA and 32604 for legacy.
<ppl>	Number	Parameter for the analysis of the stationarity. The range goes from 0 to 32767. The factory-programmed value is 3.
CID		
<cid_algo>	Number	Configure CID detector: • 0 (factory-programmed value): CID disabled • 1: HS detector enabled • 2: KO detector enabled • 3: HS + KO detector enabled
CID threshold		
<thr>	Number	Threshold to detect CID sequences. The range goes from 0 to 100000. • The factory-programmed value is 1000.
BURST		
<burst_mode>	Number	Number of minimum expected contiguous tones to output a burst: • The range goes from 0 to 16. If 0 it disables the burst mode.

Parameter	Type	Description
<timeout>	Number	Configures the wait period for next contiguous tone. It shall be set as expected tone duration + expected gap + some lag e.g. 40 ms: • The range goes from 0 to 32767.
RTP		
<enable_rtp>	Number	Enables/disables RTP DTMF support: • 0: disabled • 1 (factory-programmed value): enabled
DTMF regeneration		
<enable_regen>	Number	Enables/disables DTMF regeneration: • 0 (factory-programmed value): disabled • 1: enabled
PCM recording		
<enable_record>	Number	Enables/disables recording: • 0 (factory-programmed value): recording disabled • 1: recording enabled
URC enabling		
<urc_mode>	Number	Enables/disables URCs: • 0: URCs disabled • 1: URCs enabled • 2 (factory-programmed value): URCs with in band/RTP indication enabled • 3: URCs with in band/RTP and duration indications enabled

30.1.4 Notes

- The factory-programmed value of command parameters is set at each module start up.
- If the optional parameters are omitted the settings are left unchanged.

LARA-R6001 / LARA-R6401 / LARA-R6801

- Only the DTMF decoder (<op_name>="algo"), enable/disable URCs (<op_name>="urc") and the regenerator (<op_name>="regen") are supported.
- <algo_type>="moda" and <algo_type>="legacy" are not supported.
- <algo_type>="default" can be issued during any call state.
- <op_name>="rtp" is not supported. The RTP DTMF support is enabled by default for VoLTE calls and cannot be disabled.
- +UUDTMFDE: 2 and +UUDTMFDE: 3 are not issued.

31 I²C

31.1 Introduction

The I²C AT commands support communication with more than one connected device via one of the controllers, but require opening and closing a logical channel for each connected device. Only one logical channel at a time can be opened.

☞ The availability and hardware description of the I²C interfaces are out of the scope of this document and are described in a separate document. Refer to the corresponding module System Integration Manual.

The procedure for communicating with two different devices is:

- Open the logical channel for device1 (with AT+UI2CO)
- Read/write to/from device1 (with AT+UI2CR, AT+UI2CW and +UI2CREGR)
- Close the logical channel for device1 (with AT+UI2CC)
- Open the logical channel for device2 (with AT+UI2CO)
- Read/write to/from device2 (with AT+UI2CR, AT+UI2CW and +UI2CREGR)
- Close the logical channel for device2 (with AT+UI2CC)

Once the controller has been configured, it is possible to start I²C communication (read/write) with I²C slave peripherals.

☞ The I²C controllers available on the u-blox cellular modules module work only in Master Mode so they can be connected to slave devices only.

☞ In case of a controller/device malfunction, the command's response is only "ERROR".

31.2 I²C open logical channel +UI2CO

+UI2CO						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

31.2.1 Description

Changes the hardware and logical configuration of the selected I²C controller.

It is only possible to configure the I²C controller in Master Mode.

This command selects:

- The controller available in the u-blox cellular module
- The bus mode type
- The bit rate
- The address size (7-10 bit address)
- The slave device address

Once the selected controller has been configured, a logical channel between it and the selected slave device is set up and there is no need to further specify it. All the following I²C write, read and close commands refer to the currently opened logical channel. It is not possible to use the I²C write, read and open commands for writing or reading to/from a different slave device without first closing the I²C logical channel.

31.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UI2CO=<I2C_controller_number>,<bus_mode>,<bit_rate>,<device_address>,<address_width>	OK	AT+UI2CO=1,0,0,0x42,0 OK
Test	AT+UI2CO=?	+UI2CO: (list of supported <I2C_controller_number>s),(list of supported <bus_mode>s),(list of	+UI2CO: (1),(0-1),(0-1),(0x000-0x3FF),(0-1) OK

Type	Syntax	Response	Example
		supported <bit_rate>),(<device_ address> range),(list of supported <address_width>s) OK	

31.2.3 Defined values

Parameter	Type	Description
<I2C_controller_ number>	Number	I^2C HW controller to use: • 1: controller 1
<bus_mode>	Number	I^2C bus mode type: • 0: Bus Mode Standard (0 - 100 kbaud) • 1: Bus Mode Fast (0 - 400 kbaud)
<bit_rate>	Number	I^2C bit rate: • 0: 100 kb/s • 1: 400 kb/s
<device_address>	Hex number	Device address in HEX format • LARA-R6 - The range goes from 0x00 to 0x7F.
<address_width>	Number	I^2C size of the controller address: • 0: 7 bit address • 1: 10 bit address

31.3 I^2C write to peripheral +UI2CW

+UI2CW						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

31.3.1 Description

Writes the HEX data to the I^2C slave device of the current logical channel. The HEX data formats are without 0x prefix (see example).

31.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UI2CW=<hex_data>,<nof_byte_ to_write>	OK	AT+UI2CW="0011AABBCCDDEEFF", 8 OK
Test	AT+UI2CW=?	+UI2CW: (byte to write),(range of supported <nof_byte_to_write>) OK	+UI2CW: "data", (1-100) OK

31.3.3 Defined values

Parameter	Type	Description
<hex_data>	String	Hex data sequence without prefix 0x, enclosed in double quotes, to be written to the I^2C slave device
<nof_bytes_to_ write>	Number	Number of byte to write to the slave I^2C device. Range: 1-100

31.4 I²C read from peripheral +UI2CR

+UI2CR						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

31.4.1 Description

Reads <nof_bytes_to_read> of data from the I²C slave device of the current logical channel and prints them in HEX format in separate rows.

31.4.2 Syntax

Type	Syntax	Response	Example
Read	AT+UI2CR=<nof_bytes_to_read>	+UI2CR: <index_1>: <byte_1> [+UI2CR: <index_n>: <byte_n> [..]] OK	AT+UI2CR=3 +UI2CR: 0: 0xA3 +UI2CR: 1: 0x0F +UI2CR: 2: 0xDB OK
Test	AT+UI2CR=?	+UI2CR: (list of supported <nof_byte_to_read>s) OK	+UI2CR: (1-100) OK

31.4.3 Defined values

Parameter	Type	Description
<nof_bytes_to_read>	Number	Number of bytes to read from the slave I²C device: • LARA-R6 - The range goes from 1 to 100.
<index1>,...,<index_n>	Number	Index of the byte being printed.
<byte_1>,...,<byte_n>	Number	n-th byte of the data, in hex mode (unquoted, prefixed by 0x).

31.5 I²C read from peripheral register +UI2CREGR

+UI2CREGR						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

31.5.1 Description

Reads <nof_bytes_to_read> of data from the slave register of the I²C slave device of the current logical channel and prints them in HEX format in separate rows.

31.5.2 Syntax

Type	Syntax	Response	Example
Read	AT+UI2CREGR=<register_address>,<nof_bytes_to_read>	+UI2CREGR: <index_1>: <byte_1> [+UI2CREGR: <index_n>: <byte_n> [..]] OK	AT+UI2CREGR=0x42,3 +UI2CREGR: 0: 0xA3 +UI2CREGR: 1: 0x0F +UI2CREGR: 2: 0xDB OK
Test	AT+UI2CREGR=?	+UI2CREGR: (list of supported <register_address>s),(list of supported <nof_bytes_to_read>s) OK	+UI2CREGR: (0x00-0xFF),(1-100) OK

31.5.3 Defined values

Parameter	Type	Description
<register_address>	Number	Device address in HEX format
<nof_bytes_to_read>	Number	Number of bytes to read from the slave I²C register. • LARA-R6 - The range goes from 1 to 100.
<index1>,...,<index_n>	Number	Index of the byte being printed.
<byte_1>,...,<byte_n>	Number	n-th byte of the data, in hex mode (unquoted, prefixed by 0x).

31.6 I²C close logical channel +UI2CC

+UI2CC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

31.6.1 Description

Closes the I²C logical channel being used.

☞ The logical channel must be closed before opening a new one.

31.6.2 Syntax

Type	Syntax	Response	Example
Action	AT+UI2CC	OK	AT+UI2CC OK
Test	AT+UI2CC=?	OK	OK

31.6.3 Notes

LARA-R6

- The AT+UI2CC command automatically discards any input parameter (e.g. AT+UI2CC=123 is equivalent to AT+UI2CC).

32 Networking

32.1 Get the USB IP configuration +UIPADDR

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

32.1.1 Description

Returns the current USB IP configuration for the requested active <cid> based on the current networking mode (for more details, see the System networking modes section). If the <cid> parameter is omitted, the information text response will display all the active <cid>s.

The module does not create any virtual interface for an active IPv6 <cid> in bridge mode. The IPv6 configuration session is performed between the DTE and the network. In this case the <cid> will not be reported as configured.

LARA-R6
The bridge mode is not supported.

32.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+UIPADDR=[<cid>]	+UIPADDR: <cid>,<if_name>,<ipv4_address>,<subnet_mask>,<ipv6_global_address>[,<ipv6_link_local_address>][,<ipv4_primary_dns>,<ipv4_secondary_dns>,<ipv6_primary_dns>,<ipv6_secondary_dns>] [...] OK	See Examples
Test	AT+UIPADDR=?	+UIPADDR: (list of <cid>'s active virtual device) OK	+UIPADDR: 1,2 OK

32.1.3 Defined values

Parameter	Type	Description
<cid>	Number	Specifies the active PDP context. By default the active <cid> is reported. If the <cid> parameter is omitted, all the active <cid>s are reported.For the parameter range, see <cid>.
<if_name>	String	Interface name. For more details on interface nomenclature, see Notes.
<ipv4_address>	String	IPv4 address of the interface. The IPv4 address consists of 4 octets: "ddd.ddd.ddd.ddd". The default value is "192.168.1.1".
<subnet_mask>	String	The subnet mask consists of 4 octets: "ddd.ddd.ddd.ddd". The default value is "255.255.255.0".
<ipv6_global_address>	String	Global IPv6 address of the interface. It consists of 8 groups of four hexadecimal digits representing 2 octets. The groups are separated by colons. Leading zero suppression and zero compression maybe applied. The network prefix is written in CIDR notation, by appending a slash and the needed decimal digits to the IPv6 address.
<ipv6_link_local_address>	String	Link Local IPv6 address of the interface. It consists of 8 groups of four hexadecimal digits representing 2 octets. The groups are separated by colons. Leading zero suppression and zero compression maybe applied. The network prefix is written in CIDR notation, by appending a slash and the needed decimal digits to the IPv6 address.
<ipv4_primary_dns>	String	IPv4 address of primary DNS used by the interface. The IPv4 address consists of 4 octets: "ddd.ddd.ddd.ddd".

Parameter	Type	Description
<ipv4_secondary_dns>	String	IPv4 address of secondary DNS used by the interface. The IPv4 address consists of 4 octets: "ddd.ddd.ddd.ddd".
<ipv6_primary_dns>	String	IPv6 address of primary DNS used by the interface. It consists of 8 groups of four hexadecimal digits representing 2 octets. The groups are separated by colons. Leading zero suppression and zero compression maybe applied. The network prefix is written in CIDR notation, by appending a slash and the needed decimal digits to the IPv6 address.
<ipv6_secondary_dns>	String	IPv6 address of secondary DNS used by the interface. It consists of 8 groups of four hexadecimal digits representing 2 octets. The groups are separated by colons. Leading zero suppression and zero compression maybe applied. The network prefix is written in CIDR notation, by appending a slash and the needed decimal digits to the IPv6 address.

32.1.4 Notes

- If the requested <cid> is not active the command will reply with an error result code.

LARA-R6

- The <cid> parameter is mandatory.
- The <ipv6_link_local_address> parameter is not supported.
- In the **router mode** the interface name (see the <if_name> parameter) is "app_net(x)", where:
  - The "app_net(x)" is the name of the network interface mapped to an activated CID.
  - The x parameter is in the range from 1 to 24.
  - Example: "app_net1" interface is mapped to the PDP context with CID 1.

32.1.5 Examples

LARA-R6

Description	Command	Response
Router mode (IPv4 context)	AT+UIPADDR=1	+UIPADDR: 1,"app_net1","192.168.21.1","255.255.255.0","","185.215.195.114","185.215.195.115","",""
		OK
Router mode (IPv6 context)	AT+UIPADDR=1	+UIPADDR: 1,"app_net1","","","2A0B:AD40:1:1044:15E3:6CD4:8B8C:84E2","","","2A0B:AD40:1:100::114",""
		OK
Router mode (IPv4v6 context)	AT+UIPADDR=1	+UIPADDR: 1,"app_net1","192.168.20.34","255.255.255.0","2A0B:AD40:1:1044:15E3:6CD4:8B8C:84E2","185.215.195.114","185.215.195.115","2A0B:AD40:1:100::114",""
		OK
Wrong CID	AT+UIPADDR=4	ERROR
Router mode (IPv4v6 context) (all contexts)	AT+UIPADDR=	+UIPADDR: 1,"app_net1","192.168.21.1","255.255.255.0","","185.215.195.114","185.215.195.115","",""
		+UIPADDR: 2,"app_net2","","","2A0B:AD40:1:1044:15E3:6CD4:8B8C:84E2","","","2A0B:AD40:1:100::114",""
		OK
Router mode (IPv4v6 context) (check active CID)	AT+UIPADDR=?	+UIPADDR: 1,2
		OK

32.2 Configure port filtering for embedded applications +UEMBPF

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

32.2.1 Description

Enables/disables port filtering to allow IP data traffic from embedded applications when a dial-up connection is active. When enabled, the application will pick source port inside the configured range and the incoming traffic to those ports will be directed to embedded application instead of PPP DTE.

Each set command overwrites the previous configuration. Only one port range can be configured.

When set command with <mode>=0 is issued, the parameter <port_range> shall not be inserted otherwise the command will return an error result code.

If <mode>=0 is configured, the read command will not return any range, but only +UEMBPF: 0 as information text response.

32.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+UEMBPF=<mode>[,<port_range>]	OK	AT+UEMBPF=1,"9999-19999;" OK
Read	AT+UEMBPF?	+UEMBPF: <mode>[,<port_range>] OK	+UEMBPF: 1,"9999-19999;" OK

32.2.3 Defined values

Parameter	Type	Description
<mode>	Number	Port filtering enable/disable: • 0: disable. The configured range is removed. • 1: enable. The <port_range> parameter is mandatory The factory-programmed value is: • LARA-R6 - 1
<port_range>	String	Dash-separated port range to be filtered, in format "max_port-min_port;". The max_port and min_port value goes from 1 to 65535. The factory-programmed value is: • LARA-R6 - "9999-19999;"

32.2.4 Examples

Command	Response	Description
AT+UEMBPF=1,"9999-19999;"	OK	Enabled ports from 9999 to 19999 to be used by embedded IP application.
AT+UEMBPF?	+UEMBPF: 1,"9999-19999;" OK	Read the configuration.
AT+UEMBPF=0	OK	Disable port filtering and removes the previously-saved port range.

33 Constrained Application Protocol (CoAP)

33.1 Introduction

The Constrained Application Protocol (CoAP) is a datagram-based client/server application protocol for devices on the constrained network (e.g. low overhead, low-power), designed to easily translate to HTTP for simplified integration with the web. CoAP clients can use the GET, PUT, POST and DELETE methods using requests and responses with a CoAP server.

The CoAP defines the application level Quality of Service (QoS), where requests and response messages may be marked as:

- **"Confirmable" (CON)**: the messages must be acknowledged by the receiver if successfully received.
- **"Non-confirmable" (NON)**: the messages are "fire and forget".

Supported components are:

- **CoAP-AT**: it can be used to send or receive messages (by means of +UCOAPC command) via CoAP.

LARA-R6
If not specified, the <cid> and the <preferred_protocol_type> parameters set by means of the +UDCONF=19 AT command are used.
See +CGACT AT command for activating a PDP context.

LARA-R6001D
If not specified the default CID (<cid>=1) is used. If not specified and the protocol type is IPv4v6, then the preferred protocol type is IPv4.
See +CGACT AT command for activating a PDP context.

33.2 CoAP profile configuration +UCOAP

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

33.2.1 Description

Configures, reads and resets the current profile parameters of the CoAP client. A set command for each <op_code> parameter must be issued to set each CoAP client profile parameter (CoAP server address, CoAP URI, CoAP PDU option mask).

To store in the NVM the configured CoAP client profile parameters issue the AT+UCOAP=6,<profile_number> command where the <profile_number> parameter is the profile number.

To initiate a TCP session, instead of UDP session, in CoAP, provide the "coap+tcp" scheme by means of the <COAP_URI> parameter.

To initiate the secure session in CoAP, provide the "coaps" or "coaps+tcp" scheme by means of the <COAP_URI> parameter. Issue the AT+UCOAP=8,<USECMNG_profile> command to configure a CoAP secure session; the USECMNG profile number is set by means of the <USECMNG_profile> parameter.

LARA-R6
Command AT+UCOAP=9,<rai_flag> can be configured but is not applicable on this product and it is not used in session configuration.

Up to four profiles can be stored in the NVM and only one can be loaded at a time. The loaded profile will be considered as the current profile and only this one can be stored in the NVM on the requested profile location.

The read command (AT+UCOAP=7) returns the parameter settings for all four profiles. If the profile is not defined, then the "+UCOAP: INVALID PROFILE NUMBER <profile_number>" will be returned in the information text response to the read command.

LARA-R6
Parameter <COAP_server_IP_address> is not supported and can be provided as URI-HOST in <COAP_URI>.

33.2.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UCOAP=<op_code>,<param_val>[,<param_val1>]	OK	AT+UCOAP=1,"coap://10.17.4.27:3456/ublox/testuri?reference=0"
			OK
Read	AT+UCOAP?	+UCOAP: <param_name>[,<param_val>]	+UCOAP: "DST_IP_ADDRESS","134.102.218.18"
		[[..]	+UCOAP: "PORT",5683
		+UCOAP: <param_name>[,<param_val>]	+UCOAP: "URI_STR","coap://coap.me/test"
		OK	+UCOAP: "OPT_MASK",23
			+UCOAP: "PROFILE_NUM",2
			+UCOAP: "STATUS FLAG",1
			+UCOAP: "USECMNG PROFILE"
			+UCOAP: "RAI FLAG",0
			+UCOAP: "CID",1,0
			OK
CoAP server IP address port			
Set	AT+UCOAP=0,<COAP_server_IP_address>[,<COAP_port>]	OK	AT+UCOAP=0,"192.168.10.25","2481"
			OK
CoAP URI			
Set	AT+UCOAP=1,<COAP_URI>	OK	AT+UCOAP=1,"coap://10.17.4.27:3456/ublox/testuri?reference=0"
			OK
CoAP PDU option mask			
Set	AT+UCOAP=2,<PDU_option>[,<value>]	OK	AT+UCOAP=2,0,1
			OK
Current profile number			
Set	AT+UCOAP=3,<profile_number>	OK	AT+UCOAP=3,0
			OK
Current profile valid flag			
Set	AT+UCOAP=4,<valid_flag>	OK	AT+UCOAP=4,0
			OK
Restore profile			
Set	AT+UCOAP=5,<profile_number>	OK	AT+UCOAP=5,0
			OK
Store profile			
Set	AT+UCOAP=6,<profile_number>	OK	AT+UCOAP=6,0
			OK
Read the stored profiles			
Read	AT+UCOAP=7	+UCOAP: <param_name>,<param_val>	AT+UCOAP=7
		[[..]	+UCOAP: INVALID PROFILE NUMBER 0
		+UCOAP: <param_name>,<param_val>]	+UCOAP: INVALID PROFILE NUMBER 1
		OK	+UCOAP: "DST_IP_ADDRESS","10.56.9.34"
			+UCOAP: "PORT",3456

Type	Syntax	Response	Example
			+UCOAP: "URI_STR","coap://10.56.9.34:3456/ublox/testuri" +UCOAP: "OPT_MASK",7 +UCOAP: "PROFILE_NUM",2 +UCOAP: "STATUS FLAG",1 +UCOAP: "USECMNG PROFILE" +UCOAP: "RAI FLAG",0 +UCOAP: INVALID PROFILE NUMBER 3 OK
Select USECMNG profile			
Set	AT+UCOAP=8,<USECMNG_profile>	OK	AT+UCOAP=8,0 OK
RAI configuration			
Set	AT+UCOAP=9,<rai_flag>	OK	AT+UCOAP=9,0 OK
PDP context configuration			
Set	AT+UCOAP=20,<cid>,<preferred_protocol_type>	OK	AT+UCOAP=20,1,0 OK
Test	AT+UCOAP=?	+UCOAP: (list of supported <op_code>s) OK	+UCOAP: (0-9,20) OK

33.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	Specific parameter in profile. Allowed values are: • 0: CoAP server address configuration • 1: CoAP URI configuration • 2: CoAP PDU option mask configuration • 3: current profile number • 4: current profile valid • 5: restore profile from the NVM • 6: store profile to the NVM • 7: read all profiles from the NVM • 8: CoAP secure option (SSL encryption) • 9: release assistance indication (RAI) • 20: PDP context configuration Allowed values: • LARA-R6 - 1, 2, 3, 4, 5, 6, 7, 8, 9, 20
<COAP_server_IP_address>	String	Remote CoAP server IP address in IPv4 format. For IP address format reference see the IP addressing.
<COAP_port>	String	Remote CoAP server port; the default CoAP port is 5683, in case of secure option the default port is 5684.
<COAP_URI>	String	URI schemes supported are: • UDP connection: "coap://"URI_HOST[":"URI_PORT] [URI_PATH] ["?"URI_QUERY] • DTLS connection: "coaps://"URI_HOST[":"URI_PORT] [URI_PATH] ["?"URI_QUERY] ☞ LARA-R6 Optional URI scheme (RFC 8323 [193]) supported are: • TCP connection: "coap+tcp://"URI_HOST[":"URI_PORT] [URI_PATH] ["?"URI_QUERY] • TLS connection: "coaps+tcp://"URI_HOST[":"URI_PORT] [URI_PATH] ["?"URI_QUERY] URI limitations are:

Parameter	Type	Description
		• LARA-R6 - The maximum supported length of the URI is 785 characters. ☞ LARA-R6 URI_HOST, URI_PATH and URI_QUERY options are limited to 255 characters each as per RFC 7252 [192].
<PDU_option>	Number	PDU option to be added in PDU header. Allowed values are: • 0: URI_HOST • 1: URI_PORT • 2: URI_PATH • 3: URI_QUERY • 4: CONTENT_FORMAT (CONTENT_FORMAT option in the PDU by means of the +UCOAPC AT command) • 5: NON_Message. If it is enabled (see the <value> parameter) then the message type will be non-confirmable, otherwise it will be confirmable
<value>	Number	Allowed values are: • 0 (default value): clear the corresponding option flag • 1: set the corresponding option flag
<profile_number>	Number	Profile number to be used: • 0: profile 0 • 1: profile 1 • 2: profile 2 • 3: profile 3
<valid_flag>	Number	Sets the current profile as valid or invalid: • 0: invalid profile • 1: valid profile
<USECMNG_profile>	Number	Defines the USECMNG profile which specifies the SSL/TLS properties to be used for an SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used
<rai_flag>	Number	Sets the RAI flag. Allowed values: • 0: RAI disabled • 1: release the connection after the uplink data is sent. It can not be selected with confirmable message type. • 2: release the connection after the first data is received in downlink. It can not be selected with non-confirmable message type.
<cid>	Number	Specifies the PDP context that will be used for the CoAP data. For the parameter range, see <cid>. For more details on the default and factory-programmed value of the parameter (where supported), see Constrained Application Protocol (CoAP).
<preferred_protocol_type>	Number	In case of a context id with IPv4v6 PDP type it is possible to select: • 0: IPv4 • 1: IPv6 For more details on the default and factory-programmed value of the parameter (where supported), see Constrained Application Protocol (CoAP).
<param_name>	String	Verbose description for the specific parameter, provided with their numeric values for each profile. Supported values: • "DST_IP_ADDRESS" • "PORT" • "URI_STR" • "OPT_MASK" • "PROFILE_NUM" • "STATUS FLAG" • "USECMNG PROFILE" • "RAI FLAG"
<param_val>	String/ Number	Type and supported content depend on the related <op_code> parameter; details are given above.
<param_val1>	String/ Number	Optional parameter; type and supported content depend on the related <op_code> parameter; details are given above.

33.2.4 Notes

- No profiles are defined by factory-programmed setting.

LARA-R6

- The <COAP_server_IP_address> and <COAP_port> parameters are not returned while reading CoAP profile.
- The RAI flag can be configured by means of the AT+UCOAP=9,<rai_flag> AT command but is not applicable and it is not used in session configuration.

33.3 CoAP command +UCOAPC

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

33.3.1 Description

Triggers the CoAP action with the <coap_command> parameter:

- **GET request**: it can be used to get the requested payload. If the payload is larger than the maximum limit (the limit is imposed by the server), the block-wise transfer will be triggered automatically (if supported by the server);
- **PUT or POST requests**: this can be used to send some payload. If the payload is larger than 512 bytes, then it can be sent via block-wise transfer by dividing the payload in blocks up to 512 bytes.

The final result code indicates if sending the command request to the CoAP process was successful or not. The +UCOAPCR (CoAP command result) URC returns to the user the final result of the CoAP command previously sent with +UCOAPC. As well, the +UCOAPCD CoAP unsolicited data URC provides the data requested by the user and received from the CoAP server.

☞ The payload size in downlink is dependent upon the data packeting scheme of the CoAP server.

☞ For more details, see the RFC 7252 [192].

33.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UCOAPC=<coap_command>[,<payload>,<identifier>[,<block_number>,<more_block>]]	OK	AT+UCOAPC=1 OK
Test	AT+UCOAPC=?	+UCOAPC: (list of supported <coap_command>s) OK	+UCOAPC: (1,4) OK
URC		+UCOAPCD: <response_code>,[<identifier>,][<payload>],<more_block>[,<block_number>,<block_size>][,<urc_left>]	+UCOAPCD: 2,0,"34746E5F31",0
URC		+UCOAPCR: <coap_command>,<coap_result>	+UCOAPCR: 2,1

33.3.3 Defined values

Parameter	Type	Description
<coap_command>	Number	CoAP action. Allowed values: • 1: GET request to the CoAP server; optional parameters are not allowed • 2: DELETE request to the CoAP server; optional parameters are not allowed • 3: PUT request to the CoAP server • 4: POST request to the CoAP server
<payload>	String	Hexadecimal payload to be sent or received. The maximum size in uplink is 512 bytes. For PUT (<coap_command>=3) and POST (<coap_command>=4) commands, if <more_block>=1 (more blocks available), allowed length values for payload are 8, 16, 32, 64, 128, 256, 512 bytes. For more details, see RFC 7959 [196].
<identifier>	Number	CoAP Content-Type identifier. Allowed values: • 0: text / plain

Parameter	Type	Description
		• 1: application / link format • 2: application / xml • 3: application / octet stream • 4: application / rdf xml • 5: application / exi • 6: application / json • 7: application / cbor
<block_number>	Number	Indicates the block number being requested or provided, starting from 0.
<more_block>	Number	Indicates that the data in the message is the last block or more blocks are available: • 0: last block • 1: more blocks available
<response_code>	Number	Numeric code added in the response from the server. Allowed values: • 0: empty message • 2: success • 4: client error • 5: server error
<block_size>	Number	Size of data to be acknowledged by the server. The maximum size in uplink is 512 bytes.
<urc_left>	Number	Indicates the number of remaining URCs that will be displayed for a data block, when the payload is too long to be displayed in a single URC and therefore it is split in multiple URCs.
<coap_result>	Number	Indicates the result of last CoAP command: • 0: fail • 1: success

33.3.4 Notes

LARA-R6

- In case of secure session (i.e. "coaps" or "coaps+tcp" URI scheme), the +UCOAPC command returns the OK final result code only when the secure session handshake is completed successfully.
- The time to establish the secure session (i.e. "coaps" or "coaps+tcp" URI scheme and +UCOAP: 8,<USECMNG_profile>) could require up to 150 s in one of these cases:
  - RoT generated PSK (+USECPRF: <profile_id>,11)
  - encrypted session resumption (+USECPRF: <profile_id>,13,2,10)

  This is due to "security heartbeat" message operation. For more details on when this scenario occurs, see the +USECCONN AT command.

33.4 CoAP error reporting +UCOAPER

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

33.4.1 Description

Returns the error code of the latest CoAP operation.

33.4.2 Syntax

Type	Syntax	Response	Example
Action	AT+UCOAPER	+UCOAPER: <error_class>,<error_code> OK	AT+UCOAPER +UCOAPER: 15,4 OK

33.4.3 Defined values

Parameter	Type	Description
<error_class>	Number	List of the allowed values is available in listed in Appendix A.7.
<error_code>	Number	Value of CoAP specific error code, the allowed <error_code> values are listed in Appendix A.7.6.

34 MQTT

34.1 Introduction

MQTT AT commands are implemented according to MQTT version 3.1.1. For a more detailed overview on MQTT protocol, see MQTT version 3.1.1 - OASIS standard [212].

The Message Queueing Telemetry Transport (MQTT) protocol specifies a simple and lightweight messaging protocol, designed for constrained devices and low-bandwidth, high-latency, or unreliable networks. An MQTT client uses publish and subscribe methods to interact over a TCP connection with an MQTT message broker (henceforth referred to as an MQTT server). u-blox modules can be configured to operate as an MQTT client.

To publish or subscribe, the MQTT client must first establish a TCP connection to an MQTT server.

The MQTT protocol specifies case-sensitive topics, with topic names containing topic level separators "/" to which messages will be published. For example, a message of "78 Fahrenheit or 25 Celsius" could be published to the topic name of "/heat/sensor/SD/bldg5/DelMarConfRm". MQTT clients subscribe to topic filters to determine if the client receives messages published to a given topic name.

The topic filters may exactly specify a topic name or may contain either of the following wildcards:

- **'+'** - (single level wildcard) applies to a single topic level;
- **'#'** - (multi-level wildcard) applies to potentially many topic levels (and must be the last character specified in a topic filter).

'#' can be specified on its own or following a topic level separator ('/'). For example, the topic filter, "/heat/sensor/SD/#", would receive any messages published to the "/heat/sensor/SD/bldg5/DelMarConfRm" topic name.

MQTT specification states that topic filters starting with either wildcard will not match any topic name that starts with "$".

The MQTT protocol also specifies a Quality of Service (QoS) level to be applied to message transactions:

- **0** (default setting): at most once delivery
- **1**: at least once delivery
- **2**: exactly once delivery

The MQTT protocol also allows an MQTT client to create a will message, which the MQTT remote server will store and only publish (to the topic name specified as the will topic name) when the MQTT client gets disconnected from the MQTT server, but not if the MQTT client explicitly sends a disconnect command.

A PSD connection must be active before using MQTT AT commands. Some products require additional commands to provide connectivity to the application.

LARA-R6
If not specified, the <cid> and the <preferred_protocol_type> parameters set by means of the +UDCONF=19 AT command are used.
See +CGACT AT command for activating a PDP context.

LARA-R6001D
If not specified the default CID (<cid>=1) is used. If not specified and the protocol type is IPv4v6, then the preferred protocol type is IPv4.
See +CGACT AT command for activating a PDP context.

34.2 MQTT profile configuration +UMQTT

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

34.2.1 Description

Configures or reads the parameter value of an MQTT client profile. Issue a set command for each <op_code> parameter to set all of the parameters in an MQTT client profile.

34.2.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UMQTT=<op_code>[,<param1>[,<param2>]]	+UMQTT: <op_code>,<result> OK	AT+UMQTT=12,1 +UMQTT: 12,1 OK
MQTT unique client ID			
Set	AT+UMQTT=0,<client_id>	+UMQTT: 0,<result> OK	AT+UMQTT=0,"352753090041680" +UMQTT: 0,1 OK
MQTT local TCP port number			
Set	AT+UMQTT=1,<local_port>	+UMQTT: 1,<result> OK	AT+UMQTT=1,1883 +UMQTT: 1,1 OK
MQTT server name			
Set	AT+UMQTT=2,<server_name>[,<server_port>]	+UMQTT: 2,<result> OK	AT+UMQTT=2,"www.commercialmqttbroker.com" +UMQTT: 2,1 OK
MQTT server IP address			
Set	AT+UMQTT=3,<IP_address>[,<server_port>]	+UMQTT: 3,<result> OK	AT+UMQTT=3,"192.168.1.0",1883 +UMQTT: 3,1 OK
User name and password			
Set	AT+UMQTT=4,<username>,<password>	+UMQTT: 4,<result> OK	AT+UMQTT=4,"test","abc123" +UMQTT: 4,1 OK
Last will QoS			
Set	AT+UMQTT=6,<will_QoS>	OK	AT+UMQTT=6,1 OK
Last will retain			
Set	AT+UMQTT=7,<will_retain>	OK	AT+UMQTT=7,1 OK
Last will topic			
Set	AT+UMQTT=8,<will_topic>	OK	AT+UMQTT=8,"u-blox/publish" OK
Last will message			
Set	AT+UMQTT=9,<will_message>[,<hex_mode>]	OK	AT+UMQTT=9,"Unrequested disconnect" OK
Keep alive and linger time			
Set	AT+UMQTT=10,<keep_alive>[,<linger_time>]	+UMQTT: 10,<result> OK	AT+UMQTT=10,3600,20 +UMQTT: 10,1 OK
MQTT secure option			
Set	AT+UMQTT=11,<MQTT_secure>[,<USECMNG_profile>]	+UMQTT: 11,<result> OK	AT+UMQTT=11,1,2 +UMQTT: 11,1 OK
MQTT clean session			
Set	AT+UMQTT=12,<clean_session>	+UMQTT: 12,<result> OK	AT+UMQTT=12,1 +UMQTT: 12,1

Type	Syntax	Response	Example
			OK
MQTT server response time			
Set	AT+UMQTT=13,<server_response_time>	OK	AT+UMQTT=13,60 OK
MQTT PDP context configuration			
Set	AT+UMQTT=20,<cid>[,<preferred_protocol_type>]	OK	AT+UMQTT=20,2,1 OK
Read	AT+UMQTT=<op_code>	+UMQTT: <op_code>,<param1>[,<param2>] OK	AT+UMQTT=4 +UMQTT: 4,"my_username" OK
Read	AT+UMQTT?	+UMQTT: 0,<client_id> +UMQTT: 2,<server_name>,<server_port> +UMQTT: 3,IP_address>,<server_port> +UMQTT: 4,<username> +UMQTT: 6,<will_QoS> +UMQTT: 7,<will_retain> +UMQTT: 8,<will_topic> +UMQTT: 9,<wm_length>,<will_message> +UMQTT: 10,<keep_alive>,<linger_time> +UMQTT: 11,<MQTT_secure>[,<USECMNG_profile>] +UMQTT: 13,<server_response_time> +UMQTT: 20,<cid>,<preferred_protocol_type> OK	+UMQTT: 0,"352848080012186" +UMQTT: 2,"",1883 +UMQTT: 3,"",1883 +UMQTT: 4,"" +UMQTT: 6,0 +UMQTT: 7,0 +UMQTT: 8,"" +UMQTT: 9,0,"" +UMQTT: 10,0,10 +UMQTT: 11,0 +UMQTT: 13,30 +UMQTT: 20,1,0 OK
Test	AT+UMQTT=?	+UMQTT: (list of supported <op_code>s) OK	+UMQTT: (0,2-4,6-11,13,20) OK
URC		+UUMQTT<op_code>: <param1>[,<param2>]	+UUMQTT0: "352753090041680"

34.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	MQTT parameter: • 0: MQTT unique client id • 1: MQTT local port number • 2: MQTT server name • 3: MQTT IP address • 4: MQTT username and password • 6: MQTT last will QoS value • 7: MQTT last will retain • 8: MQTT last will topic • 9: MQTT last will message • 10: MQTT keep alive time period and linger time • 11: MQTT secure • 12: MQTT clean session • 13: MQTT server response time • 14: MQTT terse/verbose mode; the set command is not supported

Parameter	Type	Description
		• 20: MQTT PDP context configuration Allowed values: • LARA-R6001D - 0, 2, 3, 4, 6, 7, 8, 9, 10, 11, 20 • LARA-R6001 / LARA-R6401 / LARA-R6401D / LARA-R6801 - 0, 2, 3, 4, 6, 7, 8, 9, 10, 11, 13, 20
<result>	Number	Allowed values: • 0: failure • 1: success
<client_id>	String	Client identifier for the MQTT session. • LARA-R6 - The maximum length is 256 characters. The default value is the IMEI of the MT.
<local_port>	Number	MQTT client TCP port. The range goes from 1 to 65535. If the MQTT client port number is not specified, the default port number is the IANA assigned port of 1883 for non-TLS MQTT and 8883 for TLS MQTT.
<server_name>	String	Remote server name. • LARA-R6 - The maximum length is 128 characters. The default value is an empty string.
<IP_address>	String	Remote server IP address. The default value is an empty string. For IP address format reference, see the IP addressing.
<server_port>	Number	MQTT server port. The range goes from 1 to 65535. The default value is 1883 for non-TLS MQTT, 8883 for TLS MQTT. • LARA-R6 - the set command also accepts 0: it is used to automatically reset the <server_port> to the default value (1883 or 8883).
<username>	String	User name for the MQTT login procedure. The default value is an empty string: • LARA-R6 - The maximum length is 512 characters.
<password>	String	Password for the MQTT login procedure. The default value is an empty string: • LARA-R6 - The maximum length is 512 characters.
<keep_alive>	Number	Keep alive time expressed in seconds. According to the MQTT specification, an MQTT server must disconnect a client if it receives nothing from the client within 1.5x the keep alive time. If the keep alive value is 0 the server is not required to disconnect. The default value is 0. The maximum value is 65535 (corresponding to 18 hours, 12 minutes and 15 seconds).
<linger_time>	Number	Linger time expressed in seconds. The range goes from 0 to 120 s; 0 means linger time is not set. The default value is 10 s.
<will_QoS>	Number	MQTT last will Quality of Service: • 0 (default value): at most once delivery • 1: at least once delivery • 2: exactly once delivery
<will_retain>	Number	Whether or not the last will message will be retained across disconnects: • 0 (default value): the last will message will not be retained by the MQTT broker • 1: the last will message will be retained by the MQTT broker
<will_topic>	String	Last will topic name. The default value is an empty string. • LARA-R6 - The maximum length is 256 characters.
<will_message>	String	Last will message: string of characters (ASCII or hexadecimal octets). • LARA-R6 - The maximum length is 256 characters. In case of hexadecimal data, the number of characters must be even (one hexadecimal octet is composed of 2 characters).
<hex_mode>	Number	Allowed values: • 0 (default value): ASCII input for <will_message> • 1: hexadecimal input for <will_message>
<wm_length>	Number	Two meanings: • ASCII input: number of ASCII characters in <will_message> • Hexadecimal input: number of octets in <will_message>
<MQTT_secure>	Number	Enables / disables the secure option of MQTT service: • 0 (default value): no TLS encryption • 1: enable the MQTT TLS encryption
<USECMNG_profile>	Number	USECMNG profile (number). Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4.

Parameter	Type	Description
		If no profile is set a default USECMNG profile is used (see +USECMNG AT command description).
<clean_session>	Number	Clean session value. Allowed values: • 0: indicates that the client subscription and delivered messages received by the client should be remembered across disconnects by both the MQTT client and the MQTT server • 1: (default value) indicates that disconnects clean all session state information
<cid>	Number	PDP context identifier used for the MQTT communication. The allowed range is product specific, see <cid>. For more details on the default value of the parameter (where supported), see MQTT.
<preferred_protocol_type>	Number	Preferred protocol type to be specified when the <cid> protocol type is IPv4v6. Allowed values: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see MQTT.
<server_response_time>	Number	Indicates the maximum waiting time of a server response after a request was sent to the server via +UMQTTC AT command. It is expressed in seconds. The default value is 30 s. The range goes from 5 s to 255 s (corresponding to 4 minutes and 15 seconds).
<param1>	Number / String	Type and supported content depend on the related <op_code> parameter (details are given above). If <param1> is not specified the value of the corresponding parameter <op_code> is reset to the default value.
<param2>	Number / String	Type and supported content depend on the related <op_code> parameter (details are given above). If <param2> is not specified the value of the corresponding parameter <op_code> is reset to the default value.

34.2.4 Notes

- The information text response to the read command does not display the password.
- Some network operators do not allow secure MQTT. In this case the AT+UMQTTC=1 command (MQTT login) will return a failure response by means of the +UUMQTTC URC after an TLS timeout of 30 s.

LARA-R6

- The set command does not provide the +UMQTT: <op_code>,<result> information text response: only the final result code is issued.
- The +UUMQTT URC is not supported.
- The MQTT session is always cleaned on disconnection.
- See the Appendix A.1 for the allowed error result codes.
- <op_code>=2 (MQTT server name) and <op_code>=3 (MQTT IP address) are equivalent, when broker connection is established the server name is transformed into the IP address.

34.3 Save/Restore MQTT profile from NVM +UMQTTNV

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

34.3.1 Description

Either saves all of the MQTT client profile parameters to NVM (non-volatile memory) or sets all of the MQTT client profile parameters to either factory-programmed or non-volatile stored values.

For the complete list of parameters that can be stored in the NVM, see the +UMQTT AT command.

LARA-R6
The set command does not provide the information text response: only the final result code is issued.

34.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMQTTNV=<NVM_mode>	[+UMQTTNV: <NVM_mode>,<result>] OK	AT+UMQTTNV=2 +UMQTTNV: 2,1 OK
Test	AT+UMQTTNV=?	+UMQTTNV: (list of <NVM_mode>s) OK	+UMQTTNV: (0-2) OK

34.3.3 Defined values

Parameter	Type	Description
<NVM_mode>	Number	Operation to set or save the MQTT client profile parameters as follows: • 0: restore MQTT client profile parameters to the factory-programmed setting • 1: set MQTT client profile parameters to values previously stored in the NVM • 2: store current MQTT client profile parameters to the NVM
<result>	Number	Operation result: • 0: failure • 1: success

34.4 MQTT command +UMQTTC

+UMQTTC						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	partial	Yes	No	No	< 120 s	+CME Error

34.4.1 Description

Triggers the MQTT actions corresponding to the <op_code> parameter. The final result code indicates if sending the command request to the MQTT process was successful or not.

The +UUMQTTC URC provides the result of the requested action from the MQTT broker. In addition, the +UUMQTTC URC also provides notification that unread messages are available from the MQTT server. The +UUMQTTC URC is by default enabled.

LARA-R6
An MQTT command can be considered completed only after receiving the related +UUMQTTC URC.
The "+CME ERROR: operation not allowed" error result code is returned if an MQTT command is entered before the previous one is completed.

LARA-R6
The +UUMQTTC: 0,100 URC is notified when the MQTT broker releases the connection after a period of inactivity (keep alive time expired).
The +UUMQTTC: 0,101 URC is notified when the network connection is lost.

LARA-R6
The +UUMQTTC: 0,102 URC is notified when the MT releases the connection because there is a protocol violation in receiving an MQTT message.

34.4.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UMQTTC=<op_code>[,<param1>[,<param2>][,<param3>][,<param4>][,<param5>]]	OK	AT+UMQTTC=1 OK
URC		+UUMQTTC: <op_code>,<param1>[,<param2>,<param3>]	+UUMQTTC: 4,0,2,"sensor/heat/#"
MQTT logout			
Set	AT+UMQTTC=0	OK	AT+UMQTTC=0

Type	Syntax	Response	Example
			OK
URC		+UUMQTTC: 0,<logout_result>	+UUMQTTC: 0,1
MQTT login			
Set	AT+UMQTTC=1	OK	AT+UMQTTC=1 OK
URC		+UUMQTTC: 1,<MQTT_result>	+UUMQTTC: 1,1
MQTT publish to a topic			
Set	AT+UMQTTC=2,<QoS>,<retain>,[<hex_mode>],<topic_name>,<pub_msg>	OK	AT+UMQTTC=2,0,0,0,"sensor/heat/SD/bldg5/DelMarConfRm","23 degrees Celsius" OK AT+UMQTTC=2,0,0,1,"sensor/heat/SD/bldg5/DelMarConfRm","32332064656772656573 2043656C73697573" OK
URC		+UUMQTTC: 2,<MQTT_result>	+UUMQTTC: 2,1
MQTT publish a file to a topic			
Set	AT+UMQTTC=3,<QoS>,<retain>,<topic_name>,<filename>	OK	AT+UMQTTC=3,0,0,"home/u-blox","msg.txt" OK
URC		+UUMQTTC: 3,<MQTT_result>	+UUMQTTC: 3,1
MQTT subscribe to the specified topic filter			
Set	AT+UMQTTC=4,<max_QoS>,<topic_filter>	OK	AT+UMQTTC=4,0,"sensor/heat/#" OK
URC		**In case of success** +UUMQTTC: 4,1,<QoS>,<topic_name> **In case of failure** +UUMQTTC: 4,0	+UUMQTTC: 4,1,0,"sensor/heat/#"
MQTT unsubscribe from the specified topic filter			
Set	AT+UMQTTC=5,<topic_filter>	OK	AT+UMQTTC=5,"sensor/heat/#" OK
URC		+UUMQTTC: 5,<MQTT_result>	+UUMQTTC: 5,1
MQTT read message			
Set	AT+UMQTTC=6[,<one_message>]	+UMQTTC: 6,<QoS>,<topic_msg_length>,<topic_length>,<topic_name>,<read_msg_length>,<read_msg> OK	AT+UMQTTC=6,1 +UMQTTC: 6,0,31,13,"sensor/heat/#",18,"23 degrees Celsius" OK
URC		+UUMQTTC: 6,<num_unread_msgs>,<memory_full> **If an error occurs while receiving a publish message** +UUMQTTC: 6,0	+UUMQTTC: 6,3,0
Ping MQTT broker			
Set	AT+UMQTTC=8,<ping_ON_OFF>	OK	AT+UMQTTC=8,1 OK
Publish a binary message to a topic			
Set	AT+UMQTTC=9,<QoS>,<retain>,<topic_name>,<pub_msg_length> After the ">" prompt <pub_msg_length> bytes of data are entered	><pub_bin_message> OK	AT+UMQTTC=9,1,0,"u-blox/test",33 >AABB--> execute this \nand "this" OK
URC		+UUMQTTC: 9,<MQTT_result>	+UUMQTTC: 9,1
Test	AT+UMQTTC=?	+UMQTT: (list of supported <op_codes>s)	+UMQTTC: (0-9)

Type	Syntax	Response	Example
		OK	OK

34.4.3 Defined values

Parameter	Type	Description
<op_code>	Number	MQTT command request. • 0: logs out/disconnects from MQTT server. The will message will not be sent • 1: logs in/connects to MQTT server • 2: publish a message to a specific topic to the MQTT message broker • 3: publish a message from a file to a specific topic to the MQTT message broker • 4: subscribe to a topic from the MQTT message broker • 5: unsubscribe to a topic from the MQTT message broker. This should exactly match the Topic Filter used during the Subscribe • 6: read all unread messages received from MQTT message broker, at the terse/verbose mode set at the time of message reception • 7: sets the terse/verbose format for received messages (i.e. the amount of information and headers with each received MQTT message) • 8: ping the MQTT message broker • 9: publish a message in binary mode. It is used for publishing any binary data Allowed values: • LARA-R6 - 0, 1, 2, 3, 4, 5, 6, 8, 9
<MQTT_result>	Number	Result of an MQTT command request: • 0: fail; for more details, see the +UMQTTER AT command • 1: success
<login_result>	Number	Result of an MQTT login request. Allowed values: • 0: connection accepted • 1: the server does not support the level of the MQTT protocol requested by the client • 2: the client identifier is correct UTF-8 but not allowed by the server • 3: the network connection has been made but the MQTT service is unavailable • 4: the data in the user name or password is malformed • 5: the client is not authorized to connect • 6-255: reserved for future use
<logout_result>	Number	Result of an MQTT command request: • 0: fail; for more details, see the +UMQTTER AT command • 1: success Result of an unsolicited notification for an MQTT session interruption caused by: • 100: keep alive time expired, the MQTT broker released the connection. • 101: lost network connection. • 102: protocol violation in receiving an MQTT message.
<QoS>	Number	Quality of service: • 0 (default value): at most once delivery • 1: at least once delivery • 2: exactly once delivery
<retain>	Number	Whether or not the message will be retained across disconnects. Allowed values: • 0 (default value): the message will not be retained by the MQTT broker • 1: the message will be retained by the MQTT broker
<hex_mode>	Number	Allowed values: • 0 (default value): ASCII input for <pub_msg>/<message> • 1: hexadecimal input for <pub_msg>/<message>
<pub_msg>	String	ASCII or hexadecimal data. • LARA-R6 - The maximum parameter length is 1024 characters if <hex_mode>=0 or 512 octets if <hex_mode>=1.
<message>	String	ASCII or hexadecimal data. The maximum length is 256 characters. The starting quotation mark shall not be taken into account like data. At the end of the byte stream, another quotation mark is provided for user convenience and visualization purposes.
<filename>	String	Filename containing the message to be published. • LARA-R6 - The maximum parameter length is 250 characters and the maximum file content depends on the filesystem, see File system limits.

Parameter	Type	Description
<max_QoS>	Number	Maximum QoS level at which the MQTT broker can send messages to the MT. For more details, see MQTT version 3.1.1 - OASIS standard [212]. • 0: at most once delivery • 1: at least once delivery • 2: exactly once delivery
<topic_filter>	String	An expression to indicate an interest in one or more topics, wildcard characters are used to subscribe/unsubscribe to multiple topics at once. See MQTT introduction. • LARA-R6 - The maximum length is 256 characters.
<topic_name>	String	Indicates the topic to which the given MQTT message was published. • LARA-R6 - The maximum length is 256 characters.
<reason>	Number	Result of an MQTT subscribe request: • 0-2: success • 128: failure Allowed values: • LARA-R6 - 0, 128
<num_unread_msgs>	Number	Indicates the number of unread received messages.
<format>	Number	Specifies the format of the messages when read using the <op_code>=6. Allowed values: • 0: no formating. All messages will be concatenated into a single line with no separation between meeages • 1 (default value): each messages will contain the <topic_name> and <message> • 2: each messages will contain the <topic_name>, <msg_length>, <QoS> and <message>
<mqtt_server>	String	IP address or URL of MQTT server.
<one_message>	Number	Allowed values: • 0: read all received messages • 1: read only one message
<topic_msg_length>	Number	Sum of topic and message length
<topic_length>	Number	Topic length
<msg_length>	Number	Specifies the number of octets in <message> for <op_code>=6 (MQTT read message)
<read_msg_length>	Number	Specifies the number of octets in <read_msg>
<read_msg>	String	Message received from MQTT server. • LARA-R6 - The maximum length is 12288 octets.
<ping_ON_OFF>	Number	Allowed values: • 0 (default value): ping disabled • 1: ping enabled the MT will ping the MQTT broker. The ping is issued when the MQTT keep alive time period expires. See AT+UMQTT=10.
<memory_full>	Number	Indicates the message memory status. Allowed values: • 0: message memory is available • 1: message memory is full
<pub_msg_length>	Number	Specifies the number of octets in <pub_bin_message>, the maximum length is 1024 octets.
<pub_bin_message>	String	Data bytes to be published. • LARA-R6 - The maximum length is 1024 octets.

34.4.4 Notes

- The topic name should not include any wildcards for the publish commands.
- The topic filter could include the '+' wildcard to substitute for a single topic folder or the '#' wildcard to substitute for any number of topic folders. The '#' wildcard must be the last character in a topic filter.

LARA-R6

- The <memory_full> parameter is not supported.
- If <hex_mode>=1, the publishing message (<pub_msg> parameter) contains a string of hexadecimal nebbles that is transformed into a bytes sequence
- Publish a binary message to a topic:

  - This feature can be successfully used when there is need to send characters like <CR>, <CTRL-Z>, quotation marks, etc. These characters have a specific meaning and they cannot be used like data in the command itself. For more details, see 3GPP TS 27.005 [81].
  - 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.
  - In binary mode the module does not display the echo of data bytes.
- The time to establish the secure session (when using +UMQTT: 11,1[,<USECMNG_profile>]) could require up to 150 s in one of these cases:
  - RoT generated PSK (+USECPRF: <profile_id>,11)
  - encrypted session resumption (+USECPRF: <profile_id>,13,2,10)

  This is due to "security heartbeat" message operation. For more details on when this scenario occurs, see the +USECCONN AT command.
- The PING command activates an internal loop of ping requests and responses to and from the MQTT server. The ping requests are sent when the MQTT keep alive time period expires (see MQTT version 3.1.1 - OASIS standard [212]). Before establishing a connection with the server the keep alive time must be set to a non-zero value, see AT+UMQTT=10. Avoid a value of few seconds otherwise the application will be busy in sending ping requests at the expense of other MQTT requests.

LARA-R6

- The PING activation fails if the keep alive time is set to 0, see AT+UMQTT=10.

34.5 MQTT error +UMQTTER

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

34.5.1 Description

Retrieves the error class and code of the last MQTT operation that provided an error.

34.5.2 Syntax

Type	Syntax	Response	Example
Action	AT+UMQTTER	+UMQTTER: <error_code1>,<error_code2> OK	AT+UMQTTER +UMQTTER: 1,1 OK

34.5.3 Defined values

Parameter	Type	Description
<error_code1>	Number	• LARA-R6 - Value of error class. Values are listed in Internet suite error classes.
<error_code2>	Number	• LARA-R6 - Value of class-specific error code. The values are listed in MQTT class error codes.

35 MQTT-SN

35.1 Introduction

MQTT-SN AT commands are implemented according to MQTT-SN protocol specification version 1.2. For a more detailed overview of the MQTT-SN protocol, see MQTT-SN version 1.2 - standard [213].

The Message Queuing Telemetry Transport for Sensor Network (MQTT-SN) is a lightweight messaging protocol, which is an optimized version of the MQTT IoT communications protocol. MQTT-SN is optimized for low-bandwidth, high-link failures, and low-cost communication environments. It is specifically designed for low overhead mobile devices with constrained resources of storage and management. u-blox cellular modules can be configured to operate as an MQTT-SN client.

To publish or subscribe, the MQTT-SN client must first establish a UDP connection to a MQTT-SN gateway and register itself.

The MQTT-SN protocol specifies case-sensitive topics, with topic names containing topic level separators "/" to which messages will be published. For example, a message of "78 Fahrenheit or 25 Celsius" could be published to the topic name of "/heat/sensor/SD/bldg5/DelMarConfRm".

Three types of topic are defined:

- **Topic id** - A long topic name is replaced by a short, two-byte long topic identifier as a result of a client registration procedure made to map a normal topic to a server defined identifier. This identifier will then be used in the following publish commands.
- **Predefined topic id** - Predefined topic ids are a two-byte long replacement of the topic name, their mapping to the topic names is known in advance by both the client and server, no registration is required.
- **Short topic name** - Short topic names are topic names with fixed length of two octets, no registration is required.

MQTT-SN clients subscribe to topic filters to determine if the client receives messages published to a given topic name.

The topic filters may exactly specify a topic name or may contain either of the following wildcards:

- **'+'** - (single level wildcard) applies to a single topic level
- **'#'** - (multi-level wildcard) applies to potentially many topic levels (and must be the last character specified in a topic filter);

'#' can be specified on its own or following a topic level separator ('/'). For example, the topic filter, "/heat/sensor/SD/#", would receive any messages published to the "/heat/sensor/SD/bldg5/DelMarConfRm" topic name.

MQTT-SN specification states that topic filters starting with either wildcard will not match any topic name that starts with "$".

The MQTT-SN protocol also specifies a Quality of Service (QoS) level to be applied to message transactions:

- **-1**: send and forget (value valid only for publish messages)
- **0** (default setting): at most once delivery
- **1**: at least once delivery
- **2**: exactly once delivery

The MQTT-SN protocol also allows an MQTT-SN client to create a will message, which the MQTT-SN remote server will store and only publish (to the topic name specified as the will topic name) when the MQTT-SN client gets disconnected from the MQTT-SN server, but not if the MQTT-SN client explicitly sends a disconnect command.

LARA-R6
Broadcast messages are not supported so it is not possible to send a search gateway message or receive an advertisement from the gateway.

A PSD connection must be active before using MQTT-SN AT commands. Some products require additional commands to provide connectivity to the application.

LARA-R6
If not specified, the <cid> and the <preferred_protocol_type> parameters set by means of the +UDCONF=19 AT command are used.

See +CGACT AT command for activating a PDP context.

LARA-R6001D
If not specified the default CID (<cid>=1) is used. If not specified and the protocol type is IPv4v6, then the preferred protocol type is IPv4.
See +CGACT AT command for activating a PDP context.

35.2 MQTT-SN profile configuration +UMQTTSN

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

35.2.1 Description

Configures or reads the parameter value of an MQTT-SN client profile. Issue a set command for each <op_code> parameter to set all of the parameters in an MQTT-SN client profile.

35.2.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UMQTTSN=<op_code>,<param1>[,<param2>]	OK	AT+UMQTTSN=12,1 OK
MQTT-SN unique client ID			
Set	AT+UMQTTSN=0,<client_id>	OK	AT+UMQTTSN=0,"352753090041680" OK
MQTT-SN server name			
Set	AT+UMQTTSN=1,<server_name>[,<server_port>]	OK	AT+UMQTTSN=1,"www.testMQTTSNbroker.com" OK
MQTT-SN server IP address			
Set	AT+UMQTTSN=2,<IP_address>[,<server_port>]	OK	AT+UMQTTSN=2,"192.168.1.0",1883 OK
MQTT-SN gateway radius			
Set	AT+UMQTTSN=3,<radius>	OK	AT+UMQTTSN=3,1 OK
Last will QoS			
Set	AT+UMQTTSN=4,<will_QoS>	OK	AT+UMQTTSN=4,1 OK
Last will retain			
Set	AT+UMQTTSN=5,<will_retain>	OK	AT+UMQTTSN=5,1 OK
Last will topic			
Set	AT+UMQTTSN=6,<will_topic>	OK	AT+UMQTTSN=6,"u-blox/publish" OK
Last will message			
Set	AT+UMQTTSN=7,<will_message>	OK	AT+UMQTTSN=7,"Unrequested disconnect." OK
MQTT-SN connection duration			
Set	AT+UMQTTSN=8,<duration>	OK	AT+UMQTTSN=8,20 OK
MQTT-SN secure option			

Type	Syntax	Response	Example
Set	AT+UMQTTSN=9,<secure>[,<USECMNG_profile>]	OK	AT+UMQTTSN=9,1 OK
MQTT-SN clean session			
Set	AT+UMQTTSN=10,<clean_session>	OK	AT+UMQTTSN=10,1 OK
MQTT-SN PDP context configuration			
Set	AT+UMQTTSN=20,<cid>[,<preferred_protocol_type>]	OK	AT+UMQTTSN=20,2,1 OK
Read	AT+UMQTTSN?	+UMQTTSN: 0,<client_id>	+UMQTTSN: 0,"352753090041680"
		+UMQTTSN: 1,<server_name>,<server_port>	+UMQTTSN: 1,"www.commercialmqttbroker.com",1884
		+UMQTTSN: 2,IP_address>,<server_port>	+UMQTTSN: 2,"192.168.1.0",1884
		+UMQTTSN: 3,<radius>	+UMQTTSN: 3,1
		+UMQTTSN: 4,<will_QoS>	+UMQTTSN: 4,1
		+UMQTTSN: 5,<will_retain>	+UMQTTSN: 5,1
		+UMQTTSN: 6,<will_topic>	+UMQTTSN: 6,"u-blox/publish"
		+UMQTTSN: 7,<will_message>	+UMQTTSN: 7,"unrequested disconnect"
		+UMQTTSN: 8,<duration>	+UMQTTSN: 8,20
		+UMQTTSN: 9,<secure>[,<USECMNG_profile>]	+UMQTTSN: 9,1,1
		+UMQTTSN: 10,<clean_session>	+UMQTTSN: 10,1
		+UMQTTSN: 20 ,<cid>,<preferred_protocol_type>	+UMQTTSN: 20,1,0
		OK	OK
Test	AT+UMQTTSN=?	+UMQTTSN: (list of supported <op_code>s)	+UMQTTSN: (0-2,4-10,20)
		OK	OK

35.2.3 Defined values

Parameter	Type	Description
<op_code>	Number	MQTT-SN parameter: • 0: MQTT-SN unique client id • 1: MQTT-SN server name • 2: MQTT-SN IP address • 3: MQTT-SN radius • 4: MQTT-SN last will QoS • 5: MQTT-SN last will retain • 6: MQTT-SN last will topic • 7: MQTT-SN last will message • 8: MQTT-SN connection duration • 9: MQTT-SN secure • 10: MQTT-SN clean session • 20: MQTT-SN PDP context configuration Allowed values: • LARA-R6 - 0, 1, 2, 4, 5, 6, 7, 8, 9, 10, 20
<client_id>	String	Client identifier for the MQTT-SN session. The maximum length is 256 characters and the default value is the IMEI of the MT.
<server_name>	String	Remote server name. The maximum length is 128 characters. The default value is an empty string.
<server_port>	Number	MQTT-SN server port. The range goes from 1 to 65535. The default value is 1884.
<IP_address>	String	Remote server IP address. The default value is an empty string. For IP address format reference, see the IP addressing.

Parameter	Type	Description
<radius>	Number	The broadcast radius of this message.
<will_QoS>	Number	MQTT-SN last will quality of service: • 0 (default value): at most once delivery • 1: at least once delivery • 2: exactly once delivery
<will_retain>	Number	Whether or not the last will message will be retained across disconnects: • 0 (default value): the last will message will not be retained by the MQTT-SN gateway • 1: the last will message will be retained by the MQTT-SN gateway
<will_topic>	String	Last will topic name. The maximum length is 256 characters. The default value is an empty string.
<will_message>	String	Last will message in ASCII format. The maximum length is 256 characters. The default value is an empty string.
<duration>	Number	Indicates the duration of the keep alive timer, expressed in seconds. According to the MQTT-SN version 1.2 - standard [213], an MQTT-SN server must disconnect a client if it receives nothing from the client within 1.5x the keep alive duration. The allowed values are: • LARA-R6 - 0-65535 (corresponding to 18 hours, 12 minutes and 15 seconds). The default value is 0, which indicates no timeout.
<clean_session>	Number	Clean session value. Allowed values: • 0: indicates that the client subscription and delivered messages received by the client should be remembered across disconnections by both the MQTT-SN client and the MQTT-SN server • 1 (default value): indicates that disconnections clean all session state information
<secure>	Number	Enables / disables the secure option of the MQTT-SN service: • 0: (default value): no DTLS encryption • 1: enable the MQTT-SN DTLS encryption
<USECMNG_profile>	Number	USECMNG profile. Defines the USECMNG profile which specifies the SSL/TLS/DTLS properties to be used for the SSL/TLS/DTLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see +USECMNG AT command description). The parameter is omitted in the information text response to the read command if <secure>=0.
<cid>	Number	PDP context identifier used for the MQTT-SN communication. The allowed range is product specific, see <cid>. For more details on the default value of the parameter (where supported), see MQTT-SN.
<preferred_protocol_type>	Number	Preferred protocol type to be specified when the <cid> protocol type is IPv4v6. Allowed values: • 0: IPv4 • 1: IPv6 For more details on the default value of the parameter (where supported), see MQTT-SN.
<param1>	Number / String	Type and supported content depend on the related <op_code> parameter (details are given above). <param1> is compulsory parameter in set command.
<param2>	Number / String	Type and supported content depend on the related <op_code> parameter (details are given above). If <param2> is not specified the value of the corresponding parameter <op_code> is reset to the default value.

35.2.4 Notes

- <op_code>=1 (server name) and <op_code>=2 (IP address) are equivalent, when the broker connection is established the server name is transformed into the IP address.

LARA-R6

- <op_code>=10 (clean session) is supported only to maintain server-side persistence (subscription and will data persistency).

35.3 Save/Restore MQTT-SN profile from NVM +UMQTTSNNV

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

35.3.1 Description

Either saves all of the MQTT-SN client profile parameters to NVM (non-volatile memory) or sets all of the MQTT-SN client profile parameters to either factory-programmed or non-volatile stored values.

For the complete list of parameters that can be stored in the NVM, see the +UMQTTSN AT command.

35.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMQTTSNNV=<NVM_mode>	OK	AT+UMQTTSNNV=2 OK
Test	AT+UMQTTSNNV=?	+UMQTTSNNV: (list of <NVM_mode>s) OK	+UMQTTSNNV: (0-2) OK

35.3.3 Defined values

Parameter	Type	Description
<NVM_mode>	Number	Operation to set or save the MQTT-SN client profile parameters as follows: • 0: restore MQTT-SN client profile parameters to the factory-programmed setting • 1: set MQTT-SN client profile parameters to values previously stored in the NVM • 2: store current MQTT-SN client profile parameters to the NVM

35.4 MQTT-SN command +UMQTTSNC

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

35.4.1 Description

Triggers the MQTT-SN actions corresponding to the <op_code> parameter. The final result code indicates if sending the command request to the MQTT-SN process was successful or not.

The +UUMQTTSNC URC provides the result of the requested action from the MQTT-SN gateway. In addition, the +UUMQTTSNC URC also provides the notification that unread messages are available from the MQTT-SN gateway. The +UUMQTTSNC URC is by default enabled.

LARA-R6
The +UUMQTTSNC: 0,100 URC is notified when the MQTT-SN gateway releases the connection.
The +UUMQTTSNC: 0,101 URC is notified when the network connection is lost.

35.4.2 Syntax

Type	Syntax	Response	Example
Generic syntax			
Set	AT+UMQTTSNC=<op_code>[,<param1>[,<param2>[,[<param3>],[<param4>,<param5>,<param6>]]]]	[+UMQTTSNC: <op_code>,<param1>[,<param2>,<param3>,<param4>,<param5>,<param6>]] OK	AT+UMQTTSNC=1 +UMQTTSNC: 1,1 OK
MQTT-SN disconnect			
Set	AT+UMQTTSNC=0[,<duration>]	OK	AT+UMQTTSNC=0

Type	Syntax	Response	Example
			OK
URC		+UUMQTTSNC: 0,<logout_result>	+UUMQTTSNC: 0,1
MQTT-SN connect			
Set	AT+UMQTTSNC=1	OK	AT+UMQTTSNC=1 OK
URC		+UUMQTTSNC: 1,<MQTTSN_result>	+UUMQTTSNC: 1,1
MQTT-SN register			
Set	AT+UMQTTSNC=2,<topic_name>	OK	AT+UMQTTSNC=2,"sensor/heat/SD" OK
URC		+UUMQTTSNC: 2,<MQTTSN_result>,<topic_id>	+UUMQTTSNC: 2,1,1
MQTT-SN publish			
Set	AT+UMQTTSNC=4,<QoS>,<retain>,<hex_mode>,<topic_type>,<topic_pub>,<message>	OK	AT+UMQTTSNC=4,1,0,0,0,"1","23 degrees Celsius" OK
URC		+UUMQTTSNC: 4,<MQTTSN_result>	+UUMQTTSNC: 4,1
MQTT-SN subscribe			
Set	AT+UMQTTSNC=5,<max_QoS>,<topic_type>,<topic>	OK	AT+UMQTTSNC=5,1,0,"sensor/heat/SD" OK
URC		+UUMQTTSNC: 5,<MQTTSN_result>,<g_QoS>,<topic_id_sub>	+UUMQTTSNC: 5,1,0,1
MQTT-SN unsubscribe			
Set	AT+UMQTTSNC=6,<topic_type>,<topic>	OK	AT+UMQTTSNC=6,1,"1" OK
URC		+UUMQTTSNC: 6,<MQTTSN_result>	+UUMQTTSNC: 6,1
MQTT-SN will topic update			
Set	AT+UMQTTSNC=7,<will_QoS>,<will_retain>,<will_topic>	OK	AT+UMQTTSNC=7,1,0,"sensor/heat/SD/lastwill" OK
URC		+UUMQTTSNC: 7,<MQTTSN_result>	+UUMQTTSNC: 7,1
MQTT-SN will message update			
Set	AT+UMQTTSNC=8,<will_message>	OK	AT+UMQTTSNC=8,"Unrequested disconnect" OK
URC		+UUMQTTSNC: 8,<MQTTSN_result>	+UUMQTTSNC: 8,1
MQTT-SN read message			
Set	AT+UMQTTSNC=9[,<one_message>]	+UMQTTSNC: 9,<QoS>,<topic_type>,<topic_msg_length>,<topic_length>,<topic_pub>,<msg_length>,<message> OK	AT+UMQTTSNC=9,1 +UMQTTSNC: 9,1,0,19,1,"1",18,"23 degrees Celsius" OK
URC		+UUMQTTSNC: 9,<num_unread_msgs>	+UUMQTTSNC: 9,2
MQTT-SN ping			
Set	AT+UMQTTSNC=10,<ping_ON_OFF>	OK	AT+UMQTTSNC=10,1 OK
URC (only in case of no ping response received)		+UUMQTTSNC: 10,0	+UUMQTTSNC: 10,0
MQTT-SN publish a file to a topic			

Type	Syntax	Response	Example
Set	AT+UMQTTSNC=11,<QoS>,<retain>,<topic_type>,<topic_pub>,<filename>	OK	AT+UMQTTSNC=11,1,0,0,"2","msg.txt" OK
URC		+UUMQTTSNC: 11,<MQTTSN_result>	+UUMQTTSNC: 11,1
Test	AT+UMQTTSNC=?	+UMQTTSN: (list of supported <op_codes>s) OK	+UMQTTSNC: (0-2,4-11) OK
URC		+UUMQTTSNC: <op_code>,<param1>[,<param2>,...,<paramN>]	+UUMQTTSNC: 5,1,0,1

35.4.3 Defined values

Parameter	Type	Description
<op_code>	Number	MQTT-SN command request. Allowed values: • 0: logs out/disconnects from the MQTT-SN server. The will message will not be sent • 1: logs in/connects to the MQTT-SN server • 2: register message to request a topic ID against a normal topic name from the gateway • 3: search gateway message; broadcasted by a client when it searches for a gateway • 4: publish a message to a specific topic to the gateway • 5: subscribe to a topic • 6: unsubscribe to a topic.This should exactly match the topic filter used during the Subscribe • 7: update the will topic name stored in the gateway/server • 8: update the will message stored in the gateway/server • 9: read all unread messages received from the gateway • 10: ping the MQTT-SN gateway • 11: publish a message from a file to a specific topic to the gateway
<duration>	Number	Indicates the value of the sleep timer in seconds; the default value is 0.
<MQTTSN_result>	Number	Result of a MQTT-SN command request: • 0: fail; for more details, see the +UMQTTSNER AT command • 1: success
<login_result>	Number	Result of a MQTT-SN login request. Allowed values: • 0: connection accepted • 1: rejected due to a congestion • 2: rejected due to an invalid topic ID • 3: rejected because not supported • 4-255: reserved for future use
<logout_result>	Number	Result of an MQTT-SN command request: • 0: fail; for more details, see the +UMQTTSNER AT command • 1: success Result of an unsolicited notification for an MQTT-SN session interruption caused by: • 100: timeout, the MQTT-SN gateway released the connection. • 101: lost network connection.
<topic_name>	String	Indicates a topic with variable length. It must be used with the register command and can be used with the subscribe or unsubscribe commands. • LARA-R6 - The maximum length is 256 characters.
<topic_id>	Number	Indicates the topic ID value: an unique number generated by the server and sent back to the module as a response to a register request or to a subscribe request.
<gateway_id>	Number	Indicates the gateway ID.
<QoS>	Number	Quality of service: • 0: at most once delivery • 1: at least once delivery • 2: exactly once delivery • 3: special publish QoS of 3. It is also known as QoS-1 (see MQTT-SN introduction)
<retain>	Number	Whether or not the message will be retained across disconnections. Allowed values: • 0: the message will not be retained by the MQTT broker

Parameter	Type	Description
		• 1: the message will be retained by the MQTT broker
<hex_mode>	Number	Allowed values: • 0 (default value): ASCII input for <message> • 1: hexadecimal input for <message>
<topic_type>	Number	Indicates the type of the topic contained in the topic field: • 0: normal • 1: predefined • 2: short
<topic>	String	Contains the topic ID value or the short/normal topic name for which the data is published.
<topic_pub>	String	Contains the topic ID value (a number between 1 and 65535) or the short topic name (a two characters string) for which the data is published.
<message>	String	ASCII or hexadecimal data. The maximum length is: • LARA-R6 - 1024 characters if <hex_mode>=0 or 512 octets if <hex_mode>=1.
<publish_result>	Number	Result of a MQTT-SN publish request. Allowed values: • 0: accepted • 1: rejected due to an invalid topic ID • 2: rejected due to congestion
<max_QoS>	Number	Maximum requested QoS level for this topic: • 0: at most once delivery • 1: at least once delivery • 2: exactly once delivery
<sub_result>	Number	Result of a MQTT-SN subscription request. Allowed values: • 0: accepted • 1: rejected due to an invalid topic ID • 2: rejected due to congestion
<g_QoS>	Number	Indicates the granted QoS level.
<topic_id_sub>	Number	Indicates the topic ID when sending publish messages from the gateway to the client. Not relevant in case of subscriptions to a short topic name or a topic name which contains wildcard characters.
<will_QoS>	Number	Indicates the last will QoS level. Allowed values: • 0: at most once delivery • 1: at least once delivery • 2: exactly once delivery
<will_retain>	Number	Whether or not the last will message will be retained across disconnections: • 0: the last will message will not be retained by the MQTT-SN gateway • 1: the last will message will be retained by the MQTT-SN gateway
<will_topic>	String	Indicates the will topic name. Setting it as an empty string will delete <will_topic> and <will_message> stored in the gateway/server.
<will_message>	String	Will message.
<num_unread_msgs>	Number	Indicates the number of unread received messages.
<msg_length>	Number	Specifies the number of octets in <message>.
<rcv_message>	String	ASCII data. The starting quotation mark shall not be taken into account like data. At the end of the byte stream, another quotation mark is provided for user convenience and visualization purposes.
<topic_length>	Number	Topic length
<topic_msg_length>	Number	Sum of topic and message length
<one_message>	Number	Allowed values: • 0: read all received messages • 1: read only one message
<ping_ON_OFF>	Number	Allowed values: • 0 (default value): ping disabled • 1: ping enabled; the MT will ping the MQTT-SN gateway. The ping is issued when the MQTT-SN keep alive period expires. See AT+UMQTT=8,<duration>
<paramx>	Number / String	Type and supported content depend on the related <op_code> parameter (details are given above).

Parameter	Type	Description
<filename>	String	File name containing the payload of the message to be published. The maximum parameter length is 250 characters and the maximum file content is 1024 characters.

35.4.4 Notes

LARA-R6

- The time to establish the secure session (when using +UMQTTSN: 11,1[,<USECMNG_profile>]) could require up to 150 s in one of these cases:
  - RoT generated PSK (+USECPRF: <profile_id>,11)
  - encrypted session resumption (+USECPRF: <profile_id>,13,2,10)

  This is due to "security heartbeat" message operation. For more details on when this scenario occurs, see the +USECCONN AT command.
- When the module exits from the sleeping mode (with the AT+UMQTTSNC=1 connect command) the received and not read publish messages are deleted.
- Only predefined topic id or short topic name are allowed in case of publishing a message with QoS level -1.

35.5 MQTT-SN error +UMQTTSNER

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

35.5.1 Description

Retrieves the error class and code of the last MQTT-SN operation that provided an error.

35.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+UMQTTSNER	+UMQTTSNER: <error_class>,<error_code> OK	AT+UMQTTSNER +UMQTTSNER: 14,1 OK

35.5.3 Defined values

Parameter	Type	Description
<error_class>	Number	Value of error class. Values are listed in Internet suite error classes.
<error_code>	Number	Value of class-specific error code. The values are listed in MQTT-SN class error codes.

36 Lightweight M2M

36.1 LwM2M Objects management

36.1.1 Introduction

Lightweight M2M is a protocol from the Open Mobile Alliance (OMA) that defines the application layer communication between a LwM2M server and a LwM2M client. LwM2M includes device management and service enablement for LwM2M devices. For more details on LwM2M protocol, see Lightweight Machine to Machine Technical Specification [211].

36.1.1.1 LARA-R6 object management

u-blox cellular modules allows querying the available objects and their instances with +ULWM2MLIST AT command. It is not possible to add new LwM2M objects, only new instances can be created.

☞ For all the single instance objects, only Instance ID 0 is valid.

It is possible to modify LwM2M objects, using the following AT commands:

- **+ULWM2MCREATE** creates an object instance associated with a given server ID.
- **+ULWM2MDELETE** deletes an object instance. The delete target must already exist and be listed by the +ULWM2MLIST AT command.
- **+ULWM2MWRITE** writes to an object instance or resource. The instance must already exist and be listed by the +ULWM2MLIST AT command.
- **+ULWM2MREAD** reads an object, object instance, or resource. The read target must already exist and be listed by the +ULWM2MLIST AT command.

36.1.2 List available LwM2M objects +ULWM2MLIST

+ULWM2MLIST						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

36.1.2.1 Description

Lists all the instances of a specific LwM2M object. In order to list all the existing LwM2M objects and instances in the LwM2M object table issue the AT+ULWM2MLIST="/" command. If an object has no current instances, only the object ID is listed.

36.1.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MLIST=<object_URI>	+ULWM2MLIST: [<1st_URI>[,<2nd_URI>[,...[,<nth_URI>]]]] OK	AT+ULWM2MLIST="/" +ULWM2MLIST: "/1/1","/1/2","/2/1","/2/2","/2/3","/2/4","/2/5","/2/6","/2/7","/2/8","/2/0","/3/0","/4/0","/3300" OK
Test	AT+ULWM2MLIST=?	OK	OK

36.1.2.3 Defined values

Parameter	Type	Description
<object_URI>	String	Uniform Resource Identifier (URI) of the LwM2M object to query. The format is "/object_ID". By means of the special value "/" all the existing LwM2M objects and instances are returned.
<1st_URI>,...,<nth_URI>	String	Uniform Resource Identifier (URI) to existing object

36.1.2.4 Notes

LARA-R6

- The command only accepts the root URI "/" as <object_URI> parameter. This will provide the list of existing object IDs; to get each object instances, the +ULWM2MREAD AT command can be used.

36.1.3 Create new instance of LwM2M object +ULWM2MCREATE

+ULWM2MCREATE						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

36.1.3.1 Description

Creates a new instance of a LwM2M object.

36.1.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MCREATE=<JSON>, <server_id>	OK	AT+ULWM2MCREATE="{\"bn \":\"/16/0\",\"e\":[{\"n\":\"0/0\",\"sv \":\"HMAN0\"},{\"n\":\"0/1\",\"sv \":\"HMOD0\"},{\"n\":\"0/2\",\"sv \":\"HSW0\"},{\"n\":\"0/3\",\"sv\": \"HUID0\"}]}",721 OK
Test	AT+ULWM2MCREATE=?	+ULWM2MCREATE: "JSON",(list of supported <server_id>s) OK	+ULWM2MCREATE: "JSON",(1-65534) OK

36.1.3.3 Defined values

Parameter	Type	Description
<JSON>	String	JSON-formatted LwM2M resource or object instance; for more details, Lightweight Machine to Machine Technical Specification [211]. If the JSON data contains embedded double quotes, they must be properly escaped with a backslash character '\'.
<server_id>	Number	Short server ID of the LwM2M server owner of the associated object instance. The range goes from 1 to 65534.

36.1.4 Delete instance of LwM2M object +ULWM2MDELETE

+ULWM2MDELETE						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

36.1.4.1 Description

Deletes an instance of a LwM2M object.

36.1.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MDELETE=<URI>	OK	AT+ULWM2MDELETE="/14/7" OK
Test	AT+ULWM2MDELETE=?	+ULWM2MDELETE: "Object Id/ Resource Id" OK	+ULWM2MDELETE: "Object Id/ Resource Id" OK

36.1.4.3 Defined values

Parameter	Type	Description
<URI>	String	Uniform Resource Identifier (URI) to existing object

36.1.5 Write to LwM2M object +ULWM2MWRITE

+ULWM2MWRITE						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

36.1.5.1 Description

Writes a LwM2M object, object instance, or resource.

Within 60 s after the command execution, the new setting is saved in file system and is persistent across power cycles.

36.1.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MWRITE=<JSON>[,<mode>]	OK	AT+ULWM2MWRITE="{\"bn\":\"/1/1/\",\"e\":[{\"n\":\"1\",\"v\":1000}]}" OK
Test	AT+ULWM2MWRITE=?	+ULWM2MWRITE: "JSON" OK	+ULWM2MWRITE: "JSON" OK

36.1.5.3 Defined values

Parameter	Type	Description
<JSON>	String	JSON-formatted LwM2M resource or object instance; for more details, Lightweight Machine to Machine Technical Specification [211]. If the JSON data contains embedded double quotes, they must be properly escaped with a backslash character '\'. An empty string causes the LwM2M data to be immediately written into the file system.
<mode>	Number	Allowed values: • 0 (default value): partial write that changes only resources given • 1: replace write, overwriting multi-instance resources with the array passed in JSON

36.1.6 Read from LwM2M object +ULWM2MREAD

+ULWM2MREAD						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

36.1.6.1 Description

Displays the value of a LwM2M object, object instance, or resource.

36.1.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MREAD=<URI>	+ULWM2MREAD: <JSON> OK	AT+ULWM2MREAD="/1/1/1" +ULWM2MREAD: {"bn":"/1/1/1/","e":[{"n":"1","v":1000}]} OK
Test	AT+ULWM2MREAD=?	+ULWM2MREAD: "URI" OK	+ULWM2MREAD: "URI" OK

36.1.6.3 Defined values

Parameter	Type	Description
<URI>	String	Uniform Resource Identifier (URI) to existing object
<JSON>	String	JSON-formatted LwM2M resource or object instance; for more details, Lightweight Machine to Machine Technical Specification [211]. The maximum length is: • LARA-R6 - 3072 characters

Parameter	Type	Description
		If the returned JSON length exceeds the parameter maximum length an error result code is issued.

36.1.6.4 Notes

LARA-R6

- The command AT+ULWM2MREAD="/0" is not allowed in order not to disclose some security parameters.

36.2 LwM2M connectivity

36.2.1 LwM2M URCs configuration +ULWM2MSTAT

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

36.2.1.1 Description

Configures the URC reporting status for LwM2M client. The URC assumes a different syntax and meaning depending on the reported <event> value and it may be related to a specific LwM2M server (e.g. <event>=1). According to the <event> parameter value a URC can be issued:

- **<event>=0 (bootstrap status)**: for each phase of the factory bootstrap procedure
- **<event>=1 (registration status)**: when a LwM2M server changes the state of its registration
- **<event>=2 (remaining time until the next registration update)**: to periodically show the remaining time (in seconds) before the next registration update towards each LwM2M server
- **<event>=3 (notification)**: when a LwM2M notification is sent from the LwM2M client to the LwM2M server during a valid observation
- **<event>=4 (LwM2M client status)**: when the overall state of the LwM2M client changes
- **<event>=5 (LwM2M client initialization status)**: for each phase of the initialization of the LwM2M client
- **<event>=6 (LwM2M server connection status)**: when a connection with a LwM2M server starts/stops/pauses/resumes

36.2.1.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MSTAT=<n>[,<verbosity_mask>]	OK	AT+ULWM2MSTAT=1,1 OK
Read	AT+ULWM2MSTAT?	+ULWM2MSTAT: <n>,<verbosity_mask> OK	+ULWM2MSTAT: 1,1 OK
Test	AT+ULWM2MSTAT=?	+ULWM2MSTAT: (list of supported <n>s),(list of supported <verbosity_mask>s) OK	+ULWM2MSTAT: (0,1),(1-7) OK
Generic syntax			
URC		+ULWM2MSTAT: <event>,<param1>[,<param2>[,<param3>[,<param4>]]]	+ULWM2MSTAT: 1,721,2
Bootstrap status			
URC		+ULWM2MSTAT: 0,<server_id>,<status>	+ULWM2MSTAT: 0,721,2
Registration status			
URC		+ULWM2MSTAT: 1,<server_id>,<status>	+ULWM2MSTAT: 1,721,2
Registration interval			
URC		+ULWM2MSTAT: 2,<server_id>,<reg_update_timer>	+ULWM2MSTAT: 2,721,10
Notification			

Type	Syntax	Response	Example
URC		+ULWM2MSTAT: 3,<server_id>,<URI>	+ULWM2MSTAT: 3,123,"/3300/0/5700"
LwM2M client status			
URC		+ULWM2MSTAT: 4,<client_status>	+ULWM2MSTAT: 4,7
LwM2M client initialization status			
URC		+ULWM2MSTAT: 5,<client_init_status>	+ULWM2MSTAT: 5,1
LwM2M server connection status generic syntax			
URC		+ULWM2MSTAT: 6,<server_id>,<server_connection_status>,<param3>[,<param4>]	+ULWM2MSTAT: 6,721,0,"leshan.eclipseprojects.io:5684"
LwM2M server connection created			
URC		+ULWM2MSTAT: 6,<server_id>,0,<server_address>	+ULWM2MSTAT: 6,721,0,"leshan.eclipseprojects.io:5684"
LwM2M server connection suspended			
URC		+ULWM2MSTAT: 6,<server_id>,1,<sent_data>,<received_data>	+ULWM2MSTAT: 6,721,1,1254,4588
LwM2M server connection resumed			
URC		+ULWM2MSTAT: 6,<server_id>,2,<server_address>	+ULWM2MSTAT: 6,721,2,"leshan.eclipseprojects.io:5684"
LwM2M server connection closed			
URC		+ULWM2MSTAT: 6,<server_id>,3,<sent_data>,<received_data>	+ULWM2MSTAT: 6,721,3,2365,5699

36.2.1.3 Defined values

Parameter	Type	Description
<n>	Number	Enables and disables the +ULWM2MSTAT URC: • 0: LwM2M status URC disabled • 1: LwM2M status +ULWM2MSTAT URC enabled The factory-programmed value is: • LARA-R6 - 0
<verbosity_mask>	Number	Optional parameter, represents a bitmask. It enables different levels of verbosity in +ULWM2MSTAT URC: • bit 0: enables reporting of <event>s from 0 to 4 • bit 1: enables reporting of <event>: 5 • bit 2: enables reporting of <event>: 6 The factory-programmed value is 1 (only bit 0 enabled)
<event>	Number	Event type: • 0: bootstrap status • 1: registration status • 2: remaining time until the next registration update • 3: notification. A notify message has been triggered as per Lightweight Machine to Machine Technical Specification [211] • 4: LwM2M client status • 5: LwM2M client initialization status • 6: LwM2M server connection status
<server_id>	Number	Short server ID corresponding to a server defined by object 1 resource 0.
<status>	Number	Status code corresponding to the server state. Allowed values: • LARA-R6 o 0: deregistered o 1: registration hold o 2: registration pending o 3: registration success o 4: registration failed o 5: registration update pending o 6: registration update needed o 7: registration full update needed o 8: deregistration needed

Parameter	Type	Description
		o 9: deregistration pending o 10: bootstrap hold off o 11: bootstrap initiated o 12: bootstrap pending o 13: bootstrap finishing o 14: bootstrap finished o 15: bootstrap failing o 16: bootstrap failed
<reg_update_timer>	Number	Time in seconds until the next registration update.
<URI>	String	Uniform Resource Identifier (URI) to existing object
<client_status>	Number	LwM2M client status: • 0: initial • 1: bootstrap required • 2: bootstrapping • 3: registration required • 4: registering • 5: ready • 6: command mode only. No server communication occurs. • 7: client shut down
<client_init_status>	Number	LwM2M client initialization status: • 1: initialization started • 2: initialization finished • 3: client start aborted due to production mode • 4: initialization failed
<server_connection_status>	Number	LwM2M server connection status: • 0: connection created; <param3> is the <server_address> • 1: connection idle; <param3> is <sent_data> and <param4> is the <received_data> • 2: connection restored; <param3> is the <server_address> • 3: connection closed; <param3> is <sent_data> and <param4> is the <received_data>
<server_address>	String	LwM2M server address, corresponding to the resource 0 of the Security Object, in the format "host:port".
<sent_data>	Number	Amount of data sent (at the CoAP level) to the LwM2M server so far on this logical connection.
<received_data>	Number	Amount of data received (at the CoAP level) from the LwM2M server so far on this logical connection.
<param1>	Number	The content depends on the related <event> (details are given above).
<param2>	String	Content and type depend on the related <event> (details are given above).
<param3>	Number or String	The content depends on the related <event> (details are given above).
<param4>	Number	The content depends on the related <event> (details are given above).

36.2.1.4 Notes

LARA-R6

- <event>=4 (LwM2M client status) is not supported.

36.2.2 Activate/deactivate LwM2M client +ULWM2M

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

36.2.2.1 Description

Activates or deactivates the LwM2M client.

After issuing the AT+ULWM2M=1 (stop the LwM2M client) command or the AT+ULWM2M=2 (reset the LwM2M client) command, the LwM2M features and the FOTA updates are not available.

The AT+ULWM2M=2 command erases the LwM2M object database; it has no effect on the NVM settings regarding LwM2M activation/deactivation.

☞ LARA-R6

- The AT+ULWM2M=1 (stop/disable the LwM2M client) or AT+ULWM2M=0 (start/enables the LwM2M client) commands save the <activation_mode> parameter in NVM.
- If the GCF-PTCRB (<MNO>=201) profile is selected (see the +UMNOPROF AT command), the LwM2M client is disabled. Otherwise, if one of the other MNO profile is selected, and <activation_mode>=0, the LwM2M client is enabled at boot.
- It is possible to query the <activation_mode> NVM setting (can be 0 or 1) by issuing the read command.
- After issuing the AT+ULWM2M=1 (stop the LwM2M client) command, reboot the module (e.g. by means of AT+CFUN=16) to make the setting effective.

36.2.2.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2M=<activation_mode>[,<nvm_saved>]	OK	AT+ULWM2M=1 OK
Read	AT+ULWM2M?	+ULWM2M: <activation_mode> OK	+ULWM2M: 1 OK
Test	AT+ULWM2M=?	+ULWM2M: (list of supported <activation_mode>s),(list of supported <nvm_saved>s) OK	+ULWM2M: (0-2),(0-1) OK

36.2.2.3 Defined values

Parameter	Type	Description
<activation_mode>	Number	Operation type: • 0: activates and enables the LwM2M client • 1: stops or disables the LwM2M client • 2: reset the LwM2M client (erases the LwM2M object database) • 3: communication with NTT DoCoMo servers disabled • 4: communication with NTT DoCoMo servers enabled Allowed values: • LARA-R6 - 0 (factory-programmed value), 1, 2
<nvm_saved>	Number	Enables/disables the storing of <activation_mode>=1 configuration in the NVM. Allowed values: • 0 (default value): do not store the <activation_mode>=1 configuration in the NVM • 1: store the <activation_mode>=1 configuration in the NVM

36.2.2.4 Notes

LARA-R6

- The <nvm_saved> parameter is not supported.

36.2.3 Initiate LwM2M server registration +ULWM2MREG

+ULWM2MREG						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No / OP	No	-	+CME Error

36.2.3.1 Description

Forces the bootstrap or the registration for a specific LwM2M server.

36.2.3.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MREG=<server_id>	OK	AT+ULWM2MREG=123 OK

Type	Syntax	Response	Example
Read	AT+ULWM2MREG?	+ULWM2MREG: <server_id>, <server_status>[,<registration_ interval>] OK	+ULWM2MREG: 721,2,175 OK
Test	AT+ULWM2MREG=?	+ULWM2MREG: (0, list of supported <server_id>s) OK	+ULWM2MREG: (0,721,123) OK

36.2.3.3 Defined values

Parameter	Type	Description
<server_id>	Number	Short server ID corresponding to a server defined by object 1 resource 0
<server_status>	Number	Status code corresponding to the server state. Allowed values: • LARA-R6 o 0: deregistered o 1: registration hold o 2: registration pending o 3: registration success o 4: registration failed o 5: registration update pending o 6: registration update needed o 7: registration full update needed o 8: deregistration needed o 9: deregistration pending o 10: bootstrap hold off o 11: bootstrap initiated o 12: bootstrap pending o 13: bootstrap finishing o 14: bootstrap finished o 15: bootstrap failing o 16: bootstrap failed
<registration_ interval>	Number	For successfully registered servers (see the <server_status> parameter) this is the number of seconds until the next registration update

36.2.3.4 Notes

LARA-R6

- The set command returns immediately the "OK" final result code and the LwM2M registration procedure to the target set server is scheduled and executed later. The registration is confirmed by +ULWM2MSTAT URC, where the <reg_update_timer> parameter is expected to increment after a successful server registration.

36.2.4 LwM2M server deregistration +ULWM2MDEREG

+ULWM2MDEREG						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No	No	-	+CME Error

36.2.4.1 Description

Forces a deregistration for a specific LwM2M server or for all servers by means of the <server_id> parameter.

Issue a test command to retrieve the list of the available server IDs.

36.2.4.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MDEREG=<server_id>	OK	AT+ULWM2MDEREG=0 OK

Type	Syntax	Response	Example
Test	AT+ULWM2MDEREG=?	+ULWM2MDEREG: (0,list of supported <server_id>s) OK	+ULWM2MDEREG: (0,721) OK

36.2.4.3 Defined values

Parameter	Type	Description
<server_id>	Number	Short server ID corresponding to a server defined by object 1 resource 0. The special value 0 means deregister all servers.

36.2.4.4 Notes

LARA-R6

- The set command returns immediately the "OK" final result code and the LwM2M deregistration procedure to the target set server is scheduled and executed later. The deregistration is confirmed by the +ULWM2MSTAT URC, where the <status>=0 parameter confirms a successful server deregistration.

36.2.5 LwM2M server configuration +ULWM2MCONFIG

+ULWM2MCONFIG						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No / OP	No	-	+CME Error

36.2.5.1 Description

Configures connection parameters for a LwM2M server. It can be used to edit existing configurations or to define configurations for additional servers. This command allows specifying parameters used during a server connection and LwM2M client behavior in case of a registration failure.

The information text response to the read command provides the configuration of LwM2M servers connection parameters in separate rows.

LARA-R6
The LwM2M client cannot register with the LwM2M server if the connection requires the use of the pre-shared key (PSK) generated by the root of trust (<usec_psk>=1) and the secure data suite features on the module are disabled (+USECMODE: 0). If enabled, the +ULWM2MSTAT URC will report the registration failure.

Allowed values of <server_id> depends on the selected mobile network operator profile (for more details, see the +UMNOPROF AT command). For the list of available servers in each mobile network operator profile, refer to the +ULWM2MREG AT command row of the proper mobile network operator table in Mobile network operator profiles.

36.2.5.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MCONFIG= <server_id>, <bootstrap_on_failure>, <pdn_ip_type>, <cid>, <usec_psk>, <reg_update_boot>, <dtls_session_resumption>, <full_registration_after_fota>, <DTLS_NAT_timer>, <reg_upd_at_PSM_exit>, <reg_upd_after_DTLS_handshake>, <server_disabled>	OK	AT+ULWM2MCONFIG=721,0,2,1,1,0,0,0,40,0,0,0 OK
Read	AT+ULWM2MCONFIG?	+ULWM2MCONFIG: <server_id>, <bootstrap_on_failure>, <pdn_ip_type>, <cid>, <usec_psk>, <reg_update_boot>, <dtls_session_resumption>, <full_registration_after_fota>, <DTLS_NAT_timer>, <reg_upd_at_PSM_exit>, <reg_upd_after_DTLS_handshake>, <server_disabled>	+ULWM2MCONFIG: 721,0,2,1,1,0,0,0,40,0,0,0 +ULWM2MCONFIG: 123,0,1,1,0,0,0,0,40,0,0,0 OK

Type	Syntax	Response	Example
		[...] OK	
Test	AT+ULWM2MCONFIG=?	+ULWM2MCONFIG: (list of supported <server_id>s), (list of supported <bootstrap_on_failure>s), (list of supported <pdn_ip_type>s), (list of supported <cid>s), (list of supported <usec_psk>s), (list of supported <reg_update_boot>s), (list of supported <dtls_session_resumption>s), (list of supported <full_registration_after_fota>s), (list of supported <DTLS_NAT_timer>s), (list of supported <reg_upd_at_PSM_exit>s), (list of supported <reg_upd_after_DTLS_handshake>s), (list of supported <server_disabled>s) OK	+ULWM2MCONFIG: (1-65535),(0-1),(1-3),(1-8),(0-1),(0-1),(0-1),(0-1),(0-86400),(0-1),(0-2),(0-2) OK

36.2.5.3 Defined values

Parameter	Type	Description
<server_id>	Number	Short server ID corresponding to a server defined by object 1 resource 0
<bootstrap_on_failure>	Number	Enable/disable a bootstrap attempt after a failed registration. Allowed values: • 0: disable a bootstrap attempt after a failed registration • 1: enable a bootstrap attempt after a failed registration
<pdn_ip_type>	Number	Packet data network (PDN) type. Allowed values: • 1: IPv4 • 2: IPv6 • 3: IPv4v6
<cid>	Number	See <cid>. LARA-R6 Also value 255 is supported, which sets the <general_data_cid> in +ULWM2MCONFIGEXT.
<usec_psk>	Number	Use the pre-shared key (PSK) generated by the root of trust. Allowed values: • 0: disabled • 1: enabled For more details on data and device security features, see Data and device security.
<reg_update_boot>	Number	Force a registration update with the LwM2M server after a reboot. Allowed values: • 0: disabled • 1: enabled
<dtls_session_resumption>	Number	Enable the DTLS session resumption. For more details, see RFC 7925 [195]. Allowed values: • 0: disabled • 1: enabled
<full_registration_after_fota>	Number	Force a full registration with the LwM2M server after a FOTA has been performed. Allowed values: • 0: disabled • 1: enabled
<DTLS_NAT_timer>	Number	Timeout (in seconds) representing the network address translation (NAT) timer for LwM2M DTLS session re-handshake. Timer is restarted after any LwM2M packet is sent or received; if it times out, the next delivery will cause a DTLS handshake. The range goes from 0 to 86400.
<reg_upd_at_PSM_exit>	Number	Force a full registration with the LwM2M server when module turns ON as a result of PSM exit. Allowed values: • 0: disabled • 1: enabled
<reg_upd_after_DTLS_handshake>	Number	Force a registration update in the case a new DTLS handshake is performed. Allowed values: • 0: always disabled

Parameter	Type	Description
		• 1: always enabled • 2: enabled only during FOTA
<server_disabled>	Number	When disabled, LwM2M client communication to the server is prevented: it will not perform registration updates and no data to the server will be sent. Allowed values: • 0: always enabled • 1: always disabled • 2: disabled only in roaming cell condition

36.2.5.4 Notes

LARA-R6

- These settings are stored in internal files. Three files are available: one for AT&T, one for Verizon, one for all other MNOs. If the MNO profile is changed via the +UMNOPROF AT command, no change to the settings stored in the file will occur but the corresponding file will be selected.
- A FOTA/FOAT FW upgrade may change these settings. In this case the custom configurations will get lost after the upgrade and must be re-inserted.

36.2.6 LwM2M extended configuration +ULWM2MCONFIGEXT

+ULWM2MCONFIGEXT						
Modules	All products					
Attributes	**Syntax**	**PIN required**	**Settings saved**	**Can be aborted**	**Response time**	**Error reference**
	full	No	No / OP	No	-	+CME Error

36.2.6.1 Description

Configures several parameters related to LwM2M functionality: idle timer, out of coverage timer, timers and number of retry attempts, <cid> to be used in case no other connection is available, the delay before the device performs a radio reboot following a Verizon Class 3 APN replacement.

36.2.6.2 Syntax

Type	Syntax	Response	Example
Set	AT+ULWM2MCONFIGEXT=<connection_teardown_timer>,<out_of_coverage_timer>,<communication_retry_timer>,<communication_retry_count>,<general_data_cid>,<production_mode>,<production_sim>,<imei_source>,<apn_sync>,<radio_reboot_delay>	OK	AT+ULWM2MCONFIGEXT=60,3600,120,5,0,1,"00101",0,0,0 OK
Read	AT+ULWM2MCONFIGEXT?	+ULWM2MCONFIGEXT: <connection_teardown_timer>,<out_of_coverage_timer>,<communication_retry_timer>,<communication_retry_count>,<general_data_cid>,<production_mode>,<production_sim>,<imei_source>,<apn_sync>,<radio_reboot_delay> OK	+ULWM2MCONFIGEXT: 60,3600,120,5,0,1,"00101",0,0,0 OK
Test	AT+ULWM2MCONFIGEXT=?	+ULWM2MCONFIGEXT: (list of supported <connection_teardown_timer>s),(list of supported <out_of_coverage_timer>s),(list of supported <communication_retry_timer>s),(list of supported <communication_retry_count>s),(list of supported <general_data_cid>s),(list of supported <production_mode>s),(list of supported <production_sim>s),(list of supported <imei_source>s),(list of supported <apn_	+ULWM2MCONFIGEXT: (0-86400),(0-86400),(1-86400),(0-65535),(0-11),(0-1),("","00000-999999"),(0-1),(0-1),(0,5-60) OK

Type	Syntax	Response	Example
		sync>s),(list of supported <radio_ reboot_delay>s) OK	

36.2.6.3 Defined values

Parameter	Type	Description
<connection_ teardown_timer>	Number	Timeout (in seconds) after which the data connection no longer used by LwM2M is closed. The range goes from 0 to 86400. The factory-programmed value depends on the selected mobile network operator profile (for more details, see Mobile network operator profiles).
<out_of_coverage_ timer>	Number	Timeout (in seconds) after which, during an out-of-coverage condition, the LwM2M attempts to communicate again with the server. The range goes from 0 to 86400. The factory-programmed value is 20 s.
<communication_ retry_timer>	Number	The delay (in seconds) between successive communication attempts in a communication sequence. This is the value used if there is no corresponding "Communication Retry Timer" resource (/1/x/18) in the LwM2M object database. The range goes from 1 to 86400. The factory-programmed value is 30 s.
<communication_ retry_count>	Number	The number of successive communication attempts before which a communication sequence is considered as failed. This is the value used if there is no corresponding "Communication Retry Count" resource (/1/x/17) in the LwM2M object database. The range goes from 0 to 65535. The factory-programmed value is 4.
<general_data_cid>	Number	<cid> that the LwM2M client uses when connecting to a server whose <cid>, as defined by the corresponding parameter of the +ULWM2MCONFIG command, is 255. For the allowed range, see <cid>.
<production_mode>	Number	Enable LwM2M production feature: LwM2M will not start if the <production_sim> parameter values matches the used SIM. Allowed values: • 0: disabled • 1: enabled The factory-programmed value depends on the selected mobile network operator profile (for more details, see Mobile network operator profiles).
<production_sim>	String	String value of 5 or 6 digits for the SIM filtering. If the <production_sim> parameter values matches the first digits of the IMSI, the LwM2M client does not start. Used only if <production_mode> is enabled. Also accepts void string which corresponds to disabled regardless of <production_mode> value. The factory-programmed value depends on the selected mobile network operator profile (for more details, see Mobile network operator profiles).
<imei_source>	Number	Reserved. Fixed value "0" shall be configured in set command.
<apn_sync>	Number	Enable synchronization of APN entries between instances of LwM2M object 11 "APN connection profile" and +CGDCONT entries. Allowed values: • 0: disabled • 1: enabled The factory-programmed value depends on the selected mobile network operator profile (for more details, see Mobile network operator profiles).
<radio_reboot_ delay>	Number	Define the delay in seconds before the device performs a radio reboot following a Verizon Class 3 APN replacement, performed by the Verizon LWM2M server. It has sense only in Verizon configuration (+UMNOPROF: 3). Allowed values: • 0 (factory-programmed value): the radio reboot is not performed at all. • Range from 5 to 60.

36.2.6.4 Notes

LARA-R6

- These settings are stored in internal files. Three files are available: one for AT&T, one for Verizon, one for all other MNOs. If the MNO profile is changed via the +UMNOPROF AT command, no change to the settings stored in the file will occur but the corresponding file will be selected.
- A FOTA/FOAT FW upgrade may change these settings. In this case the custom configurations will get lost after the upgrade and must be re-inserted.
- When in Verizon configuration (+UMNOPROF: 3) the <connection_teardown_timer> parameter is set to 60 in compliance to Verizon LWM2M OTADM Requirement Plan. This value shall not be changed.
- At the first module boot the global MNO profile is selected (+UMNOPROF: 90), the <production_mode> is set to 1 and <production_sim> is set to "00101": this means that the LwM2M client will not start if a

test SIM with IMSI starting from "00101" is inserted. This option can be disabled with <production_mode> or it can be customized for a different SIM. For more details, see the LwM2M objects and commands application note [68].

36.2.7 LwM2M host device information +ODIS

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

36.2.7.1 Description

Sets the host identification, manufacturer, model number and software version for the LwM2M device management. If the current MNO profile is not set to AT&T (+UMNOPROF: 2), AT&T 2-4-12 (+UMNOPROF: 198) or FirstNet (+UMNOPROF: 206) and the command is issued, the module returns an error result code.

Within 60 s after the command execution, the new setting is saved in file system and is persistent across power cycles.

☞ LARA-R6
If the +UFACTORY AT command is issued, the factory-programmed setting is restored.

36.2.7.2 Syntax

Type	Syntax	Response	Example
Set	AT+ODIS=<Host_Device_ID>,<Host_Device_Manufacturer>,<Host_Device_Model>,<Host_Device_Software_Version>	OK	AT+ODIS="ubx123456-","u-blox","C030-R510","A1.01" OK
Read	AT+ODIS?	+ODIS: <Host_Device_Manufacturer>,<Host_Device_Model>,<Host_Device_Software_Version> OK	+ODIS: "u-blox","C030-R510","A1.01" OK
Test	AT+ODIS=?	+ODIS: (Host Device ID),(Host Device Manufacturer),(Host Device Model),(Host Device Software Version) OK	+ODIS: (Host Device ID),(Host Device Manufacturer),(Host Device Model),(Host Device Software Version) OK

36.2.7.3 Defined values

Parameter	Type	Description
<Host_Device_ID>	String	Host identification. The factory-programmed value is "HUID0".
<Host_Device_Manufacturer>	String	Host manufacturer name. The factory-programmed value is "HMAN0".
<Host_Device_Model>	String	Host model identification. The factory-programmed value is "HMOD0".
<Host_Device_Software_Version>	String	Host software version. The factory-programmed value is "HSW0".

A Appendix: Error result codes

A.1 Mobile termination error result codes +CME ERROR

Numeric error code	Description
0	Phone failure
1	No connection to phone
2	Phone-adaptor link reserved
3	Operation not allowed
4	Operation not supported
5	PH-SIM PIN required
6	PH-FSIM PIN required
7	PH-FSIM PUK required
10	SIM not inserted
11	SIM PIN required
12	SIM PUK required
13	SIM failure
14	SIM busy
15	SIM wrong
16	Incorrect password
17	SIM PIN2 required
18	SIM PUK2 required
20	Memory full
21	Invalid index
22	Network not found
23	Memory failure
24	Text string too long
25	Invalid characters in text string
26	Dial string too long
27	Invalid characters in dial string
30	No network service
31	Network timeout
32	Network not allowed - emergency calls only
40	Network personalisation PIN required
41	Network personalisation PUK required
42	Network subset personalisation PIN required
43	Network subset personalisation PUK required
44	Service provider personalisation PIN required
45	Service provider personalisation PUK required
46	Corporate personalisation PIN required
47	Corporate personalisation PUK required
50	Incorrect parameters
51	Command implemented but currently disabled
52	Command aborted by user
53	Not attached to network due to MT functionality restrictions
54	Modem not allowed - MT restricted to emergency calls only
55	Operation not allowed because of MT functionality restrictions
56	Fixed dial number only allowed - called number is not a fixed dial number
57	Temporarily out of service due to other MT usage
100	Unknown
103	Illegal MS
106	Illegal ME
107	GPRS services not allowed
108	GPRS and non GPRS services not allowed

Numeric error code	Description
111	PLMN not allowed
112	Location area not allowed
113	Roaming not allowed in this location area
114	GPRS services not allowed in this PLMN
115	No Suitable Cells In Location Area
122	Congestion
125	Not authorized for this CSG
126	Insufficient resources
127	Missing or unknown APN
128	Unknown PDP address or PDP type
129	User authentication failed
130	Request rejected by Serving GW or PDN GW
131	Request rejected, unspecified
132	Service option not supported
133	Requested service option not subscribed
134	Service option temporarily out of order
135	NS-api already used
137	EPS QoS not accepted
138	Network failure
140	Feature not supported
141	Semantic error in the TFT operation
142	Syntactical error in the TFT operation
143	Unknown PDP context
144	Semantic errors in packet filter(s)
145	Syntactical errors in packet filter(s)
146	PDP context without TFT already activated
147	PTI mismatch
148	Unspecified GPRS error
149	PDP authentication failure
150	Invalid mobile class
153	ESM information not received
154	PDN connection does not exist
155	Multiple PDN connections for a given APN not allowed
156	User Busy
159	Uplink Busy/ Flow Control
160	Bearer handling not supported
165	Maximum number of EPS bearers reached
166	Requested APN not supported in current RAT and PLMN combination
168	Network failure
169	IMSI unknown in VLR
170	Congestion
171	Last PDN disconnection not allowed
172	Semantically incorrect message
173	Mandatory information element error
174	Information element non-existent or not implemented
175	Conditional IE error
176	Protocol error, unspecified
177	Operator determined barring
178	Maximum number of PDP contexts reached
179	Requested APN not supported in current RAT and PLMN combination
180	Request rejected, bearer control mode violation
181	Invalid PTI value
189	Semantically incorrect message
190	Invalid mandatory IE
191	Message type non existent

Numeric error code	Description
192	Message type not compatible
193	IE non existent
194	Conditional IE error
195	Message not compatible
197	Protocol error unspecified
254	Invalid error mapping
255	Internal error
262	SIM blocked
300	ME failure
301	SMS service of ME reserved
302	Operation not allowed
303	Operation not supported
304	Invalid PDU mode parameter
305	Invalid text mode parameter
310	(U)SIM not inserted
311	(U)SIM PIN required
312	PH-(U)SIM PIN required
313	(U)SIM failure
314	(U)SIM busy
315	(U)SIM wrong
316	(U)SIM PUK required
317	(U)SIM PIN2 required
318	(U)SIM PUK2 required
320	Memory failure
321	Invalid memory index
322	Memory full
330	SMSC address unknown
331	No network service
332	Network timeout
340	No +CNMA acknowledgement expected
500	Unknown error
608	Voice call active
701	Incorrect security code
702	Max attempts reached
1001	Unassigned (unallocated) number
1003	No route to destination
1006	Channel unacceptable
1008	Operator determined barring
1016	Normal call clearing
1017	User busy
1018	No user responding
1019	User alerting, no answer
1021	Call rejected
1022	Number changed
1026	Non selected user clearing
1027	Destination out of order
1028	Invalid number format (incomplete number)
1029	Facility rejected
1030	Response to STATUS ENQUIRY
1031	Normal, unspecified
1034	No circuit/channel available
1038	Network out of order
1041	Temporary failure
1042	Switching equipment congestion
1043	Access information discarded

Numeric error code	Description
1044	requested circuit/channel not available
1047	Resources unavailable, unspecified
1049	Quality of service unavailable
1050	Requested facility not subscribed
1055	Incoming calls barred within the CUG
1056	Collision with network initiated request
1057	Bearer capability not authorized
1058	Bearer capability not presently available
1059	Unsupported QCI value
1063	Service or option not available, unspecified
1065	Bearer service not implemented
1068	ACM equal to or greater than ACMmax
1069	Requested facility not implemented
1070	Only restricted digital information bearer capability is available
1079	Service or option not implemented, unspecified
1081	Invalid transaction identifier value
1087	User not member of CUG
1088	Incompatible destination
1091	Invalid transit network selection
1095	Semantically incorrect message
1096	Invalid mandatory information
1097	Message type non-existent or not implemented
1098	Message type not compatible with protocol state
1099	Information element non-existent or not implemented
1100	Conditional IE error
1101	Message not compatible with protocol state
1102	Recovery on timer expiry
1111	Protocol error, unspecified
1112	APN restriction value incompatible with active EPS bearer context
1127	Interworking, unspecified
1142	Network Error
1143	Invalid EPS bearer identity
1149	Last PDN disconnection not allowed
1243	Emm Error Unspecified
1244	Esm Error Unspecified
1279	Number not allowed
1283	CCBS possible
1500	Wrong GPIO identifier
1501	Set GPIO default error
1502	Select GPIO mode error
1503	Read GPIO error
1504	Write GPIO error
1505	GPIO busy
1520	Wrong ADC identifier
1521	Read ADC error
1530	IPv4 only allowed
1531	IPv6 only allowed
1540	Wrong ringer identifier
1542	LLC or SNDCP failure
1543	Regular deactivation
1544	Reactivation requested
1545	Single address bearers only allowed
1546	Invalid transaction identifier value
1547	APN restriction val incompatible with PDP context
1548	PDP activation rejected

Numeric error code	Description
1549	unknown PDP address or PDP type
1550	GPRS generic operation error
1551	GPRS invalid APN
1552	GPRS authentication failure
1553	GPRS QoS parameters inconsistent
1554	GPRS network failure
1555	GPRS context busy
1556	CSD generic operation error
1557	CSD undefined profile
1558	CSD context busy
1559	PLMN scan not allowed
1600	FFS error
1560	PDP type IPv4 only allowed
1561	PDP type IPv6 only allowed
1612	FILE NOT FOUND
1613	Cannot open file
1614	TAC value not allowed
1615	OTP failure
1616	Wrong Check Digit
1620	Buffer full
1621	FFS initializing
1622	FFS already open file
1623	FFS not open file
1624	FFS file not found
1625	FFS file already created
1626	FFS illegal id
1627	FFS illegal file handle
1628	FFS illegal type
1629	FFS illegal mode
1630	FFS file range
1631	FFS operation not possible
1632	FFS write error
1633	FFS user id error
1634	FFS internal fatal error
1635	FFS memory resource error
1636	FFS maximum number of files exceeded
1637	FFS memory not available
1638	FFS invalid filename
1639	FFS streaming not enabled
1640	FFS operation not allowed on static file
1641	FFS memory table inconsistency
1642	FFS not a factory default file
1643	FFS requested memory temporary not available
1644	FFS operation not allowed for a directory
1645	FFS directory space not available
1646	FFS too many streaming files open
1647	FFS requested dynamic memory temporary not available
1648	FFS user provided a NULL parameter instead of a suitable buffer
1649	FFS timeout
1650	Command line too long
1660	Call barred - Fixed dialing numbers only
1670	SEC remote object wrong state
1671	SEC ROT not personalized
1672	SEC loss of connectivity
1673	SEC service not authorized

Numeric error code	Description
1674	SEC FW package installation required
1675	SEC FW package not valid
1676	SEC resource not available
1677	SEC data not available
1678	SEC timeout
1679	SEC data inconsistent or unsupported
1680	SEC pspk lock pending
1681	SEC C2C already paired
1682	SEC C2C channels consumed
1683	SEC C2C pairing not present
1684	SEC busy
1685	SEC connection failed due to a DNS resolution error
1686	SEC restore pending
1687	SEC RoT IO error
1688	SEC RoT IO pending
1689	SEC disabled
1700	GPS GPIO not configured
1701	GPS GPIO ownership error
1702	Invalid operation with GPS ON
1703	Invalid operation with GPS OFF
1704	Invalid GPS aiding mode
1705	Reserved GPS aiding mode
1706	GPS aiding mode already set
1707	Invalid GPS trace mode
1708	Parameter valid only in case of GPS OTA
1709	GPS trace invalid server
1710	Invalid TimeZone
1711	Invalid value
1712	Invalid parameter
1713	Invalid operation with LOC running / GPS Busy
1800	No ongoing call
1801	IBM busy / eCall already armed/active
1802	IBM feature off / eCall feature off
1803	Wrong IBM requested
1804	Audio resource not available
1805	ECALL restriction
1806	eCall invalid dial number
1900	No SAP Server Connection
1901	SAP Protocol Error
1902	SAP Connection failure
1903	SAP Server Disconnection
1904	SAP Other terminal using service
1910	USECMNG import timeout expired (no input for > 20 s)
1911	USECMNG import file size exceeds limit
1912	USECMNG no memory available
1913	USECMNG invalid certificate/key format
1914	USECMNG database full
1950	CDC-ECM is not available
1951	CDC-ECM is busy
1952	No DHCP Packets received from the DTE
2000	Command timeout
3000	Command aborted
4000	APN configuration mismatch
4001	IP type configuration mismatch
5000	FOTA package download state or name mismatch

Numeric error code	Description
5001	FOTA package data corrupted
5002	FOTA memory is in use

A.2 Message service error result codes +CMS ERROR

Numeric error code	Description
1	Unassigned (unallocated) number
5	Delta firmware unavailable on FOTA server
8	Operator determined barring
10	Call barred
17	Network failure
21	Short message transfer rejected
22	Memory capacity exceeded
27	Destination out of service
28	Unidentified subscriber
29	Facility rejected
30	Unknown Subscriber
38	Network out of order
41	Temporary failure
42	Congestion
47	Resources unavailable, unspecified
50	Requested facility not subscribed
69	Requested facility not implemented
81	Invalid short message reference value
95	Invalid message, unspecified
96	invalid mandatory information
97	Message type non-existent or not implemented
98	Message not compatible with short message protocol state
99	Information element non-existent or not implemented
111	Protocol error, unspecified
127	Interworking, unspecified
128	Telematic interworking not supported
129	Short message type 0 not supported
130	Cannot replace short message
143	Unspecified TP-PID error
144	Data coding scheme (alphabet) not supported
145	Message class not supported
159	Unspecified TP-DCS error
160	Command cannot be actioned
161	Command unsupported
175	Unspecified TP-Command error
176	TPDU not supported
192	SC busy
193	No SC subscription
194	SC system failure
195	Invalid SME address
196	Destination SME barred
197	SM Rejected-Duplicate SM
198	TP-VPF not supported
199	TP-VP not supported
208	SIM SMS storage full
209	No SMS storage capability in SIM
210	Error in MS
211	Memory Capacity Exceeded
212	SIM Application Toolkit Busy

Numeric error code	Description
213	SIM data download error
287	Network failure unspecified
290	Network no resource
296	Radio Resources not Aailable due to DUAL SIM operation
297	Out of service due to DUAL SIM operation
300	ME failure
301	SMS service of ME reserved
302	Operation not allowed
303	operation not supported
304	Invalid PDU mode parameter
305	Invalid Text mode parameter
310	SIM not inserted
311	SIM PIN required
312	PH-SIM PIN required
313	SIM failure
314	SIM busy
315	SIM wrong
320	memory failure
321	invalid memory index
322	memory full
330	SMSC address unknown
331	no network service
332	network timeout
340	no +CNMA acknowledgement expected
350	Unassigned (unallocated) number
351	Operator determined barring
352	Call barred
353	ME failure
354	Short message transfer rejected
355	Number changed
356	Destination out of order
357	Unidentified subscriber
358	Facility rejected
359	Unknown subscriber
364	Requested facility not subscribed
365	Requested facility not implemented
368	Invalid mandatory information
369	Message type non-existent or not implemented
370	Message not compatible with short message protocol state
371	Information element non-existent or not implemented
372	Protocol error, unspecified
373	Interworking, unspecified
360	Network out of order
361	Temporary failure
362	Congestion
363	Resources unavailable, unspecified
366	Invalid short message transfer reference value
367	Invalid message, unspecified
500	unknown error
512	Relay Protocol Acknowledgement
513	SMS timer expired
514	SMS forwarding availability failed
515	SMS forwarding availability aborted
516	MS invalid TP-Message-Type-Indicator
517	MS no TP-Status-Report in Phase 1

Numeric error code	Description
518	MS no TP-Reject-Duplicate in phase 1
519	MS no TP-Replay-Path in Phase 1
520	MS no TP-User-Data-Header in Phase 1
521	MS missing TP-Validity-Period
522	MS invalid TP-Service-Centre-Time-Stamp
523	MS missing TP-Destination-Address
524	MS invalid TP-Destination-Address
525	MS missing Service-Centre-Address
526	MS invalid Service-Centre-Address
527	MS invalid alphabet
528	MS invalid TP-User-Data-length
529	MS missing TP-User-Data
530	MS TP-User-Data to long
531	MS no Command-Request in Phase 1
532	MS Cmd-Req invalid TP-Destination-Address
533	MS Cmd-Req invalid TP-User-Data-Length
534	MS Cmd-Req invalid TP-User-Data
535	MS Cmd-Req invalid TP-Command-Type
536	MN MNR creation failed
537	MS CMM creation failed
538	MS network connection lost
539	MS pending MO SM transfer
540	RP-Error OK
541	RP-Error OK no icon display
542	SMS-PP Unspecified
543	SMS rejected By SMS CONTROL
543	FDN check failed
544	Service Centre Address(SCA) FDN failed
545	Destination Address(DA) FDN failed
546	BDN check failed
547	Unspecified SMS PP error
548	Undefined Result
548	No Route To Destination
549	Channel Unacceptable
555	No Circuit/Channel Available
556	Access Information Discarded
557	Requested Circuit/Channel Not Available By Other Side
558	Quality Of Service Unavailable
560	Bearer Capability Not Authorized
561	Bearer Capability Not Presently Available
562	Service or Option Not Available, Unspecified
563	Bearer Service Not Implemented
564	ACM Equal to or Greater Than ACMmax
565	Only Restricted Digital Information Bearer Capability Is Available
566	Service or Option Not Implemented, Unspecified
567	User Not Member of CUG
568	Incompatible By Destination
569	Invalid Transit Network Selection
571	Message Not Compatible With Protocol State
572	Recovery On Timer Expiry
576	Data Call Active
577	Speech Call Active
579	MOC Setup Rejected Due to Missing ACM Info
580	Temporary Forbidden Call Attempt
581	Called Party is Blacklisted

Numeric error code	Description
583	Temporary Forbidden Call Attempt No Service
584	Temporary Forbidden Call Attempt Limited Service
585	Client Temporary Barred
586	Dual Service Call Active
587	Atc Fclass Not Speech
590	Client Not Registrated
591	Active Client Gone
595	Rejected By Call Control
601	Invalid ALS Line
604	MM No Service (out of coverage)
605	MM Access Class Barred (RR_REL_IND During RR Conn. Establishment)
606	ME Busy -CM Service Request Already Pending
608	Rejected Due To SUP Timer Expiry
609	Rejected Due To USSD Busy
610	Rejected Due To SS Busy
612	SIM Toolkit Request Is Rejected, Because Another SIM Toolkit Request Is Pending
614	Rejected Because SIM Toolkit Request Is Not Yet Answered By The User
615	MN Setup SS Error
616	Call Controller Blocked (Other Call Command Pending)
618	Environment Parameter Not Set Correctly (Fclass/Cmod)
619	Other Blocking Call Present
620	Lower Layer Failure
621	The Authentication Proedure Failed
622	The Packet-Switched Registration Procedure Failed
623	CM Service Reject From The Network
624	The ABORT Message Was Received From The Network
625	Timer Expiry
626	IMSI Deatch Was Initiated
627	Normal RR Connection Release (2G)
628	Registration Failed
630	Failure Due To Handover
631	Link Establishment Failure
632	Random Access Failure
633	Radio Link Aborted
634	Lower Layer Failure in Layer 1
635	Immediate Assignment Reject
636	Failure Due To Paging
637	Abnormal Release Unspecified
638	Abnormal Release Channel Unacceptable
639	Abnormal Release Timer Expired
640	Abnormal Release No Act On Radio Path
641	Preemptive Release
642	UTRAN Configuration Unknown
643	Handover Impossible
644	Channel Mode Unacceptable
647	Lower Layer Failure From NW
649	Conditional IE Error
650	No Cell Allocation Available
653	Re Establishment Reject
654	Directed Sigconn Re Establishment
656	Release of RRC connection Witout Network Activity(3G) Lower Layer Failure Downlink
657	Lower Layer Failure Uplink
658	Cell Barred Due To Authentication Failure

Numeric error code	Description
659	Signalling Connection Release
660	CS Connection Release Triggered By MM
661	RRC Connection Establishment Failure
662	RRC Connection Establsihment Reject With Redirection
663	Resource Conflict
664	Lower Layer Failure in Layer 2
665	L2 Cause T200 Expiry N200 Plus 1 Times
669	RR Connection Release Due to BAND Change (2G)
670	Release of the RRC Connection Due to Out of Service in Cell_Fach (3G)
671	Release of the RRC Connection Due to Not Matching PLMN in Shared Networks(3G)
672	Error Happens While Call Is Already Disconnected / Late Error
674	SIM Toolkit Cannot Initiate A Call, Because MMI Is Not Registered
675	SIM Toolkit Call Setup Request Is Rejected Due User Did Not Accept
676	Proactive SIM Appl Terminated By User
677	SIM Toolkit Originated SIM Reset (Refresh Request)
680	Dial String/Number Incorrect

A.3 Firmware install final result codes

The +UFWINSTALL AT command issues a final result code providing the result of the FW install procedure. In case the FW install procedure fails, the error result code provides some indication about the error cause (syntax error or issue during the installation procedure).

A.3.1 LARA-R6 final result codes from command syntax

Syntax error resulting from the +UFWINSTALL command:

Numeric error code	Verbose description	Description
4	+CME ERROR: not supported	One of the following cases: • Wrong serial port number • Wrong baud rate • Number of parameters not allowed • Filename too long
1624	+CME ERROR: FFS file not found	The delta file is not stored in the module FS or the filename is wrong

A.3.1.1 LARA-R6 final result codes from end of update procedure

A.3.1.2 LARA-R6 final result codes table

Here below are listed the allowed final result codes that can be issued at the finalization of the install procedure by means of the +UFWINSTALL and +UFWUPD AT commands.

Error result code	Description	+UFWINSTALL: URC UART port and baud rate	+UFWUPD: URC UART port and baud rate
128	Firmware install successfully performed	Set by +UFWINSTALL	Primary UART, 115200 b/s
129	Firmware install generic failure	Set by +UFWINSTALL	Primary UART, 115200 b/s
130	Flash access failure	Default: primary UART, 115200 b/s	Primary UART, 115200 b/s
131	RAM allocation error	Default: primary UART, 115200 b/s	Primary UART, 115200 b/s
132	Retrieve partition table error	Default: primary UART, 115200 b/s	Primary UART, 115200 b/s
134	Bad block flash initialization failure	Set by +UFWINSTALL	Primary UART, 115200 b/s
140	Generic decompression engine error	Set by +UFWINSTALL	Primary UART, 115200 b/s
141	RAM error	Set by +UFWINSTALL	Primary UART, 115200 b/s
144	Requested file does not exist during installation (it could be a working file/ partition in flash or FW file/partition to be updated. It could be a flash error)	Set by +UFWINSTALL	Primary UART, 115200 b/s

Error result code	Description	+UFWINSTALL: URC UART port and baud rate	+UFWUPD: URC UART port and baud rate
145	Attempt to do file operation when file system access is not available	Set by +UFWINSTALL	Primary UART, 115200 b/s
148	Delta file is corrupted	Set by +UFWINSTALL	Primary UART, 115200 b/s
158	Delta file not recognized. It happens trying to update from a non-delta file format	Set by +UFWINSTALL	Primary UART, 115200 b/s
160	Flash writing failure	Set by +UFWINSTALL	Primary UART, 115200 b/s
168	Source firmware in flash mismatch with the one expected by the delta file	Set by +UFWINSTALL	Primary UART, 115200 b/s
173	Calculated digital signature does not match package header value - probably wrong signature or some byte corrupted	Set by +UFWINSTALL	Primary UART, 115200 b/s
174	Delta file version is not supported	Set by +UFWINSTALL	Primary UART, 115200 b/s
178	RAM memory corruption (null pointer assignment)	Set by +UFWINSTALL	Primary UART, 115200 b/s
180	Size of the delta file in flash mismatch with the real delta file size	Set by +UFWINSTALL	Primary UART, 115200 b/s
195	Data corruption found in a component/ partition/file updated in flash. Probably cause by power loss cause or flash problem	Set by +UFWINSTALL	Primary UART, 115200 b/s
224	Generic error in finalizing the end of the install procedure. Last check before exiting install	Set by +UFWINSTALL	Primary UART, 115200 b/s
227	FOTA public key is not found or invalid	Set by +UFWINSTALL	Primary UART, 115200 b/s
230	File operation (write/read/delete) in flash fail	Set by +UFWINSTALL	Primary UART, 115200 b/s
247	Pre-validation of the delta file failed	Set by +UFWINSTALL	Primary UART, 115200 b/s

A.4 FOAT error result codes

See +UFWUPD command description.

A.4.1 LARA-R6 error result codes

Error result code	Description
ERROR1	The operation has been interrupted and the actual FW is unchanged; the module drops out from Firmware Update Mode
ERROR2	The operation has been interrupted during FW updating; the actual firmware is corrupted and the module remains in Firmware Update Mode
ERROR3	The signature check fails
ERROR4	The module has received unexpected EOT because not all excepted bytes have been received
ERROR5	The boot does not support the selected baudrate
ERROR6	Invalid AT command sent during boot
FLS header decoding failed	An error occurs during decoding of file header
Buffer Data Overrun	The buffers are not filled at least with a 1029 packet: data comes too slowly
Timeout	The command must be re-sent: no data is coming

A.4.2 LARA-R6 extended error result codes

For the allowed final result codes that can be issued at the finalization of the install procedure by means of the +UFWUPD AT command, see Final result codes from end of update procedure.

A.5 Dynamic DNS unsolicited indication codes

The following table lists the available values of <error_code> parameter of the last Dynamic DNS update provided through +UUDYNDNS URC (for more details, see the +UDYNDNS AT command description).

Numeric error code	Description
0	Success

Numeric error code	Description
1	Data connection lost while performing update
2	Cannot update dynamic DNS because a private IP address has been assigned to the module
3	Connection to dynamic DNS server failed
4	Error occurred sending data to dynamic DNS server
5	Error occurred reading response from dynamic DNS server
6	Timeout while waiting response from dynamic DNS server
7	Dynamic DNS server closed connection unexpectedly
8	Unexpected response from dynamic DNS server
9	Dynamic DNS response seems to be incomplete
10	Update has been delayed in order to respect DNS update protocol timing specification
40	Dynamic DNS protocol specific: good (TZO code 200)
41	Dynamic DNS protocol specific: nochg (TZO code 304)
42	Dynamic DNS protocol specific: notfqdn
43	Dynamic DNS protocol specific: nohost
44	Dynamic DNS protocol specific: numhost
45	Dynamic DNS protocol specific: badauth (TZO code 401)
46	Dynamic DNS protocol specific: badagent (TZO code 405)
47	Dynamic DNS protocol specific: !donator
48	Dynamic DNS protocol specific: abuse
49	Dynamic DNS protocol specific: dnserr
50	Dynamic DNS protocol specific: 911
51	Dynamic DNS protocol specific: badsys
52	Dynamic DNS protocol specific: !yours
53	Dynamic DNS protocol specific: TZO code 403
54	Dynamic DNS protocol specific: TZO code 407
55	Dynamic DNS protocol specific: TZO code 414
56	Dynamic DNS protocol specific: TZO code 415
57	Dynamic DNS protocol specific: TZO code 480
100-108	Internal errors

☞ The meaning of dynamic DNS protocol specific codes depends on the provider used; see the provider documentation.

☞ Errors 45, 46, 53, 54 and 56 trigger a client self deactivation when the provider is TZO.com.

☞ Errors 42, 43, 44, 46, 48, 51 and 52 trigger a client self deactivation when the selected provider is DynDNS.org or DynDNS.it or No-IP.org or DynamicDNS.org.

A.6 Internal TCP/UDP/IP stack class error codes

The following table lists all allowed error classes that can be provided by the internal TCP/UDP/IP stack through +USOER and +USOCTL (with <param_id>=1) AT commands.

Numeric error code	Description	Resulting from the following commands
0	No error	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
1	EPERM - Operation not permitted (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
2	ENOENT - No such resource (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
4	EINTR - Interrupted system call (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI

Numeric error code	Description	Resulting from the following commands
5	EIO - I/O error (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
9	EBADF - Bad file descriptor (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
10	ECHILD - No child processes (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
11	EWOULDBLOCK / EAGAIN - Current operation would block, try again	+USOCO, +USOWR
12	ENOMEM - Out of memory (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
14	EFAULT - Bad address (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
22	EINVAL - Invalid argument	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
32	EPIPE - Broken pipe (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
38	ENOSYS - Function not implemented	+USOSO, +USOGO
64	ENONET - Machine is not on the internet	+USOCR, +USOWR, +USOST, +USORD, +USORF, +USOLI
65	EEOF - End of file	+USOWR, +USOST, +USORD, +USORF
71	EPROTO - Protocol error	+USOWR, +USOST, +USORD, +USORF
77	EBADFD - File descriptor in bad state (internal error)	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
78	EREMCHG - Remote address changed	+USOWR, +USOST, +USORD, +USORF, +USOCL
89	EDESTADDRREQ - Destination address required	+USOCO, +USOST
91	EPROTOTYPE - Wrong protocol type for socket	+USOCR
92	ENOPROTOOPT - Protocol not available	+USOCR
93	EPROTONOSUPPORT - Protocol not supported	+USOCR
94	ESOCKTNNOSUPPORT - Socket type not supported	+USOCR
95	EOPNOTSUPP - Operation not supported on transport endpoint	+USOWR, +USOST, +USORD, +USORF, +USOCL
96	EPFNOSUPPORT - Protocol family not supported	+USOCR
97	EAFNOSUPPORT - Address family not supported by protocol	+USOCR
98	EADDRINUSE - Address already in use	+USOLI
99	EADDRNOTAVAIL - Cannot assign requested address	+USOCR, +USOLI, +USOCO
100	ENETDOWN - Network is down	+USOCR, +USOLI, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOCL
101	ENETUNREACH - Network is unreachable	+USOCO, +USOST, +USORF
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

Numeric error code	Description	Resulting from the following commands
107	ENOTCONN - Transport endpoint is not connected	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
108	ESHUTDOWN - Cannot send after transport endpoint shutdown	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
110	ETIMEDOUT - Connection timed out	+USOCO, +USOST, +USORD, +USORF
111	ECONNREFUSED - Connection refused	+USOCO
112	EHOSTDOWN - Host is down	+USOCL, +USOCO, +USOWR, +USOST, +USORD, +USORF
113	EHOSTUNREACH - No route to host	+USOCO, +USOWR, +USOST, +USORD, +USORF
115	EINPROGRESS - Operation now in progress	+USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI
160	ENSRNODATA - DNS server returned answer with no data	+UDNSRN
161	ENSRFORMERR - DNS server claims query was misformatted	+UDNSRN
162	ENSRSERVFAIL - DNS server returned general failure	+UDNSRN
163	ENSRNOTFOUND - Domain name not found	+UDNSRN
164	ENSRNOTIMP - DNS server does not implement requested operation	+UDNSRN
165	ENSRREFUSED - DNS server refused query	+UDNSRN
166	ENSRBADQUERY - Misformatted DNS query	+UDNSRN
167	ENSRBADNAME - Misformatted domain name	+UDNSRN
168	ENSRBADFAMILY - Unsupported address family	+UDNSRN
169	ENSRBADRESP - Misformatted DNS reply	+UDNSRN
170	ENSRCONNREFUSED - Could not contact DNS servers	+UDNSRN
171	ENSRTIMEOUT - Timeout while contacting DNS servers	+UDNSRN
172	ENSROF - End of file	+UDNSRN
173	ENSRFILE - Error reading file	+UDNSRN
174	ENSRNOMEM - Out of memory	+UDNSRN
175	ENSRDESTRUCTION - Application terminated lookup	+UDNSRN
176	ENSRQUERYDOMAINTOOLONG - Domain name is too long	+UDNSRN
177	ENSRCNAMELOOP - Domain name is too long	+UDNSRN

A.7 Internet suite error classes

The following table lists all allowed error classes that can be provided by the <error_class> parameter for these AT error commands:

- LARA-R6 - +UFTPER, +UHTTPER, +UMQTTER, +UMQTTSNER, +UCOAPER that provide the error of the last FTP, HTTP, MQTT, MQTT-SN, COAP operation.

<error_class>	Description	<error_codes>	Resulting from the following commands
0	OK, no error occurred		All
1	FTP Protocol error class	See the Appendix A.7.1	+UFTPC, +UFTP
3	HTTP Protocol error class	See the Appendix A.7.2	+UHTTP, +UHTTPC
4	Flash File System error class	See the Appendix A.7.3	+UFTPC, +UFTPER, +UHTTPC
5	DNS error class		+UFTPC, +UHTTPC, +USMTPC
6	Socket error class	BSD error codes standard	All
7	Dynamic Memory error	0	All
8	Wrong FTP API usage (e.g. missing/null parameters)	See the Appendix A.7.1	+UFTPC, +UFTP
10	Wrong HTTP API usage (e.g. missing/null parameters)	See the Appendix A.7.2	+UHTTP, +UHTTPC
11	Syntax error in high layer Protocol (wrong/missing/ corrupted data)		+UFTPC, +UHTTPC, +USMTPC

<error_class>	Description	<error_codes>	Resulting from the following commands
12	Unspecified error	0	All
13	MQTT error class	See the Appendix A.7.4	+UMQTT, +UMQTTC, +UMQTTWTOPIC, +UMQTTWMSG
14	MQTT-SN error class	See the Appendix A.7.5	+UMQTTSN, +UMQTTSNC

A.7.1 FTP class error codes

The following table lists the available values of <error_code> parameter of the last FTP operation provided through +UFTPER AT command if <error_class>=1 or 8 (for more details, see the +UFTP, +UFTPC AT commands description).

Numeric error code	Description
0	No error
1	User missing
2	Password missing
3	Account missing
4	Server missing
5	Directory name missing
6	Filename missing
7	Null parameter
8	Unknown FTP command
9	Unknown file action
10	Wrong FTP state
11	Wrong parameter
12	PSD or CSD connection not established
13	No memory available for allocation
14	Reserved internal code
15	Length of given web server (address or hostname) too long or too short
16	Hostname of given web server invalid
17	Address of given web server is invalid
18	Username too long or too short
19	Password too long or too short
20	Account too long or too short
21	Operation not allowed because FTP client is busy
22	Not possible to connect to FTP server
23	Error occurred in FTP request
24	Reserved internal code
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

Numeric error code	Description
47	Cannot bind socket to network interface
48	Cannot resolve hostname
49	Cannot connect socket
50	Cannot get socket name
51	Cannot bind socket to port
52	Socket cannot listen
53	Socket cannot accept
54	Socket would block
55	Socket cannot write
56	Socket cannot read
57	Reserved internal code
58	No socket data to send
59	Socket cannot get available data
60	No socket data to read
61	Socket no response code found
62	Socket not connected
63	Cannot set secure socket
64	Socket cannot decode password
65	Socket cannot get size
66	FFS Invalid parameter
67	FFS invalid handle
68	FFS cannot open file
69	FFS cannot seek file
70	FFS cannot get file size
71	FFS cannot read
72	FFS bad offset
73	FFS cannot write
74	Direct link internal error
75	Failed to open extended passive mode
76	Failed to parse extended passive mode server reply
77	Internal error
78	Client IP protocol not supported - try passive mode
79	Data transfer error. The transferred (received/sent) data is not complete
226	Closing data connection; requested file action successful (for example, file transfer or file abort)
250	Requested file action okay, completed
350	Requested file action pending further information
421	Service not available, closing control connection. User limit reached Not authorized to make the connection Maximum connections reached Maximum connections exceeded
425	Cannot open data connection
426	Connection closed; transfer aborted. The command opens a data connection to perform an action, but that action is cancelled, and the data connection is closed
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

Numeric error code	Description
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 [174] and RFC 2428 [175].

A.7.2 HTTP class error codes

The following table lists the available values of <error_code> parameter of the last HTTP operation provided through +UHTTPER AT command if <error_class>=3 or 10 (for more details, see the +UHTTP and +UHTTPC AT commands description).

Numeric error code	Description
0	No error
1	Invalid profile ID
2	Invalid input
3	Server hostname too long
4	Invalid server hostname
5	Invalid server IP address
6	Invalid authorization method
7	Server missing
8	Username length exceeded
9	Password length exceeded
10	Internal error
11	Server connection error
12	Error occurred in HTTP request
13	Internal error
14	Internal error
15	Invalid POST data size
16	Empty FFS filename
17	Invalid FFS file length
18	Invalid content-type specified
19	Internal error
20	Internal error
21	Internal error
22	PSD or CSD connection not established
23	Server or proxy hostname lookup failed
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

Numeric error code	Description
42	Output file close error
43	Output file write error
44	Connection lost
45	Operation not allowed in current state
46 - 72	Internal error
73	Secure socket connect error

A.7.3 File system class error codes

LARA-R6

The following table lists the available values of <error_code> parameter of the last FTP or HTTP operation provided through +UFTPER and +UHTTPER.

Numeric error code	Description
2	Operation performed with success
3	Initialization in progress
4	File already opened
5	File not opened
6	File not found
7	File already created
8	Illegal id
9	Illegal file handle
10	Illegal type
11	Illegal mode
12	File range error
13	The operation is not possible
14	Write error
15	User id error
16	Internal fatal error
17	Memory resource error
18	Maximum number of files exceeded
19	Memory not available
20	Invalid filename
21	Streaming not enabled
22	Operation not allowed on static file
23	Memory table inconsistency
24	Not a factory default file
25	Requested memory temporary not available
26	Operation not allowed for a directory
27	Space in the directory space not available
28	Too many streaming files opened
29	Requested dynamic memory temporary not available
30	The user provided a NULL parameter instead of a suitable buffer

A.7.4 MQTT error codes

A.7.4.1 LARA-R6 MQTT class error codes

The following table lists the available values of <error_code> parameter of the last MQTT operation provided through the +UMQTTER AT command.

Numeric error code	Description
0	Operation performed with success
1	Memory failure
2	Invalid parameter
3	Invalid parameter range
4-7	Internal error
8	Cannot set secure socket

Numeric error code	Description
9	Invalid client identifier
10	Client identifier length out of range
11	Syntax error in client identifier
12	Invalid broker
13	Broker length out of range
14	Broker port out of range
15	Invalid username or password
16	Username length out of range
17	Password length out of range
18	Keep alive time out of range
19	Security mode out of range
20	Wrong Security Manager Profile
21	Security Manager Profile out of range
22	Invalid topic
23	Topic length out of range
24	Missing message or filename
25	Cannot get file size
26	File size out of range
27	Cannot open file
28	Cannot read file
29	QOS out of range
30	Retain out of range
31	Wrong will message length
32	Wrong publish message length
33	Timeout error
34	No Network service
35	Broker not connected
36	Broker connection refused
37	Broker connection refused, wrong protocol version
38	Broker connection refused, identifier rejected
39	Broker connection refused, server unavailable
40	Broker connection refused, bad user name or password
41	Broker connection refused, not authorized
42	MQTT client out of buffer
43	MQTT client malformed remaining length
44	MQTT client packet type mismatch
45	MQTT client packet Id mismatch
46	MQTT client invalid internal state
47	MQTT client TLS connect error
48	MQTT client STDIN Wake error
49	Incoming message cannot be saved
50	PSD or CSD connection not established
51	Error in callback
52	Malformed packet
53	MQTT session active, profile configuration not allowed
54	Incoming publish packet too long
55	Keep alive time is 0, ping loop not activated
56	Communication closed by server

A.7.5 LARA-R6 MQTT-SN class error codes

The following table lists the available values of <error_code> parameter of the last MQTT-SN operation provided through the +UMQTTSNER AT command.

A.7.5.1 LARA-R6 MQTT-SN class error codes

Numeric error code	Description
0	Operation performed with success
1	Memory failure
2	Invalid parameter
3	Invalid parameter range
4-7	Internal error
8	Cannot set secure socket
9	Invalid client identifier
10	Client identifier length out of range
11	Syntax error in client identifier
12	Invalid gateway
13	Gateway address length out of range
14	Gateway port out of range
15	Invalid topic
16	Topic length out of range
17	QOS out of range
18	Retain out of range
19	Will message out of range
20	Publish message out of range
21	Timeout error
22	No Network service
23	Gateway not connected
24	Not specified error returned by gateway
25	Congestion
26	Ivalid topic ID
27	Not supported
28	MQTT-SN client: out of buffer
29	MQTT-SN client: malformed remaining length
30	MQTT-SN client: packet type mismatch
31	MQTT-SN client: packet ID mismatch
32	MQTT-SN client: invalid internal state
33	MQTT-SN client: STDIN Wake
34	Incoming message cannot be saved
35	PSD or CSD connection not established
36	Incoming publish packet too long
37	Keep alive time is 0, ping loop not activated
38	Security mode out of range
39	Wrong security manager profile
40	Security manager profile out of range
41	Missing message or filename
42	Cannot get file size
43	File size out of range
44	Cannot open file
45	Cannot read file

A.7.6 CoAP error codes

The following table lists the available values of <error_code> parameter of the last CoAP operation provided through +UCOAPER (for more details see, the +UCOAP and +UCOAPC AT commands description).

Numeric error code	Description
0	No error
1	Internal error
2	Invalid input
3	Invalid 2nd parameter
4	Invalid 3rd parameter

Numeric error code	Description
5	Parameter count incomplete
6	Parameter count exceeded
7	Op code invalid
8	Server URI missing
9	Server URI invalid
10	Server URI length exceeded
11	Option mask invalid
12	Option mask value invalid
13	Profile no invalid
14	Valid flag incorrect
15	Profile not found
16	CoAP operation invalid
17	Current profile invalid
18	CoAP URI host option missing
19	CoAP URI query missing
20	Payload missing
21	Payload invalid
22	Payload length exceeded
23	Content format invalid
24	Block count invalid
25	More block invalid
26	Payload length incomplete with more block
27	Module not registered
28	NW timeout
29	RAI flag invalid
30	RAI-1 is not allowed with CON message type
31	RAI-2 is not allowed with NON message type
32	CoAP URI path length exceeded
33	CoAP URI query length exceeded
34	CoAP URI host length exceeded

A.8 IP change notification error result codes

The following table lists the available values of <error_code> parameter of the last IP Change Notification provided through +UUIPCHGN URC (for more details, see the +UIPCHGN AT command description).

Numeric error code	Description
0	The IP CN feature was enabled from a previous working session and is active
10	Internal PSD data connection is not active
11	Invalid IP address assigned to module (e.g. empty string)
12	IMEI could not be retrieved
13	IMSI could not be retrieved
14	Error preparing HTTP GET request for IP CN
15	Error creating socket for HTTP connection
16	Error connecting to remote HTTP server
17	Error sending HTTP GET request to HTTP server
18	Error receiving or parsing HTTP GET response from HTTP server

A.9 Ping error result codes

The following table lists the available values of <error_code> parameter of the last ping operation provided through +UUPINGER URC (for more details, see the +UPING AT command description).

Numeric error code	Description
0	Success (no error)
1 - 6	Internal error (ping level)

Numeric error code	Description
7	Empty remote host
8	Cannot resolve host
9	Unsupported IP version (RFU)
10	Invalid IPv4 address
11	Invalid IPv6 address (RFU)
12	Remote host too long
13	Invalid payload size
14	Invalid TTL value
15	Invalid timeout value
16	Invalid retries number
17	PSD or CSD connection not established
100 - 105	Internal error (ICMP level)
106	Error creating socket for ICMP
107	Error settings socket options for ICMP
108	Cannot end ICMP packet
109	Read for ICMP packet failed
110	Received unexpected ICMP packet
111-115	Internal error (socket level)

B Appendix: AT Commands List

AT command		Audio interface and tuning												
		+CLVL	+CMUT	+UDCONF=30	+UDTMFCFG	+UEXTDCONF	+UI2S	+UMCLK	+UPAR	+USAR	+USPEECHCFG	+USPEECHINFO	+USPM	+UTGN
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6001D-00B													
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6401D-00B													
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•

AT command		Call control													
		+CHUP	+CSTA	+CSVM	+CVHU	+CVMOD	+UCALLSTAT	+VTS	A	D	L	P	S0	T	
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6001D-00B						•		•	•					
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401D-00B						•		•	•					
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	

AT command		Circuit switched data services	
		+CRC	
LARA	R6001-00B	•	
	R6001D-00B	•	
	R6401-00B	•	
	R6401D-00B	•	
	R6801-00B	•	

AT command		File System					
		+UDELFILE	+UDWNFILE	+ULSTFILE	+URDBLOCK	+URDFILE	
LARA	R6001-00B	•	•	•	•	•	
	R6001D-00B	•	•	•	•	•	
	R6401-00B	•	•	•	•	•	
	R6401D-00B	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	

	AT command	General commands													
		+CCID	+CGMI	+CGMM	+CGMR	+CGSN	+CIMI	+CSCS	+GCAP	+GMI	+GMM	+GMR	+GSN	I	
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6001D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	

AT command		GPIO interface			
		+UGPIOC	+UGPIOR	+UGPIOW	
LARA	R6001-00B	•	•	•	
	R6001D-00B	•	•	•	
	R6401-00B	•	•	•	
	R6401D-00B	•	•	•	
	R6801-00B	•	•	•	

	AT command	I2C interface					
		+UI2CC	+UI2CO	+UI2CR	+UI2CREGR	+UI2CW	
LARA	R6001-00B	•	•	•	•	•	
	R6001D-00B	•	•	•	•	•	
	R6401-00B	•	•	•	•	•	
	R6401D-00B	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	

AT command		Internet suite											
		+UDNSCFG	+UDNSRN	+UDYNDNS	+UFTP	+UFTPC	+UFTPER	+UHTTP	+UHTTPAC	+UHTTPC	+UHTTPER	+UPING	
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	
	R6001D-00B	•	•	•	•	•	•	•	•	•	•	•	
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	
	R6401D-00B	•	•	•	•	•	•	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	

AT command		Device and data security														
		+USECCHIP	+USECCONN	+USECCDATADEC	+USECCDATAENC	+USECCDEVINFO	+USECE2EDATAENC	+USECE2EFILEENC	+USECFILEDEC	+USECFILEENC	+USECMNG	+USECMODE	+USECOPCMD	+USECPRF	+USECPSK	+USECROTUID	
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6001D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

AT command		IP Multimedia Subsystem (IMS)				
		+CIREG	+UIMSCFG	+UIMSREG	+UISMS	
LARA	R6001-00B	•	•	•	•	
	R6001D-00B	•	•	•	•	
	R6401-00B	•	•	•	•	
	R6401D-00B	•	•	•	•	
	R6801-00B	•	•	•	•	

AT command		Localization features																			
		+UDCONF=121	+UGAOS	+UGGGA	+UGGLL	+UGGSA	+UGGSV	+UGIND	+UGPRF	+UGPS	+UGRMC	+UGSRV	+UGTMR	+UGUBX	+UGVTG	+UGZDA	+ULOC	+ULOCAID	+ULOCCELL	+ULOCGNSS	+ULOCIND	
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6001D-00B		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401D-00B		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

AT command		Mobile equipment control and status													
		+CCLK	+CEER	+CFUN	+CIND	+CLCC	+CMEE	+CMER	+CPAS	+CPWROFF	+CSGT	+CTZR	+CTZU	+UCIND	
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6001D-00B	•	•	•	•		•	•	•	•	•	•	•	•	
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401D-00B	•	•	•	•		•	•	•	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	

	AT command	Network service																					
		+CEDRXS	+CESQ	+CNMPSD	+CNUM	+COPN	+COPS	+CPLS	+CPOL	+CREG	+CSCON	+CSQ	+UBANDMASK	+UCFSCAN	+UCGED	+UDCONF=20	+UDCONF=81	+UDCONF=92	+UDCONF=98	+UJAD	+UMNOPROF	+URAT	+URPM	+USVCDOMAIN
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6001D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6401D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

AT command		Network service				
		+VZWAPNE	+VZWRSRP	+VZWRSRQ	+WS46	
LARA	R6001-00B				•	
	R6001D-00B				•	
	R6401-00B	•	•	•	•	
	R6401D-00B	•	•	•	•	
	R6801-00B				•	

AT command		Networking		
		+UEMBPF	+UIPADDR	
LARA	R6001-00B	•	•	
	R6001D-00B	•	•	
	R6401-00B	•	•	
	R6401D-00B	•	•	
	R6801-00B	•	•	

	AT command	Packet switched data services																					
		+CEREG	+CGACT	+CGATT	+CGCMOD	+CGCONTRDP	+CGDATA	+CGDCONT	+CGDSCONT	+CGEQMIN	+CGEQOS	+CGEQREQ	+CGPADDR	+CGPIAF	+CGQMIN	+CGQREQ	+CGREG	+CGTFT	+UAUTHREQ	+UDCONF=19	+UDCONF=75	+UDCONF=76	+UGCNTRD	+UGCNTSET
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6001D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6401D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

AT command		Packet switched data services		
		D*	H	
LARA	R6001-00B	•	•	
	R6001D-00B	•	•	
	R6401-00B	•	•	
	R6401D-00B	•	•	
	R6801-00B	•	•	

AT command		Phonebook				
		+CPBF	+CPBR	+CPBS	+CPBW	
LARA	R6001-00B	•	•	•	•	
	R6001D-00B	•	•	•	•	
	R6401-00B	•	•	•	•	
	R6401D-00B	•	•	•	•	
	R6801-00B	•	•	•	•	

AT command		Device lock		
		+CPIN	+CPWD	
LARA	R6001-00B	•	•	
	R6001D-00B	•	•	
	R6401-00B	•	•	
	R6401D-00B	•	•	
	R6801-00B	•	•	

AT command		Serial interface																					
		&C	&D	&K	&S	+CMUX	+ICF	+IPR	E	O	Q	S10	S2	S3	S4	S5	S6	S7	S8	V	X	Z	\Q	
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6001D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

	AT command	Short Messages Service																					
		+CGSMS	+CMGC	+CMGD	+CMGF	+CMGL	+CMGR	+CMGS	+CMGW	+CMMS	+CMSS	+CNMA	+CNMI	+CPMS	+CRES	+CSAS	+CSCA	+CSCB	+CSDH	+CSMP	+CSMS	+UCMGL	+UCMGP	+UCMGR
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6001D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6401D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

AT command		Short Messages Service		
		+UCMGS	+UCMGW	
LARA	R6001-00B	•	•	
	R6001D-00B	•	•	
	R6401-00B	•	•	
	R6401D-00B	•	•	
	R6801-00B	•	•	

AT command		SIM functionalities											
		+CLAN	+CRSM	+CSIM	+CUAD	+CUSATR	+CUSATW	+UBIP	+UCUSATA	+UDCONF=50	+USIMSTAT	+UUICC	
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	
	R6001D-00B	•	•	•	•	•	•	•	•	•	•	•	
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	
	R6401D-00B	•	•	•	•	•	•	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	

AT command		Supplementary services													
		+CACM	+CAMM	+CAOC	+CCFC	+CCUG	+CCWA	+CHLD	+CLIP	+CLIR	+COLP	+CPUC	+CSSN	+CTFR	+CUSD
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6001D-00B														
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6401D-00B														
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•

AT command		System features																	
		+UANT	+UANTR	+UBKUPDATA	+UDCONF=40	+UFACTORY	+UFOTA	+UFOTASTAT	+UFWINSTALL	+UFWUPD	+ULGASP	+URING	+URXDIV	+USIO	+USTS	+UTEMP	+UTEST=10	+UUARTCONF	+UURCCONF	
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6001D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401-00B	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401D-00B	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	

AT command		Power management	
		+UPSV	
LARA	R6001-00B	•	
	R6001D-00B	•	
	R6401-00B	•	
	R6401D-00B	•	
	R6801-00B	•	

	AT command	Internet protocol transport layer																					
		+UDCONF=1	+UDCONF=10	+UDCONF=17	+UDCONF=5	+UDCONF=6	+UDCONF=7	+UDCONF=8	+UIPCHGN	+USOCL	+USOCO	+USOCR	+USOCTL	+USODL	+USOER	+USOGO	+USOLI	+USORD	+USORF	+USOSEC	+USOSO	+USOST	+USOSTF	+USOWR
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6001D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6401D-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•

	AT command	MQTT								
		+UMQTT	+UMQTTC	+UMQTTER	+UMQTTNV	+UMQTTSN	+UMQTTSNC	+UMQTTSNER	+UMQTTSNNV	
LARA	R6001-00B	•	•	•	•	•	•	•	•	
	R6001D-00B	•	•	•	•	•	•	•	•	
	R6401-00B	•	•	•	•	•	•	•	•	
	R6401D-00B	•	•	•	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	•	•	•	

AT command		CoAP			
		+UCOAP	+UCOAPC	+UCOAPER	
LARA	R6001-00B	•	•	•	
	R6001D-00B	•	•	•	
	R6401-00B	•	•	•	
	R6401D-00B	•	•	•	
	R6801-00B	•	•	•	

AT command		Lightweight M2M												
		+ODIS	+ULWM2M	+ULWM2MCONFIG	+ULWM2MCONFIGEXT	+ULWM2MCREATE	+ULWM2MDELETE	+ULWM2MDEREG	+ULWM2MLIST	+ULWM2MREAD	+ULWM2MREG	+ULWM2MSTAT	+ULWM2MWRITE	
LARA	R6001-00B	•	•	•	•	•	•	•	•	•	•	•	•	
	R6001D-00B	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401-00B	•	•	•	•	•	•	•	•	•	•	•	•	
	R6401D-00B	•	•	•	•	•	•	•	•	•	•	•	•	
	R6801-00B	•	•	•	•	•	•	•	•	•	•	•	•	

B.1 Parameters stored in profiles

The parameter settings of some commands can be stored in the profiles available in the memory module.

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) • LARA-R6 - The command setting is not stored in the personal profile
&D	DTR status	No	1 (DTR enabled) • LARA-R6 - The command setting is not stored in the personal profile
&K	Flow control status	No	• LARA-R6 - The command setting is stored in the NVM
&S	DSR override	No	1 (DSR line set to ON in data mode and to OFF in command mode) • LARA-R6 - The command setting is not stored in the personal profile
+CGREG	GPRS network registration status reporting	Yes	• LARA-R6 - The command settings is not stored in the personal profile
+CMEE	Mobile termination error reporting	Yes	• LARA-R6 - The command settings is not stored in the personal profile
+CMGF	Preferred message format	Yes	0 (format of messages in PDU mode) • LARA-R6 - The command settings is not persistent
+CNMI	New message indication	Yes	• 1 (discard indication and reject new received message URCs when MT-DTE link is reserved) • 0 (no SMS-DELIVER indications are routed to the TE) • 0 (no CBM indications to the DTE) • 0 (no SMS-STATUS-REPORTs are routed to the DTE) • 0 (MT buffer of URCs defined within this command is flushed to the DTE when >mode< 1...3 is entered) • LARA-R6 - The command settings is not stored in the personal profile
+COPS	Operator selection	Yes	• LARA-R6 - The command setting is stored in the NVM
+CPMS	Preferred message storage	No	• LARA-R6 - The command setting is stored in the NVM
+CRC	Cellular result code status	No	0 (extended format disabled) • LARA-R6 - the command setting is not stored in the personal profile
+CREG	Network registration status reporting	Yes	• LARA-R6 - The command settings is not stored in the personal profile
+CSCA	Service center address	No	• LARA-R6 - The command setting is not stored in the personal profile
+CSCB	Cell broadcast message types	No	• LARA-R6 - The command setting is not stored in the personal profile
+CSMP	Select message service	No	• LARA-R6 - The command setting is not stored in the personal profile

AT command	Description	AT interface configuration sharing	Factory-programmed value / Remarks
+CSCS	Select character set configuration	No	• LARA-R6 - The command setting is not stored in the personal profile
+CSMS	Select message service	No	• LARA-R6 - The command setting is not stored in the personal profile
+ICF	DTE-DCE character framing	No	• LARA-R6 - The command setting is not stored in the personal profile
+IPR	Baud rate	No	• LARA-R6 - The command settings is stored in the NVM
+UPSV	Power saving control	Yes	• LARA-R6 - The command setting is stored in the NVM
+USIO	Serial interfaces configuration	Yes	• LARA-R6 - The command setting is stored in the NVM
+USTS	Smart temperature supervisor	Yes	• LARA-R6 - 0 (smart temperature feature disabled)
E	Echo status	No	1 (echo enabled) • LARA-R6 - The command setting is stored in the NVM
Q	Result code suppression	No	0 (DCE transmits result codes) • LARA-R6 - The command setting is not stored in the personal profile
S0	Automatic answer	No	• LARA-R6 - The command setting is stored in the NVM
S2	Escape character selection	No	43 (043 corresponds the '+' character)
S3	Command line termination character	No	13 (0x0d corresponds to the carriage return character) • LARA-R6 - The command setting is not stored in the personal profile
S4	Response formatting character	No	10 (0x0a corresponds to the line feed character) • LARA-R6 - The command setting is not stored in the personal profile
S5	Command line editing character	No	8 (008 corresponds to the backspace character) • LARA-R6 - The command setting is not stored in the personal profile
S7	Connection completion timeout	No	60 • LARA-R6 - The command setting is not stored in the personal profile
V	DCE response format	No	1 (Verbose response text) • LARA-R6 - The command setting is not stored in the personal profile
X	Result code selection and call progress monitoring control	No	• LARA-R6 - The command setting is stored in the NVM

B.2 Parameters stored in non volatile memory

The following table lists the AT commands which setting can be stored in the non volatile memory with their parameters and the factory-programmed values.

AT command	Description	Factory-programmed value / Comment
E	Echo status	• LARA-R6 - 1 (echo enabled)
&K	Flow control status	• LARA-R6 - 3 (RTS/CTS DTE flow control enabled)
+CCLK	Clock	• LARA-R6 - "80/01/06,00:00:00+00"
+CEDRXS	eDRX setting	• LARA-R6 - 1 (use of eDRX enabled)
+CGDCONT	PDP context definition	• LARA-R6 - all contexts are undefined
+CGEQMIN	3G Quality of service profile (minimum acceptable)	• LARA-R6 - all contexts are undefined
+CGEQOS	Define EPS quality of service	• LARA-R6 - all contexts are undefined
+CGEQREQ	3G Quality of service profile (requested)	• LARA-R6 - all contexts are undefined
+CGQMIN	Quality of service profile (minimum acceptable)	• LARA-R6 - all contexts are undefined

AT command	Description	Factory-programmed value / Comment
+CGQREQ	Quality of service profile (requested)	• LARA-R6 - all contexts are undefined
+CGSMS	Select service for MO SMS messages	• 1 (CS service selected)
+CLIR	Calling line identification restriction	• 0 (presentation indicator used according to the subscription of the CLIR service)
+CLVL	Loudspeaker volume level	• LARA-R6 - 6 (loudspeaker volume level)
+COPS	Operator selection	• LARA-R6 - 0 (autoregistration enabled), 0 (operator expressed in long alphanumeric format), FFFFF (undefined PLMN to register when +COPS: 1)
+CPMS	Preferred message storage	• LARA-R6 - <mem1>, <mem2> and <mem3> are set to "ME"
+CSCA	Service center address setting	• LARA-R6 - The command setting is not stored in NVM
+CSCON	Connection status signalling	• LARA-R6 - 0 (URC disabled)
+CSCS	Select character set configuration	• LARA-R6 - The command setting is not stored in the NVM
+CSGT	Set greeting text	Greeting text is empty
+CSMS	Message service configuration	• LARA-R6 - The command setting is not stored in NVM
+CTZR	Time zone reporting	• LARA-R6 - The command setting is not stored in NVM
+CTZU	Automatic time zone update	• LARA-R6 - 1 (automatic time zone via NITZ enabled)
+IPR	Baud rate	• LARA-R6 - 115200 (115200 b/s)
+ODIS	LwM2M Host device information	HMAN0 (Host manufacturer name), HMOD0 (Host model identification), HSW0 (Host software version), HUID0 (Host identification)
+UAUTHREQ	Configure the authentication parameters of a PDP/ EPSbearer	• LARA-R6 - 0 (no authentication), "" (no username), "" (no password)
+UBANDMASK	Band selection bitmask	LTE bands bitmask (decimal value): • LARA-R6 - see Mobile Network Operator profiles NB-IoT bands bitmask (decimal value): • LARA-R6 - not supported
+UBIP	Bearer Independent Protocol status indication	0 (BIP status indication disabled)
+UCOAP	CoAP profile configuration	Empty profile
+UCUSATA	Enable USAT terminal URCs	0 (+CUSATEND, +CUSATP and +UUSIMSTAT URC disabled)
+UDCONF=17	Internal IP stack TCP window scaling factor configuration	0 (exponent of the TCP window scale factor)
+UDCONF=19	Default PDP and preferred protocol type configuration	1 (<cid>), 0 (IPv4)
+UDCONF=20	Steering of Roaming configuration	• LARA-R6401 / LARA-R6401D - 0 (SoR is disabled) • LARA-R6001 / LARA-R6001D / LARA-R6801 - see Mobile Network Operator profiles
+UDCONF=30	Speech codec configuration	• LARA-R6001 / LARA-R6401 / LARA-R6801 - 2089
+UDCONF=40	User defined power reduction	• LARA-R6 - 2 (MSPR GPRS and EDGE profile), 2 (MSPR GMSK and EDGE profile)
+UDCONF=50	SIM hot insertion detection	0 (disabled)
+UDCONF=75	PDP IP configuration when roaming	• LARA-R6 - No context is defined
+UDCONF=76	Disable data when roaming	• LARA-R6 - No context is defined
+UDCONF=81	Integrity check on test networks configuration	• LARA-R6 - 1 (integrity check on test networks enabled)
+UDCONF=92	Modem features customization	• LARA-R6 o 3 (NAS release compliance): 4 (3GPP compliance release 10 behavior) o 50 (SIM boot delay configuration): 0 s
+UDCONF=98	EEA0 encryption algorithm configuration	1 (EEA0 enabled)

AT command	Description	Factory-programmed value / Comment
+UDCONF=121	Disable the deep cells scan for database feeding in AssistNow Online operation	0 (deep cells scan enabled)
+UDYNDNS	Dynamic DNS	0 (Client disabled), 0 (TZO.com as dynamic DNS service provider), "" (Domain name empty), "" (Username empty), "" (Password empty)
+UEXTDCONF	Automatic configuration of the Maxim MAX9860 audio codec	• LARA-R6 - 0 (disabled),"0000000010A000303000063300500000008A"(MAX9860 registers configuration)
+UFACTORY	Restore factory configuration	0 (no FS factory restore), 0 (no NVM factory restore)
+UFOTASTAT	FOTA reporting	• LARA-R6 - 0 (FOTA downloading state URC disabled)
+UGGGA	Get GPS fix data	0 (NMEA $GGA messages disabled)
+UGGLL	Get geographic position	0 (NMEA $GLL messages disabled)
+UGGSA	Get satellite information	0 (NMEA $GSA messages disabled)
+UGGSV	Get number of GNSS satellites in view	0 (NMEA $GSV messages disabled)
+UGIND	Assisted GNSS unsolicited indication	• LARA-R6 - The command setting is not stored in the NVM
+UGPIOC	GPIO functionality setting	• LARA-R6001D / LARA-R6401D - GPIO1: 255, GPIO2: 3, GPIO3: 4, GPIO4: 0, I2S_WA: 255, I2S_TXD: 255, I2S_CLK: 255, I2S_RXD: 255, GPIO5: 7 • LARA-R6001 / LARA-R6401 / LARA-R6801 - GPIO1: 255, GPIO2: 3, GPIO3: 4, GPIO4: 0, I2S_WA: 12, I2S_TXD: 12, I2S_CLK: 12, I2S_RXD: 12, GPIO5: 7
+UGPRF	GNSS profile configuration	0 (No data flow on multiplexer, file and IP address), 0 (IP port not defined), "" (Server address string not defined)
+UGRMC	Get recommended minimum GNSS data	0 (NMEA $RMC messages disabled)
+UGSRV	Aiding server configuration	"cell-live1.services.u-blox.com" (primary MGA server), "cell-live2.services.u-blox.com" (secondary MGA server), 14 (Number of days for validation of Offline data), 4 (Number of weeks for validation of Offline data), 1 (Resolution of offline data for MGA), 65 (Desired GNSS for the (offline) aiding: GPS and GLONASS), 0 (AssistNow Online data are downloaded at GNSS receiver power up), 15 (all the desired data types for the (online) aiding are set), 1 (PDP context identifier)
+UGVTG	Get course over ground and ground speed	0 (NMEA $VTG messages disabled)
+UGZDA	Get GPS time and date	0 (NMEA $ZDA messages disabled)
+UI2S	I^2S digital interface mode	• LARA-R6 - 14 (normal mode 14), 1 (I2S is connected to I2Sx connection point), 0 (CLK and WA active in dynamic mode), 3 (sample rate: 16 kHz), 0 (master mode)
+UIMSCFG	IMS client configuration	• LARA-R6 o 50: AUTOLOGIN_MODE see Mobile Network Operator profiles o 51: APN_NAME (<data>= "ims") o 53: PREFFERED_PDPTYPE (<data>=2) o 200: XCAP_APN (<data>=2) o 201: XCAP_ROOT_URI (<data>= empty string) o 253: SIP_URI_FORMAT (<data>="") o 264: VoPS_registration (<data>=1)
+UIPCHGN	IP change notification	0 (IP change notification disabled)
+UEMBPF	Port filtering for embedded applications	• LARA-R6 - 1 (port filtering enabled), "9999-19999" (port range filtered)"
+UISMS	Domain configuration for MO SMS messages	• LARA-R6 - See Mobile Network Operator profiles
+UJAD	Smart jamming detection	• LARA-R6 - 0 (smart jamming detection disabled)
+ULGASP	Last gasp configuration	• LARA-R6 o <GPIO_mode>: 0 (disabled)

AT command	Description	Factory-programmed value / Comment
		o <text>: "Last Gasp" o <msg_format>: 0 (text) o <tel_number>: "" (empty) o <cid>: 255 (default socket) o <IP_protocol>: 17 (UDP) o <IP_addr:PORT>: "" (empty) o <method>: 1 (send IP) o <max_pow_red>: 0 (no power reduction) o <urc_enable>: 0 (no URC)
+ULOCCELL	Configure cellular location sensor (CellLocate®)	0 (normal mode enabled)
+ULOCGNSS	Configure GNSS sensor	• 15 (Local aiding, AssistNow online, AssistNow offline, AssistNow autonomous enabled), 0 (power saving disabled), 3 (Minimum number of satellites for navigation), 7 (Minimum satellite signal level for navigation), 0 (Disabled initial Fix must be 3D flag), 0 (Static Hold Mode), 0 (SBAS disabled), 0 (Jamming indicator disabled), 0 (Antenna settings unknown), 0 (Broadband jamming detection threshold: 0 dB), 0 (Continuous wave jamming detection threshold: 0 dB), 1 (GPS), 0, 0
+ULOCIND	Localization information request status unsolicited indication	• LARA-R6 - The command setting is not stored in the NVM
+ULWM2M	LwM2M client activation/ deactivation	• LARA-R6 - 0 (LwM2M client enabled)
+ULWM2MSTAT	LwM2M reporting	• LARA-R6 - 0 (LwM2M status +ULWM2MSTAT URC disabled)
+UMCLK	Master clock control	• LARA-R6 o 1 (CODEC_CLK mode setting, <mclk_mode>): clock out pin (input for audio codec) is set output steady low. o 0 (setting of dynamic of the application mode, <enabling_mode>): <mclk_mode> setting is applied to CODEC_CLK pin only when audio path is active. After audio path is disabled (i.e. a call is hang up) CODEC_CLK is disabled too
+UMNOPROF	MNO profile configuration	• LARA-R6 - 90 (Global)
+UPSV	Power saving control	• LARA-R6 - 0 (power saving disabled)
+URAT	Selection of Radio Access Technology	• LARA-R6001 / LARA-R6001D / LARA-R6801 - 3 (LTE RAT), 2 (UMTS RAT), 0 (GSM RAT) • LARA-R6401 / LARA-R6401D - 3 (LTE RAT)
+URING	RING line handling	0 (feature disabled (RING line is only asserted on incoming call and incoming SMS))
+URPM	RPM activation	• LARA-R6 - see Mobile Network Operator profiles
+URXDIV	RX diversity	• LARA-R6 - 1 (Rx diversity enabled)
+USECMODE	Secure data suite features configuration	1 (secure data suite features enabled)
+USECOPCMD	Security configuration and action command	• <apn_name>: "" • <pdn_ip_type>: 0 (IPv4) • <version>: 1 (E2E encryption V2) • <mode>: 0 (DNS, static IPv4/IPv6 address fallback) • <ip_address>: o IPv4: 63.35.25.213 o IPv6: 2A05::D018::0E8C::9701::484A::E62C::0337::2202 • <port>: 38292
+USIMSTAT	(U)SIM initialization status reporting	0 (URC +UUSIMSTAT disabled)
+USIO	Serial interfaces configuration	• LARA-R6 - 0 (AT command on 9-wire UART, USB1 and USB2, diagnostic log on USB0, no AUX UART)
+USPEECHCFG	VoLTE speech codec configuration	• LARA-R6 - 1 (AMR WB enabled)

AT command	Description	Factory-programmed value / Comment
+USPM	Audio path mode setting	• LARA-R6 - 1 (digital audio path), 0 (headset profile)
+USVCDOMAIN	Configure the device service domain	• LARA-R6 - 2 (CS/PS combined), 0 (IE not present), 1 (data centric)
+UUARTCONF	UART baud rate and flow control NVM management	1 (auxiliary UART interface), 115200 (115200 b/s), 3 (RTS/CTS DTE flow control enabled)
+UURCCONF	URC over AT terminal configuration	• LARA-R6 - 0 (URC filtering disabled)
+VZWAPNE	Edit Verizon wireless APN table	Verizon wireless APN table (APN list entry, APN class, Network identifier, APN type, APN bearer, APN status, APN inactivity timer) • 1,1,"IMS","ipv4v6","LTE","Enabled",0 • 2,2,"VZWADMIN","ipv4v6","LTE","Enabled",0 • 3,3,"VZWINTERNET","ipv4v6","LTE","Enabled",0 • 4,4,"VZWAPP","ipv4v6","LTE","Enabled",0 • 6,6,"ENTERPRISE","ipv4v6","LTE","Enabled",0 • 7,7,"THINGSPACE","ipv4v6","LTE","Enabled",0 Class 1 APN in table above may differ from the one here specified. Refer to +VZWAPNE for details.
X	Result code selection and call progress monitoring control	• LARA-R6 - 0 (CONNECT result code is given upon entering online data state)
S0	Automatic answering	• LARA-R6 - 0 (automatic answering disabled)

B.3 Saving AT commands configuration

B.4 Estimated command response time

After having sent a command to a u-blox cellular module, the time to obtain a resulting result code depends on the SIM and the network. It is possible to have an immediate response if the command does not interact with either the network or the SIM.

The following table reports the maximum time to get the result code for the AT commands. The commands are grouped by categories.

Category	Estimated maximum time to get response	Commands
Power off	< 40 s	+CPWROFF
Set module functionality	Up to 3 min	+CFUN
Call control	< 20 s	A, H, +CHUP, +CSVM
Dial	Up to 3 min	D
DTMF and tone generation	Up to 7 min	+VTS
Supplementary services	< 20 s	+CHLD, +CHUP, +COLP
Supplementary services	Up to 3 min	+CCFC, +CCWA, +CLIP, +CLIR, +CTFR, +CUSD
Data connection commands	Up to 3 min	+CGATT, +CGDATA
Network commands	• LARA-R6 - Up to 3 min	+COPS, +UCFSCAN
Network commands	< 10 s	+URAT
Security	Up to 3 min	+CPWD
Phonebook commands	< 35 s	+CPBF, +CPBR, +CPBS, +CPBW
Delete all SMSes	< 55 s	+CMGD
SMS acknowledgement to MT	< 150 s	+CNMA
SMS	Up to 3 min (<1 s for prompt ">")	+CPMS, +CMGC, +CMGL, +CMSS, +CMGS, +UCMGS, +UCMGL
SIM management	< 10 s	+CACM, +CAMM, +CAOC, +CMGW, +UCMGW, +CMGR, +UCMGP, +UCMGR, +CNUM, +CPIN, +CPOL, +CPUC, +CRES, +CRSM, +CSCA, +CSCB, +CSMP
PDP context activation	< 150 s	+CGACT

Category	Estimated maximum time to get response	Commands
PDP context deactivation	< 40 s	+CGACT
Restore configuration	< 5 s	+UFACTORY
GPIO commands	< 10 s	+UGPIOC, +UGPIOR, +UGPIOW
Internet suite (socket connect)	• LARA-R6 - < 80 s for IP address, < 100 s with an hostname	+USOCO
Internet suite (socket connect with SSL)	• LARA-R6 - < 80 s	+USOSEC
Internet suite (socket write)	• LARA-R6 - < 1 s	+USOWR
Internet suite (UDP socket write)	• LARA-R6 - < 1 s	+USOST
Internet suite (socket closure)	• LARA-R6 - < 1 s	+USOCL
Internet suite	• LARA-R6 - < 1 s	+USODL, +USOLI, +USORD, +USORF
Resolve name/IP number through DNS	• LARA-R6 - < 20 s	+UDNSRN
Security suite	< 30 s	+USECMODE, +USECOPCMD, +USECDEVINFO, +USECDATAENC, +USECFILEENC, +USECDATADEC, +USECFILEDEC, +USECE2EDATAENC, +USECE2EFILEENC, +USECPSK
Security suite	< 10 s	+USECCONN
GNSS commands	< 10 s (except +UGPS for which timeout is according to the performed operation)	+UGAOS, +UGGGA, +UGGLL, +UGGSA, +UGGSV, +UGPS, +UGRMC, +UGTMR, +UGUBX, +UGVTG, +UGZDA, +ULOC
Last gasp configuration	< 10 s	+ULGASP
MQTT command	• LARA-R6 - immediate	+UMQTTC
Firmware update	• LARA-R6 - < 20 s	+UFWUPD

B.5 Multiple AT command interfaces

u-blox cellular modules support multiple AT command interfaces, that means a certain number of virtual or physical channels that work as described in Definitions.

Each interface maintains an own run-time AT commands configuration (AT command profile); this means that the AT command profile is different among the interfaces and therefore the AT commands configuration for the commands belonging to the profile can be different among the interfaces.

At the module start-up, since there is only a set of the profiles (not one for each interface), all the interfaces are configured in the same way (AT commands configuration for the commands in the profile is the same for all the interfaces). Subsequently, each interface can change its run-time AT profile (stored in RAM). The commands AT&W, AT&V manage this run-time AT commands configuration for the interface where they are issued.

The USB interface implements multiple AT command interfaces. Unlike what happens for the other physical interfaces (e.g. UART, SPI), the AT command interfaces that run on the USB interface only exists as long as the USB interface connects the module with the DTE. As a result, if the USB connection between the module and the DTE is interrupted (e.g. by USB cable removal), all the AT command interfaces running on it are destroyed. This has two main consequences:

- Any data connection (both circuit switched and packet switched) established over an AT command interface associated to the USB interface is released.
- 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 33 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)
+IPR	Effective	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)	Returns OK, but it is not effective (only change the value in the AT command profile)
+UPSV	Effective	Returns OK, but it changes UART setting	Returns OK, but it changes UART setting	Returns OK, but it changes UART setting

Table 33: Interface comparison

☞ LARA-R6
It is not possible to have parallel activity on two or more AT terminals.
Basically this behavior can be detected in the following configurations:

- Double UART availability, i.e. +USIO: 1 (where supported).
- Virtual channels set through the multiplexer (MUX) protocol.

The only allowed parallel activity is present when it is defined a system architecture with a PPP dial-up on one port and AT commands on the other one.

C Mobile Network Operator profiles

C.1 LARA-R6 Introduction

By means of +UMNOPROF AT command the module is able to manage different MNO profiles that configure the module according to the MNO requirements. Reboot the module by means of the +CFUN AT command to make the MNO profile active. For more details, see +UMNOPROF AT command.

Depending on the module type numbers the MNO profile version can assume different settings. The following tables provide an overview of each MNO profile and the list of AT commands whose setting can be overridden by the MNO profile. Depending on MNO profile the corresponding AT command setting can be locked by the MNO profile (see "Locked" field for more details).

☞ The <MNO>=101 (standard Europe No-ePCO) profile factory-programmed configuration is the same of the <MNO>=100 (standard Europe profile), but the ePCO is disabled.

C.2 LARA-R6001D Americas MNO and conformance profiles table

	AT&T	GCF-PTCRB
MNO profile		
<MNO>	2	201
+UBANDMASK		
LTE bands [decimal value]	1, 2, 3, 4, 5, 7, 8, 12, 20, 28, 38, 39, 40, 41 [2061719046367, 0]	1, 2, 3, 4, 5, 7, 8, 12, 13, 18, 19, 20, 26, 28, 38, 39, 40 , 41 [2061752998111, 0]
UMTS/GSM bands [decimal value]	UMTS: 1, 2, 5, 8 GSM: DCS1800, EGSM900, 850, PCS1900 [5629500 35734912]	UMTS: 1, 2, 5, 8 GSM: DCS1800, EGSM900, 850, PCS1900 [5629500 35734912]
+URAT		
Allowed values	LTE, UMTS, GSM	LTE, UMTS, GSM
+CGDCONT		
CID (context ID) 1	"IPV4V6", "broadband"	"IPV4V6", ""
CID (context ID) 2	"IPV4V6", "attm2mglobal"	empty
CID (context ID) 11	"IPV4V6", "ims"	"IPV4V6", "ims"
+UDCONF=20		
SoR	Disabled	Disabled
LwM2M feature		
Available	Yes	No
LwM2M capabilities	u-blox, AT&T	n/a
uFOTA-LwM2M capabilities	uFOTA	n/a
+ULWM2MREG		
Supported server ID	1, 2, 3, 721	n/a
Locked	No	n/a
+ULWM2MCONFIGEXT		
Connection teardown timer	90	n/a
Production mode	0	n/a
Production SIM	""	n/a
APN synchronization	1	n/a
Locked	No	n/a
+USVCDOMAIN		
Service Domain	CS/PS	CS/PS
UE usage setting	Data centric	Data centric
Voice domain preference	Not present	Not present
+URPM		
Enabled	False	False
IMS client		
VoLTE	Disabled	Disabled
SMS over IMS	Disabled	Disabled

	AT&T	GCF-PTCRB
IMS enabled (50)	0	0
+UISMS		
Mode	0	0
MNO profile fields not accessible		
MTU size	From PCO (1430)	From PCO (1428)

C.3 LARA-R6001D EMEA and global MNO profiles table

	Global
MNO profile	
<MNO>	90 (factory-programmed value)
+UBANDMASK	
LTE bands [decimal value]	1, 2, 3, 4, 5, 7, 8, 12, 13, 18, 19, 20, 26, 28, 38, 39, 40, 41 [2061752998111, 0]
UMTS: 1, 2, 5, 8 GSM: DCS1800, EGSM900, 850, PCS1900	UMTS: 1,2,5,8 GSM: DCS1800, EGSM900, 850, PCS1900
[562950035734912]	[5629500 35734912]
+URAT	
Allowed values	LTE, UMTS, GSM
+CGDCONT	
CID (context ID) 1	"IPV4V6", ""
CID (context ID) 11	"IPV4V6", "ims"
+UDCONF=20	
SoR enable	Enabled
LwM2M feature	
Available	Yes
LwM2M capabilities	u-blox
uFOTA-LwM2M capabilities	uFOTA
+ULWM2MREG	
Supported server ID	721
Locked	No
+ULWM2MCONFIGEXT	
Connection teardown timer	90
Production mode	0
Production SIM	"00101"
APN synchronization	0
Locked	No
+USVCDOMAIN	
Service Domain	CS/PS
UE usage setting	Data centric
Voice domain preference	PS only
+URPM	
Enabled	False
IMS client	
VoLTE	Disabled
SMS over IMS	Disabled
IMS enabled (50)	0
+UISMS	
Mode	0

	Global
MNO profile fields not accessible	
MTU size	From PCO (1428)

C.4 LARA-R6001 Americas MNO and conformance profiles table

	GCF-PTCRB
MNO profile	
<MNO>	201
+UBANDMASK	
LTE bands [decimal value]	1, 2, 3, 4, 5, 7, 8, 12, 13, 18, 19, 20, 26, 28, 38, 39, 40, 41 [2061752998111, 0]
UMTS/GSM bands [decimal value]	UMTS: 1, 2, 5, 8 GSM: DCS1800, EGSM900, 850, PCS1900 [562950035734912]
+URAT	
Allowed values	LTE, UMTS, GSM
+CGDCONT	
CID (context ID) 1	"IPV4V6", ""
CID (context ID) 11	"IPV4V6", "ims"
CID (context ID) 12	"IPV4V6", "sos"
+UDCONF=20	
SoR	Disabled
LwM2M feature	
Available	No
LwM2M capabilities	n/a
uFOTA-LwM2M capabilities	n/a
+ULWM2MREG	
Supported server ID	n/a
Locked	n/a
+ULWM2MCONFIGEXT	
Connection teardown timer	n/a
Production mode	n/a
Production SIM	n/a
APN synchronization	n/a
Locked	n/a
+USVCDOMAIN	
Service Domain	CS/PS
UE usage setting	Voice centric
Voice domain preference	PS preferred
+URPM	
Enabled	False
IMS client	
VoLTE	Enabled
SMS over IMS	Enabled
IMS enabled (50)	1
+UISMS	

	GCF-PTCRB
Mode	1
MNO profile fields not accessible	
MTU size	From PCO (1428)

C.5 LARA-R6001 EMEA and global MNO profiles table

	Global
MNO profile	
<MNO>	90 (factory-programmed value)
+UBANDMASK	
LTE bands [decimal value]	1, 2, 3, 4, 5, 7, 8, 12, 13, 18, 19, 20, 26, 28, 38, 39, 40, 41 [2061752998111, 0]
UMTS: 1, 2, 5, 8 GSM: DCS1800, EGSM900, 850, PCS1900	UMTS: 1,2,5,8 GSM: DCS1800, EGSM900, 850, PCS1900
[562950035734912]	[5629500 35734912]
+URAT	
Allowed values	LTE, UMTS, GSM
+CGDCONT	
CID (context ID) 1	"IPV4V6", ""
CID (context ID) 11	"IPV4V6", "ims"
CID (context ID) 12	"IPV4V6", "sos"
+UDCONF=20	
SoR enable	Enabled
LwM2M feature	
Available	Yes
LwM2M capabilities	u-blox
uFOTA-LwM2M capabilities	uFOTA
+ULWM2MREG	
Supported server ID	721
Locked	No
+ULWM2MCONFIGEXT	
Connection teardown timer	90
Production mode	0
Production SIM	"00101"
APN synchronization	0
Locked	No
+USVCDOMAIN	
Service Domain	CS/PS
UE usage setting	Voice centric
Voice domain preference	PS preferred
+URPM	
Enabled	False
IMS client	
VoLTE	Enabled
SMS over IMS	Enabled
IMS enabled (50)	1
+UISMS	

	Global
Mode	1
MNO profile fields not accessible	
MTU size	From PCO (1428)

C.6 LARA-R6401D Americas MNO and conformance profiles table

	AT&T	Verizon	GCF-PTCRB	FirstNet
<MNO>	2	3	201	206
+UBANDMASK				
LTE bands [decimal value]	2, 4, 5, 12, 14, 66 [10266, 2]	2, 4, 5, 12, 13, 66 [6170, 2]	2, 4, 5, 12, 13, 14, 66, 71 [14362, 66]	2, 4, 5, 12, 14, 66 [10266, 2]
UMTS/GSM bands [decimal value]	n/a	n/a	n/a	n/a
+URAT				
Allowed values	LTE	LTE	LTE	LTE
+CGDCONT				
CID (context ID) 1	"IPV4V6", "broadband"	IPV4V6", "ims"	"IPV4V6", ""	"IPV4V6", "firstnet-broadband"
CID (context ID) 2	"IPV4V6", "attm2mglobal"	"IPV4V6", "VZWADMIN"	empty	"IPV4V6", "attiotfirstnet.fn"
CID (context ID) 3	empty	"IPV4V6", "VZWINTERNET"	empty	empty
CID (context ID) 4	empty	"IPV4V6", "VZWAPP"	empty	empty
CID (context ID) 6	empty	"IPV4V6", "VZWCLASS6"	empty	empty
CID (context ID) 7	empty	"IPV4V6", "VZWCLASS7"	empty	empty
CID (context ID) 8	empty	"IPV4V6", "VZWEMERGENCY"	empty	empty
CID (context ID) 11	"IPV4V6", "ims"	empty	"IPV4V6", "ims"	"IPV4V6", "ims"
LwM2M feature				
Available	Yes	Yes	No	Yes
LwM2M capabilities	u-blox, AT&T	u-blox, VZW	n/a	u-blox, AT&T
uFOTA-LwM2M capabilities	uFOTA	uFOTA, VZW	n/a	uFOTA
+ULWM2MREG				
Supported server ID	1, 2, 3, 721	101, 102, 1000, 721	n/a	1, 2, 3, 721
Locked	No	No	n/a	No
+ULWM2MCONFIGEXT				
Connection teardown timer	90	60	n/a	90
Production mode	0	0	n/a	0
Production SIM	""	""	n/a	""
APN synchronization	1	0	n/a	1
Locked	No	No	n/a	No
+USVCDOMAIN				
Service domain	CS/PS	CS/PS	CS/PS	CS/PS
UE usage setting	Data centric	Data centric	Data centric	Data centric
Voice domain preference	Not present	Not present	Not present	Not present
+URPM				
Enabled	False	False	False	False
IMS client				
VoLTE	Disabled	Disabled	Disabled	Disabled
SMS over IMS	Disabled	Enabled	Disabled	Disabled
IMS enabled (50)	0	1	0	0

	AT&T	Verizon	GCF-PTCRB	FirstNet
+UISMS				
Mode	0	1	0	0
MNO profile fields not accessible				
MTU size	From PCO (1430)	From PCO (1428)	From PCO (1428)	From PCO (1342)

C.7 LARA-R6401D EMEA and global MNO profiles table

	Global
<MNO>	90 (factory-programmed value)
+UBANDMASK	
LTE bands [decimal value]	2, 4, 5, 12, 13, 14, 66, 71 [14362, 66]
UMTS/GSM bands [decimal value]	n/a
+URAT	
Allowed values	LTE
+CGDCONT	
CID (context ID) 1	"IPV4V6", ""
CID (context ID) 2	empty
CID (context ID) 3	empty
CID (context ID) 4	empty
CID (context ID) 6	empty
CID (context ID) 11	"IPV4V6", "ims"
LwM2M feature	
Available	Yes
LwM2M capabilities	u-blox
uFOTA-LwM2M capabilities	uFOTA
+ULWM2MREG	
Supported server ID	721
Locked	No
+ULWM2MCONFIGEXT	
Connection teardown timer	90
Production mode	1
Production SIM	"00101"
APN synchronization	0
Locked	No
+USVCDOMAIN	
Service domain	CS/PS
UE usage setting	Data centric
Voice domain preference	PS only
+URPM	
Enabled	False
IMS client	
VoLTE	Disabled
SMS over IMS	Disabled
IMS enabled (50)	0
+UISMS	
Mode	0
MNO profile fields not accessible	
MTU size	From PCO (1428)

C.8 LARA-R6401 Americas MNO and conformance profiles table

	AT&T	Verizon	GCF-PTCRB	FirstNet
<MNO>	2	3	201	206
+UBANDMASK				
LTE bands [decimal value]	2, 4, 5, 12, 14, 66 [10266, 2]	2, 4, 5, 12, 13, 66 [6170, 2]	2, 4, 5, 12, 13, 14, 66, 71 [14362, 66]	2, 4, 5, 12, 14, 66 [10266, 2]
UMTS/GSM bands [decimal value]	n/a	n/a	n/a	n/a
+URAT				
Allowed values	LTE	LTE	LTE	LTE
+CGDCONT				
CID (context ID) 1	"IPV4V6", "nxtgenphone"	"IPV4V6", "ims"	"IPV4V6", ""	"IPV4V6", "firstnet-phone"
CID (context ID) 2	"IPV4V6", "attm2mglobal"	"IPV4V6", "VZWADMIN"	empty	"IPV4V6", "attiotfirstnet.fn"
CID (context ID) 3	empty	"IPV4V6", "VZWINTERNET"	empty	empty
CID (context ID) 4	empty	"IPV4V6", "VZWAPP"	empty	empty
CID (context ID) 6	empty	"IPV4V6", "VZWCLASS6"	empty	empty
CID (context ID) 7	empty	"IPV4V6", "VZWCLASS7"	empty	empty
CID (context ID) 8	empty	"IPV4V6", "VZWEMERGENCY"	empty	empty
CID (context ID) 11	"IPV4V6", "ims"	empty	"IPV4V6", "ims"	"IPV4V6", "ims"
CID (context ID) 12	"IPV4V6", "sos"	empty	"IPV4V6", "sos"	"IPV4V6", "sos"
LwM2M feature				
Available	Yes	Yes	No	Yes
LwM2M capabilities	u-blox, AT&T	u-blox, VZW	n/a	u-blox, AT&T
uFOTA-LwM2M capabilities	uFOTA	uFOTA, VZW	n/a	uFOTA
+ULWM2MREG				
Supported server ID	1, 2, 3, 721	101, 102, 1000, 721	n/a	1, 2, 3, 721
Locked	No	No	n/a	No
+ULWM2MCONFIGEXT				
Connection teardown timer	90	60	n/a	90
Production mode	0	0	n/a	0
Production SIM	""	""	n/a	""
APN synchronization	1	0	n/a	1
Locked	No	No	n/a	No
+USVCDOMAIN				
Service domain	CS/PS	CS/PS	CS/PS	CS/PS
UE usage setting	Data centric	Data centric	Data centric	Data centric
Voice domain preference	PS only	PS only	PS only	PS only
+URPM				
Enabled	False	False	False	False
IMS client				
VoLTE	Enabled	Enabled	Enabled	Enabled
SMS over IMS	Enabled	Enabled	Enabled	Enabled

	AT&T	Verizon	GCF-PTCRB	FirstNet
IMS enabled (50)	1	1	1	1
+UISMS				
Mode	1	1	1	1
MNO profile fields not accessible				
MTU size	From PCO (1430)	From PCO (1428)	From PCO (1428)	From PCO (1342)

C.9 LARA-R6401 EMEA and global MNO profiles table

	Global
<MNO>	90 (factory-programmed value)
+UBANDMASK	
LTE bands [decimal value]	2, 4, 5, 12, 13, 14, 66, 71 [14362, 66]
UMTS/GSM bands [decimal value]	n/a
+URAT	
Allowed values	LTE
+CGDCONT	
CID (context ID) 1	"IPV4V6", ""
CID (context ID) 2	empty
CID (context ID) 3	empty
CID (context ID) 4	empty
CID (context ID) 6	empty
CID (context ID) 11	"IPV4V6", "ims"
CID (context ID) 12	"IPV4V6", "sos"
LwM2M feature	
Available	Yes
LwM2M capabilities	u-blox
uFOTA-LwM2M capabilities	uFOTA
+ULWM2MREG	
Supported server ID	721
Locked	No
+ULWM2MCONFIGEXT	
Connection teardown timer	90
Production mode	1
Production SIM	"00101"
APN synchronization	0
Locked	No
+USVCDOMAIN	
Service domain	CS/PS
UE usage setting	Data centric
Voice domain preference	PS only
+URPM	
Enabled	False
IMS client	
VoLTE	Enabled
SMS over IMS	Enabled
IMS enabled (50)	1
+UISMS	
Mode	1
MNO profile fields not accessible	
MTU size	From PCO (1428)

C.10 LARA-R6801 Americas MNO and conformance profiles table

	GCF-PTCRB
MNO profile	
<MNO>	201
+UBANDMASK	
LTE bands [decimal value]	1, 2, 3, 4, 5, 7, 8, 12, 13, 18, 19, 20, 26, 28, 38, 39, 40, 41 [2061752998111, 0]
UMTS/GSM bands [decimal value]	UMTS: 1, 2, 5, 8 GSM: DCS1800, EGSM900, 850, PCS1900 [562950035734912]
+URAT	
Allowed values	LTE, UMTS, GSM
+CGDCONT	
CID (context ID) 1	"IPV4V6", ""
CID (context ID) 11	"IPV4V6", "ims"
CID (context ID) 12	"IPV4V6", "sos"
+UDCONF=20	
SoR	Disabled
LwM2M feature	
Available	No
LwM2M capabilities	n/a
uFOTA-LwM2M capabilities	n/a
+ULWM2MREG	
Supported server ID	n/a
Locked	n/a
+ULWM2MCONFIGEXT	
Connection teardown timer	n/a
Production mode	n/a
Production SIM	n/a
APN synchronization	n/a
Locked	n/a
+USVCDOMAIN	
Service Domain	CS/PS
UE usage setting	Voice centric
Voice domain preference	PS preferred
+URPM	
Enabled	False
IMS client	
VoLTE	Enabled
SMS over IMS	Enabled
IMS enabled (50)	1
+UISMS	

	GCF-PTCRB
Mode	1
MNO profile fields not accessible	
MTU size	From PCO (1428)

C.11 LARA-R6801 EMEA and global MNO profiles table

	Global
MNO profile	
<MNO>	90 (factory-programmed value)
+UBANDMASK	
LTE bands [decimal value]	1, 2, 3, 4, 5, 7, 8, 12, 13, 18, 19, 20, 26, 28, 38, 39, 40, 41 [2061752998111, 0]
UMTS: 1, 2, 5, 8 GSM: DCS1800, EGSM900, 850, PCS1900	UMTS: 1,2,5,8 GSM: DCS1800, EGSM900, 850, PCS1900
[562950035734912]	[5629500 35734912]
+URAT	
Allowed values	LTE, UMTS, GSM
+CGDCONT	
CID (context ID) 1	"IPV4V6", ""
CID (context ID) 11	"IPV4V6", "ims"
CID (context ID) 12	"IPV4V6", "sos"
+UDCONF=20	
SoR enable	Enabled
LwM2M feature	
Available	Yes
LwM2M capabilities	u-blox
uFOTA-LwM2M capabilities	uFOTA
+ULWM2MREG	
Supported server ID	721
Locked	No
+ULWM2MCONFIGEXT	
Connection teardown timer	90
Production mode	0
Production SIM	"00101"
APN synchronization	0
Locked	No
+USVCDOMAIN	
Service Domain	CS/PS
UE usage setting	Voice centric
Voice domain preference	PS preferred
+URPM	
Enabled	False
IMS client	
VoLTE	Enabled
SMS over IMS	Enabled
IMS enabled (50)	1
+UISMS	

	Global
Mode	1
MNO profile fields not accessible	
MTU size	From PCO (1428)

D Appendix: glossary

Abbreviation	Definition
2G	2nd Generation
3G	3rd Generation
3GPP	3rd Generation Partnership Project
ADC	Analog to Digital Converter
AIeC	Automatically Initiated eCall
ADN	Abbreviated Dialing Numbers
AMR	Adaptive Multi Rate
AP	Access Point
APN	Access Point Name
ASCII	American Standard Code for Information Interchange
AT	AT Command Interpreter Software Subsystem, or attention
BL	Black List
BSD	Berkley Standard Distribution
CB	Cell Broadcast
CBM	Cell Broadcast Message
CLI	Calling Line Identification
CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
COLP	Connected Line Identification Presentation
COLR	Connected Line Identification Restriction
CM	Connection Management
CPHS	Common PCN Handset Specification
CR	Carriage Return
CS	Circuit Switch
CSD	Circuit-Switched Data
CSG	Closed Subscriber Group
CTS	Clear To Send
CUG	Closed User Group
DA	Destination Address
DARP	Downlink Advanced Receiver Performance
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCM	Data Connection Management
DHCP	Dynamic Host Configuration Protocol
DM	Device Management
DNS	Domain Name Server
DSR	DSC transponder response
DTE, TE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
DTR	Data Terminal Ready
DUT	Device Under Test
EARFCN	E-UTRAN Absolute Radio Frequency Channel Number
eCall	Emergency Call
e-CDRX	Extended Connected Mode DRX
eDRX	Extended Discontinuous Reception
EEP	EEPROM Emulation Parameters
EF	Elementary File
EF_{CGST}	Elementary File "Closed Subscriber Group Type"
EF_{HNBN}	Elementary File "Home Node B Number"
$EF_{PLMNwAcT}$	Elementary File "User controlled PLMN Selector with Access Technology"
eIM	eCall In-band Modem
EONS	Enhanced Operator Name from SIM-files EF_{OPL} and EF_{PNN}

Abbreviation	Definition
EPD	Escape Prompt Delay
EPS	Evolved Packet System
ETSI	European Telecommunications Standards Institute
E-UTRAN/EUTRAN	Evolved UTRAN
FDN	Fixed Dialling Number
FOAT	Firmware Over AT
FOTA	Firmware Over The Air
FS	File System
FTP	File Transfer Protocol
FW	Firmware
FWINSTALL	Firmware Install
GAS	Grouping information Alpha String
GERAN	GSM/EDGE Radio Access Network
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
HDLC	High Level Data Link Control
HNB	Home Node B
HPLMN	Home PLMN
HTTP	HyperText Transfer Protocol
I	Information
I^2C	Inter-Integrated Circuit
I^2S	Inter IC Sound or Integrated Interchip Sound
ICCID	Integrated Circuit Card ID
ICMP	Internet Control Message Protocol
ICP	Inter Processor Communication
IMEI	International Mobile Equipment Identity
IMS	IP Multimedia Subsystem
IMSI	International Mobile Station Identity
InBM	In-Band Modem (generic)
IP	Internet Protocol
IRA	International Reference Alphabet
IRC	Intermediate Result Code
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
IVS	In-Vehicle System (eCall related)
L3	Layer 3
LCP	Link Control Protocol
LF	Line Feed
LNS	Linux Network Subsystem
LwM2M	Lightweight M2M
M2M	Machine-To-Machine
MCC	Mobile Country Code
ME	Mobile Equipment
MIeC	Manually Initiated eCall
MMI	Man Machine Interface
MN	Mobile Network Software Subsystem
MNC	Mobile Network Code
MNO	Mobile Network Operator
MO	Mobile Originated
MS	Mobile Station
MSC	Modem Status Command
MSD	Minimum Set of Data (eCall related)
MSIN	Mobile Subscriber Identification Number

Abbreviation	Definition
MSISDN	Mobile Systems International Subscriber Identity Number
MSPR	Multi-Slot Power Reduction
MT	Mobile Terminated
MWI	Message Waiting Indication
NAA	Network Access Application
NAS	Non Access Stratum
NITZ	Network Identity and Time Zone
NVM	Non-Volatile Memory
ODIS	OMA-DM IMEI Sync
OLCM	On Line Commands Mode
PAD	Packet Assembler/Disassembler
P-CID	Physical Cell Id
PCN	Personal Communication Network
PDP	Packet Data Protocol
PDU	Protocol Data Unit
PIN	Personal Identification Number
PLMN	Public Land Mobile Network
PPP	Point-to-Point Protocol
PSAP	Public Safety Answering Point (eCall related)
PSD	Packet-Switched Data
PUK	Personal Unblocking Key
QoS	Quality of Service
RAM	Random Access Memory
RDI	Restricted Digital Information
RFU	Reserved for Future Use
RI	Ring Indicator
RNDIS	Remote Network Driver Interface Specification
RRC	Radio resource control
RTC	Real Time Clock
RTP	Real-time Transport Protocol
RTS	Request To Send
Rx	Receiver
SAP	SIM Access Profile
SC	Service Centre
SI	SIM Application Part Software Subsystem
SIP	Session Initiation Protocol
SIM	Subscriber Identity Module
SMS	Short Message Service
SMSC	Short Message Service Center
SMTP	Simple Mail Transfer Protocol
SoR	Steering of Roaming
SDIO	Secure Digital Input Output
SES	Speech Enhancement System
STA	station
SSID	Service Set Identifier
TA	Terminal Adaptor
TCP	Transfer Control Protocol
TE	Terminal Equipment
TFT	Traffic Flow Template
TP	Transfer layer Protocol
Tx	Transmitter
TZ	Time Zone
UCS2	Universal Character Set
UDI	Unrestricted Digital Information
UDP	User Datagram Protocol

Abbreviation	Definition
UI	Unnumbered Information
UICC	Universal Integrated Circuit Card
UIH	Unnumbered Information with header Check
URC	Unsolicited Result Code
USIM	UMTS Subscriber Identity Module
UTRAN	Universal Terrestrial Radio Access Network
UUS1	User-to-User Signalling Supplementary Service 1
WLAN	Wireless Local Area Network
ZTP	Zero Touch Provisioning

Related documentation

1. TOBY-L4 series data sheet, UBX-16009856
2. TOBY-L4 series system integration manual, UBX-16024839
3. TOBY-L2 series data sheet, UBX-13004573
4. MPCI-L2 series data sheet, UBX-13004749
5. TOBY-L2 / MPCI-L2 series system integration manual, UBX-13004618
6. LARA-R6 series data sheet, UBX-21004391
7. LARA-R6 series system integration manual, UBX-21010011
8. LARA-R6 series application development guide, UBX-22001850
9. LARA-R6 series Internet applications development guide, UBX-22001854
10. LARA-R6 end user test application note, UBX-22008644
11. LARA-R6 audio application note, UBX-22001999
12. LARA-R6 LwM2M objects and commands application note, UBX-22008379
13. LARA-R6 firmware update application note, UBX-22008011
14. LARA-R2 series data sheet, UBX-16005783
15. LARA-R2 series system integration manual, UBX-16010573
16. TOBY-R2 series data sheet, UBX-16005785
17. TOBY-R2 series system integration manual, UBX-16010572
18. ALEX-R5 series data sheet, UBX-20012524
19. ALEX-R5 series system integration manual, UBX-21004087
20. SARA-R5 series data sheet, UBX-19016638
21. SARA-R5 series system integration manual, UBX-19041356
22. SARA-R5 series application development guide, UBX-20009652
23. SARA-R4 / SARA-R5 series Internet applications development guide, UBX-20032566
24. SARA-R4 series data sheet, UBX-16024152
25. SARA-R4 series system integration manual, UBX-16029218
26. SARA-R41 application development guide, UBX-18019856
27. SARA-R42 application development guide, UBX-20050829
28. SARA-U2 series data sheet, UBX-13005287
29. LISA-U2 series data sheet, UBX-13001734
30. LISA-U1 series data sheet, UBX-13002048
31. LISA-U1 / LISA-U2 series system integration manual, UBX-13001118
32. SARA-G450 data sheet, UBX-18006165
33. SARA-G450 system integration manual, UBX-18046432
34. SARA-G3 series data sheet, UBX-13000993
35. SARA-G3 / SARA-U2 series system integration manual, UBX-13000995
36. LEON-G1 series data sheet, UBX-13004887
37. LEON-G1 series system integration manual, UBX-13004888
38. SARA-N2 series data sheet, UBX-15025564
39. NB-IoT application development guide, UBX-16017368
40. SARA-N3 series data sheet, UBX-18066692
41. SARA-N2 / SARA-N3 series system integration manual, UBX-17005143
42. SARA-N3 series application development guide, UBX-19026709
43. TOBY-R2 / LARA-R2 "03B" audio application note, UBX-20036864
44. AT commands examples application note, UBX-13001820
45. u-blox multiplexer implementation application note, UBX-13001887
46. u-blox firmware update application note, UBX-13001845
47. GNSS implementation application note, UBX-13001849
48. End user test application note, UBX-13001922
49. Wi-Fi / cellular integration application note, UBX-14003264
50. LTE initial default bearer application note, UBX-20015573
51. eCall / ERA GLONASS Implementation in u-blox cellular modules, UBX-13001924

52. TOBY-L4 series extended audio application note, UBX-17065359
53. TOBY-L4 uCPU series Audio CSD API application note, UBX-18067601
54. TOBY-L4 series eCall implementation in u-blox cellular modules application note, UBX-18019819
55. TOBY-L2 series audio application note, UBX-15015834
56. TOBY-L2 series networking modes application note, UBX-14000479
57. TOBY-L2 / MPCI-L2 series enforced security application note, UBX-19022699
58. SARA-U2 audio application note, UBX-14002981
59. SARA-U2 series audio extended tuning application note, UBX-17012797
60. LISA-U1 / LISA-U2 audio application note, UBX-13001835
61. SARA-G450 audio interface application note, UBX-20028599
62. SARA-G450 audio tuning commands application note, UBX-20013500
63. SARA-G3 audio application note, UBX-13001793
64. LEON-G1 audio application note, UBX-13001890
65. SARA-R5 series firmware update with uFOTA, FOAT and EasyFlash application note, UBX-20033314
66. SARA-R4 / SARA-R5 series positioning implementation application note, UBX-20012413
67. SARA-R4 series firmware update with uFOTA, FOAT and EasyFlash application note, UBX-17049154
68. LwM2M objects and commands application note, UBX-18068860
69. IoT Security-as-a-Service application note, UBX-20013561
70. 3GPP TS 27.007 - Technical Specification Group Core Network and Terminals; AT command set for User Equipment (UE)
71. 3GPP TS 22.004 - General on supplementary services
72. 3GPP TS 22.030 - Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Man-Machine Interface (MMI) of the User Equipment (UE)
73. 3GPP TS 22.090 - Unstructured Supplementary Service Data (USSD); Stage 1
74. 3GPP TS 23.038 - Alphabets and language-specific information
75. 3GPP TS 23.040 - Technical realization of Short Message Service (SMS)
76. 3GPP TS 23.041 - Technical realization of Cell Broadcast Service (CBS)
77. 3GPP TS 23.060 - Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description
78. 3GPP TS 24.007 - Mobile radio interface signalling layer 3; General aspects
79. 3GPP TS 24.008 - Mobile radio interface layer 3 specification
80. 3GPP TS 24.011 - Point-to-point (PP) Short Message Service (SMS) support on mobile radio interface
81. 3GPP TS 27.005 - Technical Specification Group Terminals; Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE-DCE) interface for Short Message Services (SMS) and Cell Broadcast Service (CBS)
82. 3GPP TS 27.060 - Technical Specification Group Core Network; Packet Domain; Mobile Station (MS) supporting Packet Switched Services
83. 3GPP TS 51.011 - Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface
84. 3GPP TS 31.102 - Characteristics of the Universal Subscriber Identity Module (USIM) application
85. 3GPP TS 05.08 - Radio subsystem link control
86. 3GPP TS 22.087 - User-to-User Signalling (UUS)
87. 3GPP TS 22.022 - Personalisation of Mobile Equipment (ME)
88. 3GPP TS 22.082 - Call Forwarding (CF) supplementary services
89. 3GPP TS 22.083 - Call Waiting (CW) and Call Holding (HOLD)
90. 3GPP TS 22.081 - Line identification Supplementary Services- Stage 1
91. 3GPP TS 23.081 - Line identification supplementary services- Stage 2
92. 3GPP TS 22.086 - Advice of Charge (AoC) Supplementary Services
93. 3GPP TS 22.024 - Description of Charge Advice Information (CAI)
94. 3GPP TS 22.085 - Closed User Group (CUG) Supplementary Services
95. 3GPP TS 22.096 - Name identification supplementary services
96. 3GPP TS 04.18 - Mobile radio interface layer 3 specification; Radio Resource Control (RRC) protocol
97. 3GPP TS 05.02 - Multiplexing and Multiple Access on the Radio Path

98. 3GPP TS 51.014 - Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface

99. 3GPP TS 27.010 V3.4.0 - Terminal Equipment to User Equipment (TE-UE) multiplexer protocol (Release 1999)

100. 3GPP TS 22.060 - General Packet Radio Service (GPRS); Service description; Stage 1

101. 3GPP TS 25.306 - UE Radio Access capabilities

102. 3GPP TS 22.002 - Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN)

103. 3GPP TS 22.067 - enhanced Multi Level Precedence and Pre-emption service (eMLPP); Stage 1

104. 3GPP TS 23.972 - Circuit switched multimedia telephony

105. 3GPP TS 24.615 Communication Waiting (CW) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol Specification

106. 3GPP TS 25.101 - User Equipment (UE) radio transmission and reception (FDD)

107. 3GPP TS 23.122 - NAS Functions related to Mobile Station (MS) in idle mode

108. 3GPP TS 45.005 - Radio transmission and reception

109. 3GPP TS 23.014 Support of Dual Tone Multi-Frequency (DTMF) signalling V11.0.0 (2012-09)

110. 3GPP TS 26.267 V12.0.0 (2012-12) eCall Data Transfer; In-band modem solution; General description (Release 12)

111. 3GPP TS 51.010-1 Mobile Station (MS) conformance specification; Part 1: Conformance specification

112. 3GPP TS 51.010-2 Mobile Station (MS) conformance specification; Part 2: Protocol Implementation Conformance Statement (PICS) proforma specification

113. 3GPP TS 34.121-2 User Equipment (UE) conformance specification; Radio transmission and reception (FDD); Part 2: Implementation Conformance Statement (ICS)

114. 3GPP TS 24.301 Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3

115. 3GPP TS 44.060 General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol

116. 3GPP TS 23.221 Architectural requirements

117. 3GPP TS 23.203 Policy and charging control architecture

118. 3GPP TS 31.101 UICC-terminal interface; Physical and logical characteristics

119. 3GPP TS 25.305 User Equipment (UE) positioning in Universal Terrestrial Radio Access Network (UTRAN); Stage 2

120. 3GPP TS 23.032: Universal Geographical Area Description (GAD)

121. 3GPP TS 25.331 Radio Resource Control (RRC); Protocol specification

122. 3GPP TS 36.101 Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception

123. 3GPP TS 24.173 IMS Multimedia telephony communication service and supplementary services; Stage 3

124. 3GPP TS 24.341 Support of SMS over IP networks; Stage 3

125. 3GPP TS 24.229 IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3

126. 3GPP TS 36.306 Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities

127. 3GPP TS 36.133 Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management

128. 3GPP TS 25.133 Requirements for support of radio resource management (FDD)

129. 3GPP TS 22.071 Location Services (LCS); Service description

130. 3GPP TS 36.331 Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 10)

131. 3GPP TS 24.167 3GPP IMS Management Object (MO); Stage 3

132. 3GPP TS 26.201 Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; Frame structure

133. 3GPP TS 24.216 Communication Continuity Management Object (MO)

134. 3GPP TS 36.521-2 - Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment conformance specification; Radio transmission and reception; Part 2: Implementation Conformance Statement (ICS)

135. 3GPP TS 36.523-2 - Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment conformance specification; Part 2: Implementation Conformance Statement (ICS)

136. 3GPP TS 23.003 Numbering, addressing and identification

137. 3GPP TS 31.111 Universal Subscriber Identity Module (USIM) Application Toolkit (USAT)
138. 3GPP TS 22.084 MultiParty (MPTY) supplementary service; Stage 1
139. 3GPP TS 24.607 Originating Identification Presentation (OIP) and Originating Identification Restriction (OIR) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification
140. 3GPP TS 24.608 Terminating Identification Presentation (TIP) and Terminating Identification Restriction (TIR) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification
141. 3GPP TS 36.213 Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures
142. 3GPP TS 36.212 Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding
143. 3GPP TS 24.166 - 3GPP IP Multimedia Subsystem (IMS) conferencing Management Object (MO)
144. 3GPP TS 29.061 - Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)
145. 3GPP TS 24.303 - Mobility management based on Dual-Stack Mobile IPv6; Stage 3
146. 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
147. 3GPP TS 25.367 - Mobility procedures for Home Node B (HNB); Overall description; Stage 2
148. 3GPP TS 25.304 - User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode
149. 3GPP TS 36.304 - Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode
150. 3GPP TS 45.008 - GSM/EDGE Radio Access Network; Radio subsystem link control
151. 3GPP TS 25.401 - Universal Mobile Telecommunications System (UMTS); UTRAN Overall Description
152. 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
153. 3GPP TS 36.211 - Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation
154. 3GPP TS 23.682 - Architecture enhancements to facilitate communications with packet data networks and applications
155. 3GPP TS 23.401 - General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access
156. 3GPP TS 44.018 - Mobile radio interface layer 3 specification; GSM/EDGE Radio Resource Control (RRC) protocol
157. 3GPP TS 43.064 - General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2
158. 3GPP TS 36.321 - Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification
159. 3GPP TS 22.011 - Service accessibility
160. 3GPP2 C.S0015-0 - Short Message Service
161. ETSI TS 102 223 - Smart cards; Card Application Toolkit (CAT)
162. ETSI TS 102 221 V8.2.0 (2009-06) Smart Cards; UICC-Terminal interface; Physical and logical characteristics (Release 8)
163. ETSI TS 127 007 V10.3.0 (2011-04) AT command set for User Equipment (UE) (3GPP TS 27.007 version 10.3.0 Release 10)
164. ETSI TS 122 101 V8.7.0 (2008-01) Service aspects; Service principles (3GPP TS 22.101 version 8.7.0 Release 8)
165. GSM 02.04 - Digital cellular telecommunications system (Phase 2+); Mobile Stations (MS) features
166. GSM 03.60 - Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS) Service description; Stage 2
167. GSM 04.12 - Digital cellular telecommunications system (Phase 2+); Short Message Service Cell Broadcast (SMSCB) Support on Mobile Radio Interface.
168. GSM 04.60 - Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol
169. GSMA TS.34 - IoT Device Connection Efficiency Guidelines
170. RFC 791 - Internet Protocol - http://www.ietf.org/rfc/rfc791.txt
171. RFC 2460 - Internet Protocol, Version 6 (IPv6) - http://www.ietf.org/rfc/rfc2460.txt

172. RFC 3267 - Real-Time Transport Protocol (RTP) Payload Format and File Storage Format for the Adaptive Multi-Rate (AMR) and Adaptive Multi-Rate Wideband (AMR-WB) Audio Codecs
173. RFC 792 Internet Control Message Protocol (http://tools.ietf.org/html/rfc0792)
174. RFC 959 File Transfer Protocol (http://tools.ietf.org/html/rfc959)
175. RFC 2428 FTP Extensions for IPv6 and NATs (https://tools.ietf.org/html/rfc2428)
176. RFC 4291 - IP Version 6 Addressing Architecture (http://tools.ietf.org/html/rfc4291)
177. RFC 793 - Transmission Control Protocol (TCP) Protocol Specification (https://www.rfc-editor.org/rfc/rfc793.txt)
178. RFC 7323 - TCP Extensions for High Performance - https://www.ietf.org/rfc/rfc7323.txt
179. RFC 3969 - The Internet Assigned Number Authority (IANA) Uniform Resource Identifier (URI) Parameter Registry for the Session Initiation Protocol (SIP)
180. RFC 3261 - SIP: Session Initiation Protocol
181. RFC 5341 - The Internet Assigned Number Authority (IANA) tel Uniform Resource Identifier (URI) Parameter Registry
182. RFC 3966 - The tel URI for Telephone Numbers
183. RFC 2141 - URN Syntax
184. RFC 3406 - Uniform Resource Names (URN) Namespace Definition Mechanisms
185. RFC 5031 - A Uniform Resource Name (URN) for Emergency and Other Well-Known Services
186. RFC 4715 - The Integrated Services Digital Network (ISDN) Subaddress Encoding Type for tel URI
187. RFC 5626 - Managing Client-Initiated Connections in the Session Initiation Protocol (SIP)
188. RFC 4867 - RTP Payload Format and File Storage Format for the Adaptive Multi-Rate (AMR) and Adaptive Multi-Rate Wideband (AMR-WB) Audio Codecs
189. RFC 4733 - RTP Payload for DTMF Digits, Telephony Tones, and Telephony Signals
190. RFC 1518 - An Architecture for IP Address Allocation with CIDR (https://tools.ietf.org/html/rfc1518)
191. RFC 1519 - Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy (https://tools.ietf.org/html/rfc1519)
192. RFC 7252 - Constrained Application Protocol (CoAP)
193. RFC 8323 - CoAP (Constrained Application Protocol) over TCP, TLS, and WebSockets - https://www.ietf.org/rfc/rfc8323.txt
194. RFC 5280 - Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile - http://www.ietf.org/rfc/rfc5280.txt
195. RFC 7925 - TLS/DTLS IoT Profiles - https://www.ietf.org/rfc/rfc7925.txt
196. RFC 7959 - Block-Wise Transfers in the Constrained Application Protocol (CoAP) - https://www.ietf.org/rfc/rfc7959.txt
197. ITU-T Recommendation V250, 05-99.
198. ITU-T V.25ter - ITU-T V.25 ter Recommendation: Data Communications over the Telephone Network; Serial asynchronous automatic Dialling and control.
199. ITU-T T.32 - ITU-T Recommendation T.32 Asynchronous Facsimile DCE Control - Service Class 2
200. ISO 639 (1988) Code for the representation of names of languages
201. ITU-T Recommendation V24, 02-2000. List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Connection Equipment (DCE).
202. ITU-T E.212 - Series E: Overall network operation, telephone service, service operation and human factors
203. IEC 61162 Digital interfaces for navigational equipment within a ship
204. Stevens. TCP/IP Illustrated Volume1 & 2 Addison-Wesley, 1994.
205. SIM Access Profile - Interoperability Specification - Bluetooth Specification V11r00
206. Device terminal access protocol-EDP technical specification, version 1.6
207. BS EN 16062:2015 Intelligent transport systems - ESafety - eCall high level application requirements (HLAP) using GSM/UMTS circuit switched networks, April 2015
208. PCCA standard - Command set extensions for CDPD modems, Revision 2.0, March, 1998
209. OMA Device Management V1.2.1 (http://technical.openmobilealliance.org/Technical/technical-information/release-program/current-releases/dm-v1-2-1)
210. Open Mobile Alliance (OMA) SyncML Common Specification, Version 1.2.2 (http://www.openmobilealliance.org/release/Common)
211. Open Mobile Alliance (OMA) - Lightweight Machine to Machine Technical Specification, Version 1.0
212. MQTT Version 3.1.1 - OASIS Standard

213. MQTT-SN Protocol Specification Version 1.2
214. AT&T: Device Requirements -- Requirements Document -- Document Number 13340 -- Revision 4.6 -- Revision Date 9/2/11
215. Common PCN Handset Specification v4.2
216. Maxim MAX9860 16-Bit Mono Audio Voice Codec datasheet, 19-4349; Rev 1; 9/09. Available from the Maxim website (http://datasheets.maxim-ic.com/en/ds/MAX9860.pdf)
217. Digital Communication Standard -Ademco Contact ID Protocol -for Alarm System Communications,SIA DC-05-1999.09

For regular updates to u-blox documentation and to receive product change notifications, register on our homepage.

Revision history

Revision	Date	Name	Comments
R01	22-Dec-2021	lpah	Initial release
R02	17-Jan-2022	lpah	New commands: +UDCONF=17. Modified commands: AT command settings, AT Commands Settings Notes, URCs, +UJAD, +CSCON, +CEDRXS, +UISMS, +ICF, \Q, S3, S4, S5, S6, S7, S10, E, Q, V, X, Z, PPP LCP handshake behavior, +CGREG, +CEREG, +UANT, +USTS, +USIO, +UTEMP, +CLVL, +USPM, +USOCR, +USOSO, +USOER, FTP, HTTP introduction, +UHTTP, PING, +UPING, +UGPS, +UGIND, +UGPRF, +UGSRV, +UGUBX, +ULOC, +ULOCIND, +UCOAP, MQTT introduction, +UMQTT, MQTT-SN introduction, +UMQTTSN, LARA-R6001D MNO profiles, LARA-R6401D MNO profiles. Review the command applicability for these commands: +UJAD, +CSCON, +CEDRXS, +UISMS, +ICF, \Q, S3, S4, S5, S6, S7, S8, S10, E, Q, V, X, Z, +CGREG, +CEREG, +UANT, +USTS, +UTEMP, +CLVL, +UGPS, +UGIND, +UGPRF, +UGSRV, +UGAOS, +UGUBX, +UGTMR, +UGZDA, +UGGGA, +UGGLL, +UGGSV, +UGRMC, +UGVTG, +UGGSA, +ULOC, +ULOCIND, +ULOCAID, +ULOCGNSS, +ULOCCELL.
R03	18-Feb-2022	lpah	New commands: +CNMPSD, +UDCONF=98. Modified commands: URCs presentation deferring, +CMUX, I, +CSCS, +CFUN, D, +VTS, +URAT, +UCFSCAN, +UDCONF=20, +UCGED, +VZWAPNE, +VZWRSRP, +VZWRSRQ, +UMNOPROF, +UBANDMASK, +UDCONF=92, +UIMSCFG, +CNMI, +CUSD, +UDCONF=50, +UFWINSTALL, +UFWUPD, +URING, +USIO, +UFACTORY, +UBKUPDATA, +UFOTASTAT, +ULGASP, GPIO introduction, GPIO additional notes, UART (DSR, DTR, DCD e RI) interface, +UGPIOC, File System Introduction, +UDWNFILE, +ULSTFILE, +UDELFILE, File System limits, +CLVL, +USPM, +UPAR, +USAR, +UTGN, Data security introduction, +USECMNG, +USECPRF, Cipher suite applicability, +USOSO, +UHTTP, +UHTTPAC, +UGPRF, +UDTMFCFG, +UMQTT, +UMQTTC, LwM2M objects management, +ULWM2MCONFIGEXT, +ODIS, MQTT class error codes, LARA-R6001D Americas MNO and conformance profiles, LARA-R600 1D EMEA and global MNO profiles, LARA-R6001D Americas MNO and conformance profiles, LARA-R6401D EMEA and global MNO profiles. Review the command applicability for these commands: +CGMI, +GMI, +CGMM, +GMM, +CGMR, +GMR, +CGSN, +GSN, I, +GCAP, A, +VTS, +UCFSCAN, +UDCONF=20, +UCGED, +VZWAPNE, +VZWRSRP, +VZWRSRQ, +UIMSCFG, +UFWUPD, +UFACTORY, +UBKUPDATA, +ULGASP, +UDWNFILE, +ULSTFILE, +URDFILE, +URDBLOCK, +UDELFILE, +UPAR, +USAR, +UTGN, +USECMNG, +USECPRF.
R04	07-Apr-2022	lpah	New commands: +UDCONF=19, +UDCONF=40, +UURCCONF, +UDCONF=121. Modified commands: Operational mode of the AT interface, Command line, Concatenation of AT commands, Information text responses and result codes, Storing of AT commands setting, General operation, Auto-registration, Operational restrictions, Maximum vs typical response time of cellular network related AT commands, +CSCS, <MCC>, <MNC>, <CI>, <scrambling_code>, <arfcn>, <EARFCN>, <TAC>, <RSRP>, <RSRQ>, <Lband>, +CSQ, +COPS, +UCFSCAN, +UJAD, +CSCON, +VZWAPNE, +UBANDMASK, +UIMSCFG, +CPWD, +CPBR, +CPBF, +CPBW, +CRC, &K, +ICF, E, X, +CRSM, <APN>, +CGDCONT, +CGQREQ, +CGQMIN, +CGEQREQ, +CGEQMIN, +UAUTHREQ, +CGEQOS, +UFWINSTALL, +UFWUPD, +UANT, +URXDIV, +UDCONF=40, +UUARTCONF, +ULGASP, +UPSV, +UDWNFILE, +UMCLK, +UEXTDCONF, +USPEECHCFG, DNS introduction, +UDNSRN, +UDYNDNS, +UDNSCFG, Internet protocol transport layer, +USOCR, +UIPCHGN, +USECPRF, FTP introduction, +UFTP, HTTP introduction, +UHTTP, PING introduction, +UPING, +UGSRV, +ULOCCELL, +UIPADDR, CoAP introduction, +UCOAP, MQTT introduction, +UMQTT, MQTT-SN introduction, +UMQTTSN, +UMQTTSNC, Mobile termination error result codes +CME ERROR, MQTT class error codes, MQTT-SN class error codes, Multiple AT command interfaces, LARA-R6001D Americas MNO and conformance profiles, LARA-R6001D EMEA and global MNO profiles, LARA-R6001-

Revision	Date	Name	Comments
			00B Americas MNO and conformance profiles table, LARA-R6001-00B EMEA and global MNO profiles table, LARA-R6401D Americas MNO and conformance profiles, LARA-R6401D EMEA and global MNO profiles, LARA-R6401-00B Americas MNO and conformance profiles , LARA-R6401-00B EMEA and global MNO profiles , LARA-R6801-00B Americas MNO and conformance profiles , LARA-R6801-00B EMEA and global MNO profiles table. Updated estimated response time information for these commands: +UDNSRN, +USOSEC, +USOCL, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI, +USODL. Review the command applicability for these commands: +CGQMIN, +CGEQREQ, +CGEQMIN, +URXDIV, +UMCLK, +USPEECHCFG, +UIPADDR.
R05	11-May-2022	lpah	Modified commands: Command line, +CSCS, +VTS, S0, <scrambling_code>, +UCFSCAN, \Q, +ULGASP, +URING, +UDWNFILE, +UI2S, +UTGN, +UEXTDCONF, +USPEECHCFG, +USPEECHINFO, +UDNSCFG, +ULOCCELL, +UI2CC, MQTT-SN class error codes.

Contact

For complete contact information, visit us at www.u-blox.com.

u-blox Offices

North, Central and South America

u-blox America, Inc.
Phone: +1 703 483 3180
Email: info_us@u-blox.com

Regional Office West Coast:
Phone: +1 408 573 3640
Email: info_us@u-blox.com

Technical Support:
Phone: +1 703 483 3185
Email: support_us@u-blox.com

Headquarters

Europe, Middle East, Africa

u-blox AG
Phone: +41 44 722 74 44
Email: info@u-blox.com
Support: support@u-blox.com

Asia, Australia, Pacific

u-blox Singapore Pte. Ltd.
Phone: +65 6734 3811
Email: info_ap@u-blox.com
Support: support_ap@u-blox.com

Regional Office Australia:
Phone: +61 3 9566 7255
Email: info_anz@u-blox.com
Support: support_ap@u-blox.com

Regional Office China (Beijing):
Phone: +86 10 68 133 545
Email: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Chongqing):
Phone: +86 23 6815 1588
Email: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Shanghai):
Phone: +86 21 6090 4832
Email: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office China (Shenzhen):
Phone: +86 755 8627 1083
Email: info_cn@u-blox.com
Support: support_cn@u-blox.com

Regional Office India:
Phone: +91 80 4050 9200
Email: info_in@u-blox.com
Support: support_in@u-blox.com

Regional Office Japan (Osaka):
Phone: +81 6 6941 3660
Email: info_jp@u-blox.com
Support: support_jp@u-blox.com

Regional Office Japan (Tokyo):
Phone: +81 3 5775 3850
Email: info_jp@u-blox.com
Support: support_jp@u-blox.com

Regional Office Korea:
Phone: +82 2 542 0861
Email: info_kr@u-blox.com
Support: support_kr@u-blox.com

Regional Office Taiwan:
Phone: +886 2 2657 1090
Email: info_tw@u-blox.com
Support: support_tw@u-blox.com