# SARA-R5 series

## LTE-M / NB-IoT modules with secure cloud

### AT commands manual

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

UBX-19047455 - R06
C1-Public

www.u-blox.com

| Document information | | |
|---|---|---|
| **Title** | **SARA-R5 series** | |
| **Subtitle** | LTE-M / NB-IoT modules with secure cloud | |
| **Document type** | AT commands manual | |
| **Document number** | UBX-19047455 | |
| **Revision and date** | R06 | 28-Sep-2020 |
| **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 |
|---|---|---|---|---|
| SARA-R500S | SARA-R500S-00B-00 | 02.05 | A00.01 | UBX-20037360 |
| SARA-R510S | SARA-R510S-00B-00 | 02.05 | A00.01 | UBX-20037360 |
| SARA-R510M8S | SARA-R510M8S-00B-00 | 02.05 | A00.01 | UBX-20037360 |

## How to use this manual

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

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

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

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

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

## Summary table

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

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

It is composed of two sections:

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

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

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

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

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

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

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

# u-blox technical documentation

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

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

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

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

- For some guidelines when developing applications for LTE Cat M1 technologies, see the SARA-R4 series application development guide [178] or the SARA-R5 series application development guide [177].
- For some guidelines when developing applications for NB-IoT technologies, see the SARA-N3 series application development guide [179] or the NB-IoT application development guide [181].
- 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 [176].

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 ..... 12**
1.1 Definitions ..... 12
1.2 Storing of AT commands setting ..... 16
1.3 S-parameters ..... 16
1.4 +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 ..... 29
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 Alarm +CALA ..... 37
5.9 Delete alarm +CALD ..... 38
5.10 Set greeting text +CSGT ..... 39
5.11 Automatic time zone update +CTZU ..... 39
5.12 Time zone reporting +CTZR ..... 40
5.13 Report mobile termination error +CMEE ..... 41
5.14 Extended error report +CEER ..... 42

**6 Call control ..... 43**
6.1 Dial command D ..... 43
6.2 Hook control H ..... 44
6.3 Automatic answer S0 ..... 44

**7 Network service ..... 46**
7.1 Network parameters definition ..... 46
7.2 Subscriber number +CNUM ..... 48
7.3 Signal quality +CSQ ..... 49
7.4 Extended signal quality +CESQ ..... 50
7.5 Operator selection +COPS ..... 52

7.6 Radio Access Technology (RAT) selection +URAT ..... 57
7.7 Radio manager configuration +URATCONF ..... 58
7.8 Display operator name +UDOPN ..... 60
7.9 Coverage enhancement status +CRCES ..... 61
7.10 Preferred PLMN list selection +CPLS ..... 62
7.11 Network registration status +CREG ..... 63
7.12 Preferred operator list +CPOL ..... 66
7.13 Read operator names +COPN ..... 67
7.14 Network selection control +PACSP ..... 67
7.15 Integrity check on test networks configuration +UDCONF=81 ..... 68
7.16 Channel and network environment description +UCGED ..... 69
7.17 Provide cell information +UCELLINFO ..... 73
7.18 Smart jamming detection +UJAD ..... 75
7.19 Extended cell information +UMETRIC ..... 76
7.20 Edit Verizon wireless APN table +VZWAPNE ..... 89
7.21 Read RSRP values +VZWRSRP ..... 90
7.22 Read RSRQ values +VZWRSRQ ..... 91
7.23 Signalling connection status +CSCON ..... 91
7.24 Radio Policy Manager (RPM) activation +URPM ..... 92
7.25 Radio Policy Manager (RPM) configuration +URPMCONF ..... 93
7.26 eDRX setting +CEDRXS ..... 94
7.27 eDRX read dynamic parameters +CEDRXRDP ..... 96
7.28 Set MNO profile +UMNOPROF ..... 97
7.29 Band selection bitmask +UBANDMASK ..... 100
7.30 Retrieve coverage enhancement mode information +CEINFO ..... 101

**8 Device lock ..... 103**
8.1 Enter PIN +CPIN ..... 103
8.2 Read remaining SIM PIN attempts +UPINCNT ..... 104
8.3 Facility lock +CLCK ..... 105
8.4 Change password +CPWD ..... 106
8.5 Custom SIM lock +USIMLCK ..... 107

**9 Phonebook ..... 109**
9.1 Select phonebook memory storage +CPBS ..... 109
9.2 Read phonebook entries +CPBR ..... 110
9.3 Find phonebook entries +CPBF ..... 111
9.4 Write phonebook entry +CPBW ..... 112

**10 Short Messages Service ..... 115**
10.1 Introduction ..... 115
10.2 Select message service +CSMS ..... 115
10.3 Preferred message storage +CPMS ..... 116
10.4 Preferred message format +CMGF ..... 117
10.5 Save settings +CSAS ..... 118
10.6 Restore settings +CRES ..... 118
10.7 Show text mode parameters +CSDH ..... 119
10.8 New message indication +CNMI ..... 119
10.9 Select service for MO SMS messages +CGSMS ..... 123
10.10 Read message +CMGR ..... 123
10.11 New message acknowledgement to MT +CNMA ..... 126
10.12 List message +CMGL ..... 127
10.13 Send message +CMGS ..... 129
10.14 Write message to memory +CMGW ..... 130
10.15 Send message from storage +CMSS ..... 131
10.16 Set text mode parameters +CSMP ..... 132
10.17 Delete message +CMGD ..... 133
10.18 Service center address +CSCA ..... 133
10.19 Select cell broadcast message types +CSCB ..... 134
10.20 More messages to send +CMMS ..... 135
10.21 Peek message +UCMGP ..... 135

**11 V24 control and V25ter ..... 137**
11.1 Introduction ..... 137
11.2 Circuit 109 behavior &C ..... 137
11.3 Circuit 108/2 behavior &D ..... 137
11.4 DSR override &S ..... 139
11.5 Flow control &K ..... 139
11.6 DTE-DCE character framing +ICF ..... 141
11.7 DTE-DCE local flow control +IFC ..... 142
11.8 Set flow control \Q ..... 143
11.9 UART data rate configuration +IPR ..... 144
11.10 Return to on-line data state O ..... 146
11.11 Escape character S2 ..... 146
11.12 Command line termination character S3 ..... 147
11.13 Response formatting character S4 ..... 148
11.14 Command line editing character S5 ..... 148
11.15 Connection completion timeout S7 ..... 149
11.16 Escape prompt delay (EPD) S12 ..... 150
11.17 Command echo E ..... 150
11.18 Result code suppression Q ..... 151
11.19 DCE response format V ..... 151
11.20 Reset to default configuration Z ..... 152
11.21 Set to factory defined configuration &F ..... 152
11.22 Store current configuration &W ..... 153
11.23 Display current configuration &V ..... 153
11.24 Designate a default reset profile &Y ..... 154

**12 SIM management ..... 155**
12.1 Generic SIM access +CSIM ..... 155
12.2 Restricted SIM access +CRSM ..... 155
12.3 Read the SIM language +CLAN ..... 157
12.4 Check for UICC card +UUICC ..... 158
12.5 Customer service profile +UCSP ..... 158
12.6 SIM hot insertion configuration +UDCONF=50 ..... 159
12.7 UICC application discovery +CUAD ..... 160
12.8 Open logical channel +CCHO ..... 160
12.9 Close logical channel +CCHC ..... 161
12.10 Generic UICC logical channel access +CGLA ..... 162
12.11 Restricted UICC logical channel access +CRLA ..... 163
12.12 SIM states reporting +USIMSTAT ..... 164

**13 SIM toolkit ..... 166**
13.1 Introduction ..... 166
13.2 Bearer Independent Protocol status indication +UBIP ..... 166
13.3 Terminal profile +UCATPROF ..... 167

**14 Packet switched data services ..... 168**
14.1 PDP contexts and parameter definition ..... 168
14.2 PPP LCP handshake behaviour ..... 169
14.3 Printing IP address format +CGPIAF ..... 170
14.4 PDP context definition +CGDCONT ..... 171
14.5 IPv6 configuration +UDCONF=66 ..... 174
14.6 Packet switched data configuration +UPSD ..... 175
14.7 Packet switched data action +UPSDA ..... 177
14.8 Packet switched network-assigned data +UPSND ..... 178
14.9 GPRS attach or detach +CGATT ..... 179
14.10 PDP context activate or deactivate +CGACT ..... 180
14.11 Enter data state +CGDATA ..... 181
14.12 Enter PPP state/GPRS dial-up D* ..... 182
14.13 Show PDP address +CGPADDR ..... 183
14.14 Packet switched event reporting +CGEREP ..... 184

14.15 GPRS network registration status +CGREG....186
14.16 Manual deactivation of a PDP context H....188
14.17 PDP context modify +CGCMOD....188
14.18 Define secondary PDP context +CGDSCONT....189
14.19 UE modes of operation for EPS +CEMODE....190
14.20 EPS network registration status +CEREG....191
14.21 Delete non-active PDP contexts +CGDEL....193
14.22 Traffic flow template read dynamic parameters +CGTFTRDP....194
14.23 Configure the authentication parameters of a PDP/EPS bearer +UAUTHREQ....196
14.24 Send custom packets over a context +UTGSINK....197
14.25 Define EPS quality of service +CGEQOS....197
14.26 EPS quality of service read dynamic parameters +CGEQOSRDP....198
14.27 Secondary PDP context read dynamic parameters +CGSCONTRDP....199
14.28 UE's usage setting for EPS +CEUS....200
14.29 PDP context read dynamic parameters +CGCONTRDP....201
14.30 Traffic flow template +CGTFT....203
14.31 Read counters of sent or received PSD data +UGCNTRD....205
14.32 Set/reset counter of sent or received PSD data +UGCNTSET....206
14.33 Uplink user data plane configuration +UDCONF=9....207
14.34 Feature Group Indicators (FGI) settings +UFGI....207
14.35 PDP IP configuration when roaming +UDCONF=75....208
14.36 Disable data when roaming +UDCONF=76....209
14.37 APN back-off timer read dynamic parameters +CABTRDP....209

**15 System features....211**
15.1 Firmware installation +UFWINSTALL....211
15.2 Firmware update Over AT (FOAT) +UFWUPD....213
15.3 Antenna detection +UANTR....215
15.4 End user test +UTEST....216
15.5 Smart temperature supervisor +USTS....226
15.6 RING line handling +URING....227
15.7 CTS line state in case of disabled HW flow control +UCTS....228
15.8 Serial interfaces configuration selection +USIO....229
15.9 Restore factory configuration +UFACTORY....230
15.10 Cancel FOTA download +UFOTA....231
15.11 Sets FOTA status URCs +UFOTASTAT....232
15.12 Last gasp configuration +ULGASP....234

**16 Power management....236**
16.1 Power saving control (Power SaVing) +UPSV....236
16.2 Power Saving Mode Setting +CPSMS....237
16.3 Power Saving Mode assigned values +UCPSMS....239
16.4 Power Saving Mode indication +UPSMR....240
16.5 Power Preference Indication for EPS +CEPPI....242

**17 GPIO....243**
17.1 Introduction....243
17.2 GPIO select configuration command +UGPIOC....248
17.3 GPIO read command +UGPIOR....250
17.4 GPIO set command +UGPIOW....251

**18 File System....252**
18.1 File tags....252
18.2 Download file +UDWNFILE....254
18.3 List files information +ULSTFILE....255
18.4 Read file +URDFILE....256
18.5 Partial read file +URDBLOCK....256
18.6 Delete file +UDELFILE....257
18.7 File system limits....258

**19 DNS....259**

19.1 Resolve name / IP number through DNS +UDNSRN....259
19.2 Dynamic DNS update +UDYNDNS....260
**20 Internet protocol transport layer....264**
20.1 Introduction....264
20.2 IPv4/IPv6 addressing....264
20.3 Create Socket +USOCR....265
20.4 SSL/TLS/DTLS mode configuration on TCP/UDP socket +USOSEC....266
20.5 Set socket option +USOSO....267
20.6 Get Socket Option +USOGO....268
20.7 Close Socket +USOCL....269
20.8 Get Socket Error +USOER....270
20.9 Connect Socket +USOCO....271
20.10 Write socket data +USOWR....272
20.11 SendTo command (UDP only) +USOST....274
20.12 Read Socket Data +USORD....275
20.13 Receive From command (UDP only) +USORF....277
20.14 Set Listening Socket +USOLI....278
20.15 HEX mode configuration +UDCONF=1....279
20.16 Set socket in Direct Link mode +USODL....280
20.17 Timer Trigger configuration for Direct Link +UDCONF=5....281
20.18 Data Length Trigger configuration for Direct Link +UDCONF=6....282
20.19 Character trigger configuration for Direct Link +UDCONF=7....282
20.20 Congestion timer configuration for Direct Link +UDCONF=8....283
20.21 Direct Link disconnect DSR line handling +UDCONF=10....283
20.22 Socket control +USOCTL....284
20.23 IP Change Notification +UIPCHGN....285
20.24 Configure Dormant Close Socket Behavior +USOCLCFG....289
**21 Device and data security....291**
21.1 Introduction....291
21.2 Device security....291
21.3 Data security....295
**22 FTP....320**
22.1 FTP service configuration +UFTP....320
22.2 FTP command +UFTPC....323
22.3 FTP error +UFTPER....326
**23 HTTP....327**
23.1 HTTP control +UHTTP....327
23.2 HTTP advanced control+UHTTPAC....330
23.3 HTTP command +UHTTPC....331
23.4 HTTP protocol error +UHTTPER....333
**24 Ping....334**
24.1 Ping command +UPING....334
24.2 ICMP echo reply configuration +UDCONF=4....335
**25 Positioning....337**
25.1 NMEA....337
25.2 AssistNow services....337
25.3 GNSS....338
25.4 CellLocate and hybrid positioning....350
25.5 UTIME....358
**26 $I^2C$....362**
26.1 Introduction....362
26.2 $I^2C$ open logical channel +UI2CO....362
26.3 $I^2C$ write to peripheral +UI2CW....363
26.4 $I^2C$ read from peripheral +UI2CR....364
26.5 $I^2C$ read from peripheral register +UI2CREGR....364

26.6 $I^2C$ close logical channel +UI2CC ... 365
27 Networking ... 366
27.1 Configure the port forwarding +UPORTFWD ... 366
28 Constrained Application Protocol (CoAP) ... 368
28.1 Introduction ... 368
28.2 CoAP profile configuration +UCOAP ... 368
28.3 CoAP command +UCOAPC ... 371
28.4 CoAP error reporting +UCOAPER ... 373
29 MQTT ... 374
29.1 Introduction ... 374
29.2 MQTT profile configuration +UMQTT ... 374
29.3 Save/Restore MQTT profile from NVM +UMQTTNV ... 378
29.4 MQTT command +UMQTTC ... 378
29.5 MQTT error +UMQTTER ... 382
30 MQTT-SN ... 383
30.1 Introduction ... 383
30.2 MQTT-SN profile configuration +UMQTTSN ... 383
30.3 Save/Restore MQTT-SN profile from NVM +UMQTTSNNV ... 386
30.4 MQTT-SN command +UMQTTSNC ... 386
30.5 MQTT-SN error +UMQTTSNER ... 390
31 Lightweight M2M ... 391
31.1 LwM2M Objects management ... 391
31.2 LwM2M connectivity ... 395
A Appendix: Error result codes ... 404
A.1 Mobile termination error result codes +CME ERROR ... 404
A.2 Message service error result codes +CMS ERROR ... 410
A.3 +CEER error result codes ... 414
A.4 Firmware install final result codes ... 420
A.5 FOAT error result codes ... 420
A.6 Dynamic DNS unsolicited indication codes ... 421
A.7 Internal TCP/UDP/IP stack class error codes ... 421
A.8 Internet suite error classes ... 423
A.9 IP change notification error result codes ... 430
A.10 Ping error result codes ... 430
B Appendix: AT Commands List ... 432
B.1 Parameters stored in profiles ... 458
B.2 Parameters stored in non volatile memory ... 459
B.3 Saving AT commands configuration ... 462
B.4 Estimated command response time ... 462
B.5 Multiple AT command interfaces ... 463
B.6 Mobile Network Operator profiles ... 464
C Appendix: Glossary ... 467
Related documents ... 470
Revision history ... 475
Contact ... 477

# 1 AT command settings

u-blox cellular modules provide at least one physical serial interface that is compliant to V.24 [23]. 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.

SARA-R5
u-blox cellular modules can implement more than one interface between the DTE and the DCE, either virtual interfaces (multiplexer channels) or physical interfaces (UART, USB, SPI, etc., when available). Each interface works as specified by the followings definitions. If not differently stated, all the subsequent descriptions are applicable to each interface. Appendix B.5 describes the different behaviour among the interfaces in reference to the AT command interface.

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

SARA-R5
Where supported, two UART AT interfaces can be used at the same time (it is not the default behaviour). See +USIO command description for details on how to set such behaviour.
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).

The DCE/MT interface can operate in these modes:

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

SARA-R5
The AT commands over IP connection is not supported.

SARA-R5

For more details on PSD connection see the +UPSD, +UPSDA and +UPSND commands description.

### 1.1.1 Switch from data mode to online command mode

When a data connection is established it is possible to switch from data mode to online command mode (OLCM) in the following ways:

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

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

When using the multiplexer and PPP combined, toggling the DTR line (of the physical serial interface where the multiplexer protocol is started) from ON to OFF state does not terminate the PPP session and return the device to the command mode. In this configuration, it is recommended that the host terminates the PPP session, which can be done by sending LCP_TERM REQ or deasserting the DTR virtual line (sending of specific MUX MSC command).

### 1.1.2 Command description

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

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

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

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

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

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

### 1.1.3 Default values

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

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

### 1.1.4 Command line

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

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

Where:

- "AT": prefix to be set at the beginning of each command line
- <command_name>: command name string; it can have a "+" character as prefix
- <string>: string consisting of the parameters value following the syntax provided in this manual

The following rules are used when describing the command syntax:
- o <...>: the name in angle brackets is a parameter. The brackets themselves do not appear in the command line
- o [...]: the square brackets represent the optional parameters of a command or an optional part of the DCE information text response. Brackets themselves do not appear in the command line. When a parameter is not given, the value will be set to the default value provided in the command description

Parameter types:
- o Number: positive and negative counting numbers, as well as zero {..., -2, -1, 0, 1, 2,...}.
- o String: sequence of characters enclosed within quotation marks (" ").

- <S3_character>: command line termination character; the factory-programmed termination character is <CR>

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

☞ SARA-R5
The command line is not case sensitive unless autobauding is enabled; in this case the prefix "AT" must be typed either as "AT" or "at"; other combinations ("aT" or "Ta") are not allowed.

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

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

#### 1.1.4.1 Concatenation of AT commands

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

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

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

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

☞ SARA-R5
Not all the commands can be entered with other commands on the same command line: +CMGW, +CMGS, +USOWR, +USOST, +UDWNFILE must be used by themselves.

### 1.1.5 Notes

**SARA-R5**

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

### 1.1.6 Information text responses and result codes

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

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

where

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

SARA-R5
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 AT+CMEE command configures the error result format |
| NO DIALTONE | 6 | Final | No dialtone detected |
| BUSY | 7 | Final | Engaged signal detected (the called number is busy) |
| NO ANSWER | 8 | Final | No hang up detected after a fixed network timeout |
| CONNECT<data rate> | 9 | Intermediate | Same as CONNECT including also the data rate (data call).<br>SARA-R5<br>In case of data/fax call, see Circuit 108/2, +++ behaviour for the different &D: summarizing table to return in command mode and disconnect the call. |
| 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 |

**Table 1: Allowed result codes**

SARA-R5
The `DISCONNECT` result code is not supported.

SARA-R5
These result codes are not supported: `NOT SUPPORT`, `INVALID COMMAND LINE`, `CR`, `SIM DROP`.

SARA-R5
The result codes `CONNECT` and `NO CARRIER` are supported only in verbose format.

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

SARA-R5
The attribute abortability means that the command line is always returned, instead the service is really aborted only in case of the PLMN search and PLMN extended search procedures.

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

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

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

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

The most typical error result codes are the following:

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

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

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

- SARA-R5 - Firmware update Over The Air: see the Appendix A.4
- SARA-R5 - Firmware update Over AT command: see the Appendix A.5
- SARA-R5 - DNS: see the Appendix A.6 and Appendix A.7
- SARA-R5 - TCP and UDP connections: see the Appendix A.7, Appendix A.8
- SARA-R5 - FTP: see the Appendix A.8.1
- SARA-R5 - HTTP: see the Appendix A.8.2
- SARA-R5 - MQTT: see the Appendix A.8.4
- SARA-R5 - MQTT-SN: see the Appendix A.8.5
- SARA-R5 - IP change notification: see the Appendix A.9
- SARA-R5 - CoAP: see the Appendix A.8.6
- SARA-R5 - Ping: see the Appendix A.10

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

## 1.2 Storing of AT commands setting

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

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

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

SARA-R5
More details about loading, storing and updating profiles can be found in the command descriptions for: ATZ, AT&F, AT&W, AT&V, and AT&Y.

## 1.3 S-parameters

The S-parameters, as specified in ITU-T recommendation V250 [19], constitute a group of commands that begin with the string "ATS". They are generally indicated as S registers and are used to configure the way the module operates. Their syntax is:

```
ATS<parameter_number>?
```

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

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

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

| AT command | S Number | Description |
|---|---|---|
| S0 | 0 | Automatic answer setting |
| S2 | 2 | Escape character setting |
| S3 | 3 | Command line termination character setting |
| S4 | 4 | Response formatting character setting |
| S5 | 5 | Command line editing character setting |
| S7 | 7 | Connection completion timeout setting |
| S12 | 12 | Escape prompt delay setting |

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

## 1.4 +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.

☞ SARA-R5
If the SIM card has enabled the PIN check, some commands answer with "+CME ERROR: SIM PIN required" and most cellular functionalities are not started. After entering the required PIN via the +CPIN command, or if booting with a SIM with disabled PIN check, SIM initialization is carried out and a lot of SIM files are read: it is possible that some commands (e.g. phonebook AT commands) are affected by this preliminary phase, resulting in a temporary error response.

### 2.1.1 Auto-registration

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

☞ SARA-R5
During the auto-registration (both at start-up and during normal operation), any further network request (by means of AT+COPS=0 or AT+COPS=1) triggers a PLMN selection that can collide with underlying registration procedures, and in this case the error result code "+CME ERROR: Temporary failure" can be issued.
In these cases the +COPS AT command can be eventually retried.

☞ SARA-R5
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. In case of failures of the automatic registration whose cause cannot be retrieved via +CEER, it is suggested to disable auto-COPS starting the module in +COPS: 2 or in airplane mode +CFUN: 4 and trigger registration with AT commands.

### 2.1.2 Operational restrictions

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

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

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

## 2.2 AT commands types

### 2.2.1 Action command

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

### 2.2.2 Set command

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

### 2.2.3 Read command

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

### 2.2.4 Test command

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

### 2.2.5 Unsolicited Result Code (URC)

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

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

#### 2.2.5.1 URCs presentation deferring

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

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

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

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

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

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

For the above classes, it is possible to select the presentation strategy in case of AT interface busy according the 3GPP TS 27.007 [2]; the buffering or discarding are the two possible choices (URCs are lost in the latter case). This is done by means of the corresponding AT command (see the AT command listed in the table above).

If the URCs are enabled or for the three described classes of URCs, the buffered URCs are sent out only when the AT interface is in idle again; this occurs as soon as:

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

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

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

### 2.2.6 Intermediate Result Code (IRC)

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

# 3 IPC - Inter Processor Communication

## 3.1 Multiplexing mode +CMUX

| +CMUX | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | 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 [41]. The command sets the parameters for the control channel. The result code is returned using the old interface speed. The parameters become active only after sending the OK result code.

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

The multiplexer configuration is as follows:

| Modules | Control channel | AT commands / data connection | GNSS tunneling | SAP (SIM Access Profile) |
|---|---|---|---|---|
| SARA-R5 | Channel 0 | Channel 1 - 3 | Channel 4 | |

**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<br>OK |
| Read | AT+CMUX? | +CMUX: <mode>,[<subset>],<port_speed>,<N1>,<T1>,<N2>,<T2>,<T3>[,<k>]<br>OK | +CMUX: 0,0,0,1500,253,3,254,0,0<br>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)<br>OK | +CMUX: (0),(0),,(1-1509),(1-255),(0-5),(2-255),,<br>OK |

### 3.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Multiplexer transparency mechanism:<br>• 0: basic option |
| <subset> | Number | The way in which the multiplexer control channel is set up:<br>• 0 (default value): UIH frames used only<br>• 1: UI frames used only<br>See Notes for the parameter applicability. |
| <port_speed> | Number | Transmission rate. The allowed range is 0-7.<br>This parameter is ignored and the value 0 is always displayed in case of read command. |
| <N1> | Number | Maximum frame size:<br>• Allowed range is 1-1509.<br>• The default value is 31. |

| Parameter | Type | Description |
|---|---|---|
| <T1> | Number | Acknowledgement timer in units of ten milliseconds. The allowed range is 1-255.<br>This parameter is ignored and the value 253 is always set. |
| <N2> | Number | Maximum number of re-transmissions:<br>• Allowed range is 0-5.<br>• 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.<br>This parameter is ignored and the value 254 is always set. |
| <T3> | Number | Wake up response timer. The allowed range is 0-255.<br>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.<br>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>.

**SARA-R5**

- <subset> can only assume the value 0.
- After having issued the set command, a timeout of 5 s is started. The MUX protocol is aborted if the DTE does not initiate the establishment of the MUX control channel (via a SABM frame on DLCI 0) within this time.
- On the AUX UART interface, the multiplexer protocol is not supported.
- In case the AUX UART interface is configured as AT interface (for more details, see +USIO AT command, <requested_variant>=2) 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 - 2
  - GNSS tunneling: channel 3
- In case the AUX UART interface is configured as GNSS tunneling (for more details, see +USIO AT command, <requested_variant>=4) 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 model identification.

### 4.3.2 Syntax

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

### 4.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <model> | String | Name of model |

## 4.4 Model identification +GMM

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

### 4.4.1 Description

Text string identifying the model identification.

### 4.4.2 Syntax

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

### 4.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <model> | String | Name of model |

## 4.5 Firmware version identification +CGMR

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

### 4.5.1 Description

Returns the firmware version of the module.

### 4.5.2 Syntax

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

### 4.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <version> | String | Firmware version |

## 4.6 Firmware version identification +GMR

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

### 4.6.1 Description

Returns the firmware version of the module.

### 4.6.2 Syntax

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

### 4.6.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <version> | String | Firmware version |

## 4.7 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:<br>• 0 (default value): MT serial number, typically the International Mobile station Equipment Identity (IMEI)<br>• 1: International Mobile station Equipment Identity (IMEI)<br>• 2: International Mobile station Equipment Identity and Software Version Number (IMEISV)<br>• 3: Software Version Number (SVN)<br>• 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**<br>ATI[0] | <type_number><br>OK | ATI0<br>SARA-G350-00S-00<br>OK |
| | **Module boot sequence version request**<br>ATI6 | <module_boot_sequence_version><br>OK | ATI6<br>1<br>OK |
| | **Modem and application version request**<br>ATI9 | <modem_version>,<applications_version><br>OK | ATI9<br>29.90,A01.00<br>OK |

### 4.9.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <manufacturer> | String | Manufacturer name |
| <type_number> | String | Product type number |
| <ordering_code> | String | Product ordering code |
| <modem_version> | String | Module modem version |
| <FW_rel_date> | String | Firmware release date and time |
| <applications_version> | String | Module application version. Where not applicable the module provides "Undefined" |
| <SVN> | String | Software Version Number |
| <IMEI> | String | International Mobile Equipment Identity (IMEI) of the MT |
| <module_boot_sequence_version> | Number | Module boot sequence 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.

SARA-R5
The command setting is not stored in the profile.

### 4.10.2 Syntax

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

### 4.10.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <chset> | String | Allowed characters set:<br>• "IRA" (factory-programmed value): International Reference Alphabet (ITU-T T.50)<br>• "GSM": GSM default alphabet (3GPP TS 23.038)<br>• "PCCP437": PC character set Code Page 437<br>• "8859-1": ISO 8859 Latin 1 character set<br>• "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<br>• "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<br>• "PCCP936": Chinese character set<br>Allowed values:<br>• SARA-R5 - "IRA" (factory-programmed value), "GSM", "PCCP437", "8859-1", "UCS2", "HEX" |

## 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><br>OK | 222107701772423<br>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><br>OK | +CCID: 8939107800023416395<br>OK |
| Read | AT+CCID? | +CCID: <ICCID><br>OK | +CCID: 8939107900010087330<br>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>[...]]<br>OK | +GCAP: +FCLASS, +CGSM<br>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<br>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:<br>• 0: ready (MT allows commands from DTE)<br>• 1: unavailable (MT does not allow commands from DTE)<br>• 2: unknown (MT is not guaranteed to respond to instructions)<br>• 3: ringing (MT is ready for commands from DTE, but the ringer is active)<br>• 4: call in progress (MT is ready for commands from DTE, but a call is in progress, e.g. call active, hold, disconnecting)<br>• 5: asleep (ME is unable to process commands from DTE because it is in a low functionality state)<br>Allowed values:<br>• SARA-R5 - 0, 1, 2, 3, 4, 5 |

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

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

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

### 5.2.2 Syntax

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

### 5.2.3 Notes

**SARA-R5**

- 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.

### 5.3.2 Syntax

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

### 5.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <fun> | Number | Selected functionality:<br>• 0: sets the MT to minimum functionality (disable both transmit and receive RF circuits by deactivating both CS and PS services)<br>• 1 (factory-programmed value): sets the MT to full functionality, e.g. from airplane mode or minimum functionality<br>• 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=16 or AT+CPWROFF (where supported)<br>• 6: enables the SIM toolkit interface in dedicated mode and fetching of proactive commands by SIM Application Toolkit from the SIM card<br>• 7 or 8: disables the SIM toolkit interface and fetching of proactive commands by SIM Application Toolkit from the SIM card<br>• 9: enables the SIM toolkit interface in raw mode and fetching of proactive commands by SIM Application Toolkit from the SIM card<br>• 10: fast and safe power-off, the command triggers a fast shutdown where the flash memory is closed right away and no further files are saved to the memory, cached settings are discarded and not saved.<br>• 15: MT silent reset (with detach from network and saving of NVM parameters), without reset of the SIM card<br>• 16: MT silent reset (with detach from network and saving of NVM parameters), with reset of the SIM card<br>• 19: sets the MT to minimum functionality by deactivating CS and PS services and the SIM card<br>• 127: sets the MT in a deep low power state "HALT" (with detach from the network and saving of the NVM parameters); the only way to wake up the module is a power cycle or a module reset<br>Allowed values:<br>• SARA-R5 - 0, 1, 4, 6, 7, 8, 9, 10, 16 |
| <rst> | Number | Reset mode. This parameter can be used only when <fun> is 1, 4 or 19.<br>• 0 (default value): do not reset the MT before setting it to the selected <fun> |

| Parameter | Type | Description |
|---|---|---|
| | | • 1: performs a MT silent reset (with detach from network and saving of NVM parameters) with reset of the SIM card before setting it to the selected <fun> |
| <power_mode> | Number | • 0: MT is switched on with minimum functionality<br>• 1: MT is switched on<br>• 4: MT is in "airplane mode"<br>• 19: MT is in minimum functionality with SIM deactivated |
| <STK_mode> | Number | • 6: the SIM-toolkit interface in dedicated mode and fetching of proactive commands by SIM-APPL from the SIM-card are enabled<br>• 0, 7 or 8: the SIM-toolkit interface is disabled; fetching of proactive commands by SIM-APPL from the SIM-card is enabled<br>• 9: the SIM-toolkit interface in raw mode and fetching of proactive commands by SIM-APPL from the SIM-card are enabled |

## 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 [2].

### 5.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CIND=[<ind>[,<ind>[,...]]] | OK | AT+CIND=<br>OK |
| Read | AT+CIND? | +CIND: <ind>[,<ind>[,...]]<br>OK | +CIND: 5,0,0,0,0,0,0,0,0,0,0<br>OK |
| Test | AT+CIND=? | +CIND: (list of <descr>s)<br>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))<br>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:<br>• "battchg": battery charge level (0-5)<br>• "signal": signal level. See mapping in the Notes below<br>• "service": network service availability<br>  o 0: not registered to any network<br>  o 1: registered to the network<br>  o 65535: indication not available<br>• "sounder": sounder activity, indicating when the module is generating a sound |

| Parameter | Type | Description |
|---|---|---|
| | | o 0: no sound<br>o 1: sound is generated<br>• "message": unread message available in <mem1> storage<br>o 0: no messages<br>o 1: unread message available<br>• "call": call in progress<br>o 0: no call in progress<br>o 1: call in progress<br>• "roam": registration on a roaming network<br>o 0: not in roaming or not registered<br>o 1: roaming<br>o 65535: indication not available<br>• "smsfull": indication that an SMS has been rejected with the cause of SMS storage full<br>o 0: SMS storage not full<br>o 1: SMS storage full<br>• "gprs": PS indication status:<br>o 0: no PS available in the network<br>o 1: PS available in the network but not registered<br>o 2: registered to PS<br>o 65535: indication not available<br>• "callsetup": call set-up:<br>o 0: no call set-up<br>o 1: incoming call not accepted or rejected<br>o 2: outgoing call in dialling state<br>o 3: outgoing call in remote party alerting state<br>• "callheld": call on hold:<br>o 0: no calls on hold<br>o 1: at least one call on hold<br>• "simind": SIM detection<br>o 0: no SIM detected<br>o 1: SIM detected<br>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) |

**SARA-R5**

- To enable the "SIM card detection" feature the SIM_DET pin must be properly configured (if not already set); for more details, see the GPIO introduction and +UGPIOC command description (<gpio_mode>=7).

## 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<br>OK |
| Read | AT+UCIND? | +UCIND: <conf><br>OK | +UCIND: 7<br>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 order number (see the <descr> parameter of +CMER). The least significant bit is used for the first indicator.<br>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.

SARA-R5
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<br>OK |
| Read | AT+CMER? | +CMER: <mode>,<keyp>,<disp>,<ind>,<bfr><br>OK | +CMER: 1,0,0,0,1<br>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)<br>OK |

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

### 5.6.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Allowed values:<br>• 0 (default value): buffer URCs in the MT<br>• 1: discard URCs when the V.24 interface is reserved for data; otherwise directly display them on the DTE<br>• 2: buffer URCs in MT when the V.24 interface is reserved and flush them after reservation; otherwise directly display them on the DTE<br>• 3: same as 1 |
| <keyp> | Number | Allowed values:<br>• 0: no keypad event reporting |
| <disp> | Number | Allowed values:<br>• 0: no display event reporting |
| <ind> | Number | Allowed values:<br>• 0: no indicator event reporting<br>• 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.<br>• 2: indicator event reporting using the +CIEV URC. All the indicator events shall be directed from MT to DTE. |
| <bfr> | Number | Allowed values:<br>• 0: MT buffer of URCs defined within this command is cleared when <mode> 1...3 is entered<br>• 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:<br>• 1 ("battchg"): <value> provides the battery charge level (0-5)<br>• 2 ("signal"): <value> provides the signal level<br>o 0: < -105 dBm<br>o 1: < -93 dBm<br>o 2: < -81 dBm<br>o 3: < -69 dBm<br>o 4: < - 57 dBm<br>o 5: >= -57 dBm<br>• 3 ("service"): <value> provides the network service availability:<br>o 0: not registered to the network<br>o 1: registered to the network<br>• 4 ("sounder"): <value> provides the sounder activity:<br>o 0: no sound<br>o 1: sound is generated<br>• 5 ("message"): <value> provides the unread message available in <mem1> storage:<br>o 0: no messages<br>o 1: unread message available<br>• 6 ("call"): <value> provides the call in progress:<br>o 0: no call in progress<br>o 1: call in progress<br>• 7 ("roam"): <value> provides the registration on a roaming network:<br>o 0: not in roaming<br>o 1: roaming<br>• 8 ("smsfull"): <value> provides the SMS storage status:<br>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)<br>• 9 ("gprs"): <value> provides the GPRS indication status:<br>o 0: no GPRS available in the network<br>o 1: GPRS available in the network but not registered<br>o 2: registered to GPRS<br>o 65535: PS service indication is not available<br>• 10 ("callsetup"): <value> provides the call set-up:<br>o 0: no call set-up<br>o 1: incoming call not accepted or rejected<br>o 2: outgoing call in dialing state<br>o 3: outgoing call in remote party alerting state<br>• 11 ("callheld"): <value> provides the call on hold:<br>o 0: no calls on hold<br>o 1: at least one call on hold<br>• 12 ("simind"): <value> provides the SIM detection:<br>o 0: no SIM detected<br>o 1: SIM detected<br>o 2: not available |

## 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.

SARA-R5
When the power is removed and no battery is mounted, the +CCLK read command returns an error result code or invalid values. If +CTZU: 1 (factory-programmed value) and NITZ notification is obtained during the module registration, the local clock is automatically updated and +CCLK AT command can be queried.

### 5.7.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CCLK=<time> | OK | AT+CCLK="14/07/01,15:00:00+01"<br>OK |
| Read | AT+CCLK? | +CCLK: <time><br>OK | +CCLK: "14/07/01,15:00:00+01"<br>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.<br>• SARA-R5 - The factory-programmed value is "04/01/01,00:00:00+00"<br>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 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 Alarm +CALA

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

## 5.8.1 Description

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

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

## 5.8.2 Syntax

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

## 5.8.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <time> | String | Format is "yy/MM/dd,hh:mm:ss+TZ". Characters indicate year, month, day, hour, minutes, seconds, time zone. |
| <n>, <n1>, <n2> | Number | Indicates the index of the alarm, the range is 1-3; the default value is 1. |
| <type> | Number | Type of the alarm |
| <text> | String | Text to be displayed when the alarm time is reached. |
| <tlength> | Number | Maximum length of <text>; the maximum length is 255. |
| <recurr> | String | Maximum string length is 13, it indicates the day of week for the alarm in one of the following formats:<br>• "<1..7>[,<1..7>[...]]": sets a recurrent alarm for one or more days in the week. The digits 1 to 7 corresponds to the days in the week, Monday (1), ..., Sunday (7). Example: the string "1,2,3,4,5" may be used to set an alarm for some weekdays.<br>• "0": sets a recurrent alarm for all days in the week and all following weeks<br>• when the recurrent parameter is set, the time parameter format is "hh:mm:ss +TZ" (hour, minutes, seconds, time zone) |
| <rlength> | Number | Indicates the maximum length of <recurr> |
| <silent> | Number | Indicates if the alarm is silent or not: |

| Parameter | Type | Description |
|---|---|---|
| | | • 0 (default value): the alarm will not be silent<br>• 1: the alarm will be silent and the only result from the alarm is the +CALV URC |

### 5.8.4 Notes

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

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

**SARA-R5**

- If PSM feature is enabled (+CPSMS: 1) and the module has entered the deep-sleep mode, any alarm programmed by means of the +CALA AT command, which expires before the programmed PSM alarm, is not effective. Alarms programmed for a later time are successfully handled (unless deep-sleep mode is re-entered).
- The alarm can not be set more than 97 days in the future.

## 5.9 Delete alarm +CALD

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

### 5.9.1 Description

Deletes an alarm in the MT.

### 5.9.2 Syntax

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

### 5.9.3 Defined values

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

## 5.10 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 |

### 5.10.1 Description

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

☞ SARA-R5
Take care about restrictions related to the baud rate described in the Autobauding description.

### 5.10.2 Syntax

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

### 5.10.3 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<br>• 1: turn on the greeting text |
| <ltext> | Number | Maximum length of the <text> parameter. |

## 5.11 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 |

### 5.11.1 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).

### 5.11.2 Syntax

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

### 5.11.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <on_off> | Number | Automatic time zone update:<br>• 0: automatic time zone via NITZ disabled<br>• 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)<br>• 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)<br>Allowed values:<br>• SARA-R5 - 0, 1 (factory-programmed value) |

## 5.12 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 |

### 5.12.1 Description

Configures the time zone change event reporting. If the reporting is enabled, according with 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

### 5.12.2 Syntax

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

### 5.12.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Enables the time zone reporting URCs:<br>• 0: disable the time zone change event reporting<br>• 1: enable the time zone reporting by +CTZV and +CTZDST URCs<br>• 2: enable the time zone reporting by +CTZE URC<br>• 3: enable the time zone reporting and universal time reporting by +CTZEU URC according with 3GPP TS 27.007 Release 13<br>Allowed values:<br>• SARA-R5 - 0 (default value), 1, 2, 3 |
| <tz> | Number | Indicates the time zone. The range goes from -48 to +56. |
| <time> | String | Current local time in format "yy/MM/dd,hh:mm:ss". The characters indicate year, month, day, hour, minutes, seconds. |
| <dst> | Number | Indicates the daylight saving time. The allowed values are:<br>• 0: no adjustments<br>• 1: +1 hour adjustment |

| Parameter | Type | Description |
|---|---|---|
| | | • 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. |

### 5.12.4 Notes

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

**SARA-R5**

- The command setting is not stored in the NVM.

## 5.13 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 |

### 5.13.1 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.

### 5.13.2 Syntax

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

### 5.13.3 Defined values

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

### 5.13.4 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 |

## 5.14 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 |

### 5.14.1 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.

### 5.14.2 Syntax

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

### 5.14.3 Defined values

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

### 5.14.4 Notes

**SARA-R5**

- <cause> and <error_description> parameters are mandatory in the response to the action command.
- Test command is not supported.

# 6 Call control

## 6.1 Dial command D

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

### 6.1.1 Description

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

SARA-R5
Voice calls are not supported. For more details about data calls, see the D* AT command.

### 6.1.2 Syntax

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

### 6.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <number> | Number | Dial string; the allowed characters are: 1 2 3 4 5 6 7 8 9 0 * # + A B C D , T P ! W @ (see the 3GPP TS 27.007 [2]). The following characters are ignored: , T ! W @.<br>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:<br>• I (ASCII code 49 Hex): CLI presentation restricted<br>• i: CLI presentation allowed<br>The CLIR supplementary service subscription is overridden for this call. |
| <G> | String | Configures the CUG supplementary service for the specific call:<br>• G: CUG activated<br>• g: CUG deactivated |

### 6.1.4 Notes

**SARA-R5**

- The ATD*#06# command provides IMEI (not including the spare digit), the check digit and the SVN.
- To change the PIN, issue the ATD**04*OLD_PIN*NEW_PIN*NEW_PIN# command.
- To unblock the PIN, issue the ATD**05*PIN_UNBLOCKING_KEY*NEW_PIN*NEW_PIN# command.
- To change the PIN2, issue the ATD**042*OLD_PIN2*NEW_PIN2*NEW_PIN2# command.
- To unblock the PIN2, issue the ATD**052*PIN2_UNBLOCKING_KEY*NEW_PIN2*NEW_PIN2# command.

- The maximum number of characters accepted by the dial command is 81.

## 6.2 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 |

### 6.2.1 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.

☞ SARA-R5
CS calls are not supported. The command deactivates an active PDP context with PPP L2 protocol in online command mode as described in H AT command.

### 6.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Action | ATH | OK | |

## 6.3 Automatic answer S0

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

### 6.3.1 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.

### 6.3.2 Syntax

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

### 6.3.3 Defined values

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

### 6.3.4 Notes

**SARA-R5**

- The command has not effect.

# 7 Network service

## 7.1 Network parameters definition

| Parameter | Type | Description | Commands |
|---|---|---|---|
| <MCC> | Number | Mobile Country Code. The range is 0-999 (3 digits).<br>• SARA-R5 - The FFF value is to be considered not known or not detectable | +COPS, +UCGED, +UCELLINFO, +UMETRIC |
| <MNC> | Number | Mobile Network Code. The range is 0-999 (1 to 3 digits).<br>• SARA-R5 - the FFF value is to be considered not known or not detectable | +COPS, +UCGED, +UCELLINFO, +UMETRIC |
| <LAC> | Number | Location Area Code, The range is 0x0-0xFFFF (2 octets) | +COPS, +UCELLINFO |
| <CI> | Number | Cell identity.<br>• SARA-R5 - The range is:<br>o 2G cell: range 0x0-0xFFFF (2 octets)<br>o 3G cell: range 0x0-0xFFFFFFF (28 bits)<br>o 4G cell: range (decimal format) 0-4294967295 (default value). | +COPS, +UCELLINFO |
| <RxLev> | Number | Received Signal Strength Indicator (RSSI) index as defined in 3GPP TS 45.008 [26]:<br>• 0: less than -110 dBm<br>• 1..62: from -110 to less than -48 dBm with 1 dBm steps<br>• 63: -48 dBm or greater | +COPS, +UCGED, +UCELLINFO |
| <RAC> | Number | Routing Area Code, range 0h-FFh (1 octet); see the 3GPP TS 44.018 [137] | +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 [37] | +UCELLINFO |
| <ch_type> | Number | Channel type of the current connection (see the 3GPP TS 04.18 [37]):<br>• 0: invalid channel type<br>• 1: TCH/F<br>• 2: TCH/H<br>• 3: SDCCH/4<br>• 4: SDCCH/8<br>• other values are to be considered invalid / not available | +UCELLINFO |
| <ch_mode> | Number | Channel mode of current connection (see the 3GPP TS 04.18 [37]):<br>• 0: signalling only<br>• 1: speech full rate<br>• 2: speech half rate<br>• 3: data full rate, 12.0 kb/s radio interface rate<br>• 4: data full rate, 6.0 kb/s radio interface rate<br>• 5: data half rate, 6.0 kb/s radio interface rate<br>• 6: data full rate, 3.6 kb/s radio interface rate<br>• 7: data half rate, 3.6 kb/s radio interface rate<br>• 8: speech full rate version 2<br>• 9: speech full rate version 3<br>• 10: speech half rate version 2<br>• 11: speech half rate version 3<br>• other values are to be considered invalid / not available | +UCELLINFO |
| <scrambling_code> | Number | Scrambling code. | +COPS, +UCGED, +UCELLINFO |

| Parameter | Type | Description | Commands |
|---|---|---|---|
| <dl_frequency> | Number | Downlink frequency. The range is 0-16383. | +COPS, +UCELLINFO |
| <ul_frequency> | Number | Uplink frequency. The range is 0-16383. | +COPS |
| <arfcn> | Number | Absolute Radio Frequency Channel Number (ARFCN). | +COPS, +UCGED |
| <rscp_lev> | Number | Received Signal Code Power expressed in dBm levels:<br>• 0: less than -115 dBm<br>• 1..90: from -115 dBm to less than -25 dBm with 1 dBm steps<br>• 91: -25 dBm | +COPS, +UCELLINFO |
| <ecn0_lev> | Number | Energy per Chip/Noise ratio expressed in dB levels:<br>• 0: less than -24 dB<br>• 1..48: from -24 dB to less than 0 dB with 0.5 dB steps<br>• 49: 0 dB | +COPS, +UCGED, +UCELLINFO |
| <rrc_state> | String | Allowed values:<br>• "CD": CELL_DCH (0)<br>• "CF": CELL_FACH(1)<br>• "CP": CELL_PCH(2)<br>• "UP": URA_PCH(3)<br>• "ID": IDLE(4)<br>• "ST": START(5) | +UCELLINFO |
| <EARFCN> | Number | E-UTRAN Absolute radio frequency channel number.<br>• SARA-R5 - The range is 0-9659 (0x25BB), 65535 if not known or not detectable | +UCGED, +UCELLINFO, +VZWRSRQ |
| <PhysCellID> | Number | Physical cell ID. The range is 0-503. | +COPS, +UCELLINFO, +UMETRIC |
| <TAC> | Number | Tracking area code.<br>• SARA-R5 - The range is 0-0xFFFF (2 octets), FFFF if not known or not detectable | +COPS, +UCGED, +UCELLINFO |
| <CellId> | Number | E-UTRAN CI (cell identifier) in hexadecimal format; the range is 0h-FFFFFFFh (28 bits), 0000000 if not known or not detectable. | +UCGED, +UMETRIC |
| <dl_EARFCN> | Number | Downlink E-UTRAN absolute radio frequency channel number in decimal format.<br>• SARA-R5 - The range is 0-9659. The default value is 65535. | +COPS, +UMETRIC |
| <ul_EARFCN> | Number | Uplink E-UTRAN absolute radio frequency channel number in decimal format.<br>• SARA-R5 - The range is 0-27659. The default value is 65535. | +COPS, +UMETRIC |
| <RSRP> | Number | Reference Signal Received Power (RSRP) as defined in 3GPP TS 36.133 [84]:<br>• 0: less than -140 dBm<br>• 1..96: from -140 dBm to less than -44 dBm with 1 dBm steps<br>• 97: -44 dBm or greater<br>• SARA-R5 - The value 255 is return if not known or not detectable | +COPS, +UCGED, +UCELLINFO, +UMETRIC |
| <RSRQ> | Number | • SARA-R5 - Extended Reference Signal Received Quality (RSRQ) as defined in 3GPP TS 36.133 [84]:<br>o -30: less than -34 dB<br>o -29..-1: from -34 dB to less than -19.5 dB with 0.5 dB steps<br>o 1..33: from -19.5 dB to less than -3 dB with 0 .5 dB steps<br>o 35..45: from -3 dB to less than 2.5 dB with 0 .5 dB steps<br>o 46: 2.5 dB or greater | +COPS, +UCGED, +UCELLINFO, +UMETRIC |

| Parameter | Type | Description | Commands |
|---|---|---|---|
| | | o The value 255 is return if not known or not detectable | |
| <TA> | Number | Timing advance information:<br>• In RRC_IDLE state, the value of timing advance (TA) is updated from the Random-Access-Response message; the range is 0-1282.<br>• In RRC_CONNECTED state, the value of timing advance (TA) is updated from the MAC control element; the range is 0-63. | +UCELLINFO |
| <BSIC> | Number | Base Station Identify Code (BSIC) in hexadecimal format, the range is 0x0-0x3F (6 bits). | +COPS, +UCGED |
| <Lband> | Number | E-UTRAN band (see 3GPP TS 36.101 Table 5.5-1 [79]). Allowed values:<br>• SARA-R5 - From 0 to 28, 255 if not known or not detectable | +UCGED, +UMETRIC |
| <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 [12].<br>• SARA-R5 - The factory programmed value is 0 ("0 000") | +CEDRXS, +CEDRXRDP |
| <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 [12]. | +CEDRXS, +CEDRXRDP |
| <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 [12].<br>• SARA-R5 - The factory programmed value is 0 ("0 000") | +CEDRXS |
| <Assigned_paging_time_window> | String | Assigned paging time window value. Half byte in a 4 bit format: the paging time window (PTW) refers to bit 8 to 5 of octet 3 of the extended DRX parameters information element. For the coding and the value range, see the extended DRX parameters information element in 3GPP TS 24.008 table 10.5.5.32/3GPP TS 24.008 [12]. | +CEDRXS, +CEDRXRDP |

## 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><br>[+CNUM: [<alpha2>],<number2>,<type2><br>[...]]<br>OK<br>or<br>OK | +CNUM: "Mario Rossi","+39320 821708",145<br>+CNUM: "ABCD . AAA","123456789012",129<br>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) |

### 7.2.4 Notes

**SARA-R5**

- The character set of the <alphax> parameter is selected by means of +CSCS AT command.

## 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.

SARA-R5
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><br>OK | +CSQ: 2,5<br>OK |
| Test | AT+CSQ=? | +CSQ: (list of supported <signal_power>s),(list of supported <qual>s)<br>OK | +CSQ: (0-31,99),(0-7,99)<br>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:<br>• the Received Signal Strength Indication (RSSI) in GSM and LTE RATs. For more details on the RSSI values mapping in LTE RAT, see Notes. |

| Parameter | Type | Description |
|---|---|---|
| | | • the Received Signal Code Power (RSCP) in UMTS RAT.<br>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:<br>• In 2G RAT CS dedicated and GPRS packet transfer mode indicates the Bit Error Rate (BER) as specified in 3GPP TS 45.008 [125]<br>• In 2G RAT EGPRS packet transfer mode indicates the Mean Bit Error Probability (BEP) of a radio block. 3GPP TS 45.008 [125] specifies the range 0-31 for the Mean BEP which is mapped to the range 0-7 of <qual><br>• In UMTS RAT indicates the Energy per Chip/Noise (ECN0) ratio in dB levels of the current cell. 3GPP TS 25.133 [85] specifies the range 0-49 for EcN0 which is mapped to the range 0-7 of <qual><br>• In LTE RAT indicates the Reference Signal Received Quality (RSRQ). TS 36.133 [84] specifies the range 0-34 for RSRQ which is mapped to the range 0-7 of <qual><br>See Table 3 for the complete parameter mapping. |

### 7.3.4 Notes

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

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

**SARA-R5**

- 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**

## 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><br>OK | +CESQ: 99,99,255,255,20,80<br>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)<br>OK | +CESQ: (0-63,99),(0-7,99),(0-96,255),(0-49,255),(0-34,255),(0-97,255)<br>OK |

### 7.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <rxlev> | Number | Received Signal Strength Indication (RSSI).<br>• SARA-R5 - The allowed values are:<br>o 0: less than -110 dBm<br>o 1..62: from -110 to -49 dBm with 1 dBm steps<br>o 63: -48 dBm or greater<br>o 99: not known or not detectable |
| <ber> | Number | Bit Error Rate (BER):<br>• 0..7: as RXQUAL values in the table in 3GPP TS 45.008 [125], subclause 8.2.4<br>• 99: not known or not detectable |
| <rscp> | Number | Received Signal Code Power (RSCP):<br>• 0: less than -120 dBm<br>• 1..95: from -120 dBm to -26 dBm with 1 dBm steps<br>• 96: -25 dBm or greater<br>• 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 [85] subclause):<br>• 0: less than -24 dB<br>• 1..48: from -24 dB to -0.5 dBm with 0.5 dB steps (i.e. 1: -24 dB <= Ec/Io < -23.5 dB)<br>• 49: 0 dB or greater<br>• 255: not known or not detectable |
| <rsrq> | Number | Reference Signal Received Quality (RSRQ):<br>• 0: less than -19.5 dB<br>• 1..33: from -19.5 dB to -3.5 dB with 0.5 dB steps<br>• 34: -3 dB or greater<br>• 255: not known or not detectable |
| <rsrp> | Number | Reference Signal Received Power (RSRP):<br>• 0: less than -140 dBm<br>• 1..96: from -140 dBm to -45 dBm with 1 dBm steps<br>• 97: -44 dBm or greater<br>• 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 the auto-registration. Fore more details, see Auto-registration.

☞ 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 [66], 3GPP TS 34.121-2 [67], 3GPP TS 36.521-2 [94] and 3GPP TS 36.523-2 [95], 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. 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.

☞ SARA-R5
If the MT is set in automatic selection mode (<mode>=0) also the format (<format>) is immediately stored in the current activated profile.

- **<mode>=4**: the module starts a manual selection of the specified operator; if this operation is not successful, the module will start an automatic network selection and will remain in automatic mode.
- **<mode>=5 and <mode>=6**: an extended network search, 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 neighbour list of the serving cell. The command response includes the following data (if supported): AcT, MCC, MNC, LAC, CI, BSIC, Arfcn, RxLev (see the 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 neighbour list of the serving cell. For each cell, the scan will trigger the additional reception of the SIB type 1 and type 3, to properly report the LAC, RAC, and CI of the cell. The command response includes the following data: MCC, MNC, LAC, RAC, CI, DLF, ULF, SC, RSCP LEV, ECN0 LEV (see the Network parameters definition section for the parameter description)
  - **for LTE networks**: all cells found will be reported, including those belonging to the neighbour list of the serving cell. For each cell, the command response includes the following data: MCC, MNC, TAC, CI, DLF, ULF, PCI, RSRP and RSRQ (see the Network parameters definition section for the parameter description).
- **<mode>=8**: when a module is registered on the GSM network, a network timing advance search is performed
  - The network timing advance search is performed only on the serving cell and the 6 neighbour 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 neighbour 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 neighbour 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 [57]), 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 [57]

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:

- SARA-R5 - Network registration status +CREG
- SARA-R5 - 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 in case overlapping registration and deregistration requests are not handled by the network, and could result in an unpredictable registration state. Similarly, when notified of a GPRS mobile terminated detach event (e.g. via +CGEV URC), it is recommended to wait a few seconds before entering AT+COPS=2 in order to let the pending registration procedure (automatically triggered by the module in most cases) successfully end.

The 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.

SARA-R5
The manual PLMN selection can fail due to the MNO control on the network selection procedure via $EF_{CSP}$ setting; for further details see +PACSP.

SARA-R5
If more than one PLMN have the same alphanumeric name in the ROM PLMN name list (see +COPN), a manual PLMN selection can fail because the device tries to register only on the first PLMN in the ROM list whose alphanumeric code matches the one specified in the +COPS command.

SARA-R5
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 [57]). 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:222, MNC: 10, LAC:4e54, CI:ffff, BSIC:32, Arfcn:00080, RxLev:032 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | [MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<arfcn>, RxLev:<RxLev><br>[...]]]<br>OK | ...<br>...<br>MCC:222, MNC: 88, LAC:55fa, CI:1d39, BSIC:3d, Arfcn:00756, RxLev:005<br>OK |
| | | **If <mode>=5 and on UMTS networks:**<br>[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><br>[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><br>[...]]]<br>OK | AT+COPS=5<br>MCC:222, MNC:10, LAC:61ef, RAC:14, CI:07d2088, DLF:10788, ULF: 9838, SC:81, RSCP LEV:23, ECN0 LEV:41<br>MCC:222, MNC:10, LAC:61ef, RAC:14, CI:07d2085, DLF:10813, ULF: 9863, SC:81, RSCP LEV:26, ECN0 LEV:41<br>...<br>...<br>MCC:222, MNC:01, LAC:ef8d, RAC:0, CI:52d36fb, DLF:10688, ULF: 9738, SC:285, RSCP LEV:16, ECN0 LEV:32<br>OK |
| | | **If <mode>=5 and on LTE networks:**<br>[MCC:<MCC>, MNC:<MNC>, TAC:<TAC>, CI:<CI>, DLF:<dl_EARFCN>, ULF:<ul_EARFCN>, PCI:<PhysCellID>, RSRP LEV:<RSRP>, RSRQ LEV:<RSRQ><br>[MCC:<MCC>, MNC:<MNC>, TAC:<TAC>, CI:<CI>, DLF:<dl_EARFCN>, ULF:<ul_EARFCN>, PCI:<PhysCellID>, RSRP LEV:<RSRP>, RSRQ LEV:<RSRQ><br>[...]]]<br>OK | AT+COPS=5<br>MCC:222, MNC:88, TAC:562c, CI:57367043, DLF: 1325, ULF:19325, PCI:163, RSRP LEV:25, RSRQ LEV:1<br>MCC:222, MNC:10, TAC:5a25, CI:10086944, DLF: 1850, ULF:19850, PCI:287, RSRP LEV:25, RSRQ LEV:6<br>...<br>...<br>MCC:293, MNC:40, TAC:27ec, CI:519425, DLF: 6400, ULF:24400, PCI:393, RSRP LEV:27, RSRQ LEV:9<br>OK |
| | | **If <mode>=6 and on GSM networks:**<br>[<AcT>,<MCC>,<MNC>,<LAC>,<CI>, <BSIC>,<arfcn>,<RxLev><br>[<AcT>,<MCC>,<MNC>,<LAC>,<CI>, <BSIC>,<arfcn>,<RxLev> [...]]]<br>OK | AT+COPS=6<br>0,222,88,55fa,ffff,3f,00104,037<br>...<br>0,222,10,4e54,ffff,32,00080,032<br>...<br>OK |
| | | **If <mode>=6 and on UMTS networks:**<br>[<MCC>,<MNC>,<LAC>,<RAC>,<CI>,<dl_frequency>,<ul_frequency>,<scrambling_code>,<RSCP LEV>,<ecn0_lev><br>[<MCC>,<MNC>,<LAC>,<RAC>,<CI>,<dl_frequency>,<ul_frequency>,<scrambling_code>,<RSCP LEV>,<ecn0_lev><br>[...]]]<br>OK | AT+COPS=6<br>222,99,754f,2,03554d7,10713,9763,341,255,14<br>...<br>222,01,ef8d,0,52d2647,10663,9713,453,4,23<br>...<br>OK |
| | | **If <mode>=6 and on LTE networks:**<br>[<AcT>,<MCC>,<MNC>,<TAC>,<CI>,<dl_EARFCN>,<ul_EARFCN>,<PhysCellID>,<RSRP>,<RSRQ><br>[<AcT>,<MCC>,<MNC>,<TAC>,<CI>,<dl_EARFCN>,<ul_EARFCN>,<PhysCellID>,<RSRP>,<RSRQ> | AT+COPS=6<br>7,222,88,562c,57367043,1325,19325,163,35,10<br>7,222,01,3aa3,179291197,6300,24300,271,48,14 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | [...]]]<br>OK | 7,222,01,3aa3,179290685,6300,24300,402,27,11<br>7,293,40,27ec,519425,6400,24400,393,24,1<br>OK |
| | | **If <mode>=8 and on GSM networks:**<br>[MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<arfcn>, RxLev:<RxLev>, TA:<TA><br>[MCC:<MCC>, MNC:<MNC>, LAC:<LAC>, CI:<CI>, BSIC:<BSIC>, Arfcn:<arfcn>, RxLev:<RxLev>, TA:<TA><br>[...]]]<br>OK | AT+COPS=8<br>MCC:222, MNC: 10, LAC:4e54, CI:12f1, BSIC:3f, Arfcn:00104, RxLev:037, TA:3<br>MCC:222, MNC: 10, LAC:4e54, CI:8841, BSIC:32, Arfcn:00080, RxLev:032, TA:5<br>MCC:222, MNC: 10, LAC:4e54, CI:1ef4, BSIC:31, Arfcn:00082, RxLev:022, TA:255<br>...<br>MCC:222, MNC: 10, LAC:55fa, CI:1d39, BSIC:3d, Arfcn:00756, RxLev:005, TA:7<br>OK |
| Read | AT+COPS? | +COPS: <mode>[,<format>,<oper>[,<AcT>]]<br>OK | +COPS: 0,0,"vodafone IT"<br>OK |
| Test | AT+COPS=? | +COPS: [(<stat>, long <oper>, short <oper>, numeric <oper>[,<AcT>])[,(<stat>, long <oper>, short <oper>, numeric <oper>[,<AcT>]),[...]]],(list of supported <mode>s),(list of supported <format>s)<br>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)<br>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>:<br>• 0 (default value and factory-programmed value): automatic (<oper> field is ignored)<br>• 1: manual<br>• 2: deregister from network<br>• 3: set only <format><br>• 4: manual/automatic<br>• 5: extended network search<br>• 6: extended network search without the tags (e.g. MCC, RxLev will not be printed, see the syntax and the command example)<br>• 8: network timing advance search<br>Allowed values:<br>• SARA-R5 - 0, 1, 2, 3, 4, 5, 6 |
| <format> | Number | • 0 (factory-programmed value): long alphanumeric <oper><br>• 1: short format alphanumeric <oper><br>• 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<br>• 1: available<br>• 2: current<br>• 3: forbidden |
| <AcT> | Number | Indicates the radio access technology:<br>• 0: GSM<br>• 1: GSM COMPACT |

| Parameter | Type | Description |
|---|---|---|
| | | • 2: UTRAN<br>• 3: GSM/GPRS with EDGE availability<br>• 4: UTRAN with HSDPA availability<br>• 5: UTRAN with HSUPA availability<br>• 6: UTRAN with HSDPA and HSUPA availability<br>• 7: LTE<br>• 8: EC-GSM-IoT (A/Gb mode)<br>• 9: E-UTRAN (NB-S1 mode)<br>Allowed values:<br>• SARA-R5 - 7 |
| <TA> | Number | Timing Advance; the range is 0-63. If the information is not known or not detectable or currently not available, the value is 255. |
| <MCC> | Number | See <MCC>. |
| <MNC> | Number | See <MNC>. |
| <LAC> | Number | See <LAC>. |
| <CI> | Number | See <CI>. |
| <BSIC> | Number | See <BSIC>. |
| <arfcn> | Number | See <arfcn>. |
| <RxLev> | Number | See <RxLev>. |
| <RAC> | Number | See <RAC>. |
| <dl_frequency> | Number | See <dl_frequency>. |
| <ul_frequency> | Number | See <ul_frequency>. |
| <scrambling_code> | Number | See <scrambling_code>. |
| <rscp_lev> | Number | See <rscp_lev>. |
| <ecn0_lev> | Number | See <ecn0_lev>. |
| <TAC> | Number | See <TAC>. |
| <dl_EARFCN> | Number | See <dl_EARFCN>. |
| <ul_EARFCN> | Number | See <ul_EARFCN>. |
| <PhysCellID> | Number | See <PhysCellID>. |
| <RSRP> | Number | See <RSRP>. |
| <RSRQ> | Number | See <RSRQ>. |

## 7.5.4 Notes

**SARA-R5**

- The PIN insertion is mandatory before to issue the test command.
- If no network is available, the test command returns the 'No Network Service' error result code.
- 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. The user may retry later on.
- <format> and <oper> parameters are optional only if the <mode> parameter is set to 0, 2, 3 or 6.
- 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.

## 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 behaviour. The order of the RAT parameters defines the priority of the related radio access technologies selected at boot or when entering full functionality from de-registered 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).

☞ SARA-R5
Set the module in minimum functionality (issuing the AT+CFUN=0 command), before to change the RAT selection. Use AT+CFUN=1 to return to the module full functionality. Reboot the module by means of AT +CFUN=16 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 [66], 3GPP TS 34.121-2 [67], 3GPP TS 36.521-2 [94] and 3GPP TS 36.523-2 [95], is a statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

☞ In dual mode and tri mode, due to lack of inter-RAT coordination, only the Access Stratum protocol of the current selected RAT is active.

### 7.6.2 Syntax

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

### 7.6.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <1stAcT> | Number | Indicates the single or highest priority RAT enabled and may be:<br>• 3: LTE<br>• 7: LTE Cat M1<br>• 8: LTE Cat NB1<br>• 9: GPRS / eGPRS<br>Allowed values depend on the module series:<br>• SARA-R5 - 7 (factory-programmed value) |
| <2ndAcT> | Number | Indicates the second priority RAT enabled and has the same range as <1stAcT>. The default and factory-programmed value is:<br>• SARA-R5 - The parameter is not supported. |

| Parameter | Type | Description |
|---|---|---|
| <3rdAct> | Number | Indicates the third priority RAT enabled and has the same range as <1stAcT>.The default and factory-programmed value is:<br>• SARA-R5 - 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 Radio manager configuration +URATCONF

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

### 7.7.1 Description

Configures the radio manager feature. The radio manager aims to reduce the power consumption, controlling the number of PLMN scans in those cellular scenarios where the radio coverage or the network conditions would cause an inefficient usage of power supply: the typical use case is when the module has limited service or is outside of the coverage area, causing it to perform frequent PLMN scans or unsuccessful registration attempts cycles.

If the radio manager feature is enabled (<en_radio_manager>=1), the out of coverage condition is detected when the module is not able to register with the network on the current RAT after performing a number of PLMN scans for an amount of time defined by means of the <scan_time> parameter.

Optionally the out of coverage condition can be detected when the module often loses coverage for short periods, e.g. at cell borders in static conditions. By means of the <bounce_count> a user defined threshold can be imposed on the maximum number of loss of coverage and cell selection events performed in sequence to prevent the module from bouncing between normal service an no service conditions. This threshold is not enabled in the factory-programmed configuration.

Support for more than one RAT can be set by +URAT AT command. If the radio manager feature is enabled and the module supports more than one RAT and the out of coverage condition is detected for the highest priority RAT (for more details, see the +URAT AT command), the module switches to second priority RAT. After registering to second priority RAT, the module will keep on trying to connect to the highest priority RAT at regular intervals set by means of the <scan_interval> parameter. If the out of coverage condition is detected for all the supported RATs, the module enters the airplane mode or the low power mode according to the <suspend_mode> parameter configuration, for an amount of time set by means of the <power_save_duration> parameter.

The radio manager can be activated by the application processor when it is required to save module power in out of coverage scenarios, to perform automatic RAT switching and RAT switching based in requests by internal cellular applications. It is recommended to use this feature in static conditions, because in mobility the device can often enter no coverage or limited service conditions: in these cases the application processor should re-start the cellular functionality when it detects an unexpected change to airplane or low power mode and must consider that the radio manager feature is still running. Therefore if the radio and service coverage is unchanged, the airplane mode or the low power mode can be entered again or the RAT technology switching can be performed, unless the feature is disabled (recommended setting).

If cellular functionality is switched off by means of the AT+CFUN=0 or the AT+CFUN=4 AT command, the radio manager is stopped even if it is enabled by the +URATCONF command. This is also applicable when the module is deregistered from the network (+COPS: 2). The radio manager does not consider a RAT to be out of coverage if module registration is denied with temporary ESM cause. In case of permanent reject ESM cause, irrespective of any RAT selected, radio manager is stopped until the next power cycle.

Follow this procedure to properly set up the configuration:

- set the MT to minimum functionality by means of the AT+CFUN=0 command
- configure the radio manager by means of the +URATCONF AT command
- sets the MT back to full functionality by means of the AT+CFUN=1 command

To disable the radio manager feature issue only the <en_radio_manager> parameter.

### 7.7.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+URATCONF=<en_radio_manager>[,[<scan_counter>],[<scan_interval>],[<power_save_duration>],[<PSD_step>],[<scan_time>],[<bounce_count>],[<interval>],[<suspend_mode>]] | OK | AT+URATCONF=1,3,30,1,1,0,,,<br>OK |
| Read | AT+URATCONF? | +URATCONF: <en_radio_manager>,<scan_counter>,<scan_interval>,<power_save_duration>,<PSD_step>,<scan_time>,<bounce_count>,<interval>,<suspend_mode><br>OK | +URATCONF: 1,3,30,1,1,0,0,10,0<br>OK |
| Test | AT+URATCONF=? | +URATCONF: (list of supported <en_radio_manager>s),(list of supported <scan_counter>s),(list of supported <scan_interval>s),(list of supported <power_save_duration>s),(list of supported <PSD_step>s),(list of supported <scan_time>s),(list of supported <bounce_count>s),(list of supported <interval>s),(list of supported <suspend_mode>s)<br>OK | +URATCONF: (0,1),(1-10),(5-120),(1-60),(0-2),(1-86400),(0-100),(10-1800),(0,1)<br>OK |

### 7.7.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <en_radio_manager> | Number | Enables/disables the radio manager feature. Allowed values:<br>• 0 (factory-programmed value): radio manager disabled<br>• 1: radio manager enabled |
| <scan_counter> | Number | Number of attempts that the module makes on each RAT before entering in mode selected by means of the <suspended_mode> parameter, when it is in out of coverage for all the RAT(s) supported. The range goes from 1 to 10, the default and factory-programmed value is 3. |
| <scan_interval> | Number | Timer that is used when the module first priority RAT is not selected and that starts from the moment the module registers on any RAT that is not the highest priority one. The range is 5-120 minutes. The default and factory-programmed value is 30 minutes. |
| <power_save_duration> | Number | Time during which the module remains in power saving state set by means of the <suspended_mode> parameter. The range is 1-60 minutes. The default and factory-programmed value is 1 minute. |
| <PSD_step> | Number | Configures how the timer value defined by the <power_save_duration> parameter is changed after each power saving cycle. Allowed values:<br>• 0: static. The value of the <power_save_duration> timer is not changed.<br>• 1 (default and factory-programmed): step. The <power_save_duration> timer is incremented by 1 after each cycle.<br>• 2: exponential. The <power_save_duration> timer is doubled after every cycle.<br>The power save duration can be increased up to 60 minutes. |
| <scan_time> | Number | Time during which the module after entering in deregistered state, is allowed to scan the PLMN. The range goes from 1 s to 86400 s. The default and factory-programmed value is 30 s. |
| <bounce_count> | Number | Number of changes between normal service and no service condition which can mark RAT as currently not available. The range goes from 10 to 100, the special value 0 means that the de-bouncing feature is disabled. The default and factory-programmed value is 0. |
| <interval> | Number | Maximum time interval expressed in seconds during which the change between normal service and limited service/no coverage condition is considered an unexpected |

| Parameter | Type | Description |
|---|---|---|
| | | event and is used to increment the guard counter. When the guard counter reaches the <bounce_count> parameter value, the module declares that current RAT is not available. Depending upon the overall state of Radio Manager, the module can enter the mode set by the <suspended_mode> or can switch to another RAT. The parameter range goes from 10 s to 1800 s, the default and factory-programmed value is 20 s, suggested value for <interval> is smaller than <scan_time> value. |
| <suspend_mode> | Number | Mode in which the module is set after that the number of changes between normal service and no service condition, considered unexpected events (for more details see the <interval> parameter), reaches the <bounce_count> parameter value. Allowed values:<br>• 0 (default and factory-programmed value): the module is set in airplane mode (+CFUN: 4)<br>• 1: the module is set in low power mode |

### 7.7.4 Notes

**SARA-R5**

- The <scan_counter>, <scan_interval>, <bounce_count>, <interval> parameters are not supported and must be left empty in the set command.

## 7.8 Display operator name +UDOPN

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

### 7.8.1 Description

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

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

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

### 7.8.2 Syntax

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

### 7.8.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <type> | Number | Network name format:<br>• 0: numeric format of MCC/MNC network (three BCD digit country code and two/three BCD digit network code)<br>• 1: short name in ROM<br>• 2: long name in ROM<br>• 3: short network operator name (CPHS)<br>• 4: long network operator name (CPHS)<br>• 5: short NITZ name<br>• 6: full NITZ name<br>• 7: service provider name<br>• 8: EONS short operator name<br>• 9: EONS long operator name<br>• 11: short network operator name<br>• 12: long network operator name<br>• 13: numeric format of network MCC/MNC even in limited service<br>Allowed values:<br>• SARA-R5 - 0, 1, 2, 5, 6, 7, 8, 9, 11, 12 |
| <name> | String | • MCC/MNC code for <type>= 0 or 13<br>• Corresponding network name for <type>= 1, 2, 3, 4, 5, 6, 8, 9, 11 or 12<br>• Service provider name followed by <display_condition> for <type>=7 |
| <display_condition> | Number | Display condition as stored on SIM for the service provider name in respect to the registered PLMN (see 3GPP TS 51.011 [17] for more details). |

### 7.8.4 Notes

**SARA-R5**

- EONS means Enhanced Operator Name from SIM-files $EF_{OPL}$ and $EF_{PNN}$.
- The coding of <name> is according to the +CSCS setting.

## 7.9 Coverage enhancement status +CRCES

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

### 7.9.1 Description

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

SARA-R5
The coverage enhancement status is only provided by the MT if the radio access technology of the serving cell is E-UTRAN, otherwise the module returns an error result code.

### 7.9.2 Syntax

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

### 7.9.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <AcT> | Number | Access technology of the serving cell. Allowed values:<br>• 1: E-UTRAN<br>• 3: E-UTRAN (NB-S1 mode). The 3GPP TS 36.331 [88] specifies the System Information blocks which give the information about whether the serving cell supports NB-IoT, which corresponds to E-UTRAN (NB-S1 mode).<br>Allowed values:<br>• SARA-R5 - 1 |
| <CE_level> | Number | Coverage enhancement (CE) level of the MT in the serving cell. For more details about the Coverage Enhancement levels, see the 3GPP TS 36.331 [88].<br>• 0 (default value): no coverage enhancement in the serving cell<br>• 1: coverage enhancement level 0<br>• 2: coverage enhancement level 1<br>• 3: coverage enhancement level 2<br>• 4: coverage enhancement level 3 |
| <CC> | Number | Coverage class (CC) of the MT in the serving cell. For more details on coverage classes, see the 3GPP TS 43.064 [138]. Allowed values:<br>• 0 (default value): no coverage class in the serving cell |

## 7.10 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 |

### 7.10.1 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.

### 7.10.2 Syntax

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

### 7.10.3 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 [18]).<br>• 1: operator controlled PLMN selector with Access Technology $EF_{OPLMNwAcT}$; this file can be read only (see the 3GPP TS 31.102 [18]).<br>• 2: HPLMN selector with Access Technology $EF_{HPLMNwAcT}$; this file can be read only (see the 3GPP TS 31.102 [18]). |

### 7.10.4 Notes

**SARA-R5**

- The set command can be issued also omitting the <list> parameter.

## 7.11 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 |

### 7.11.1 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.

### 7.11.2 Syntax

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

### 7.11.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <n> | Number | Network registration URC configuration. Allowed values:<br>• 0 (default value and factory-programmed value): network registration URC disabled<br>• 1: network registration URC enabled<br>• 2: network registration and location information URC enabled<br>• 3: network registration and reject cause URC enabled |
| <stat> | Number | Network registration status. Allowed values:<br>• 0: not registered, the MT is not currently searching a new operator to register to<br>• 1: registered, home network<br>• 2: not registered, but the MT is currently searching a new operator to register to<br>• 3: registration denied<br>• 4: unknown (e.g. out of GERAN/UTRAN/E-UTRAN coverage)<br>• 5: registered, roaming<br>• 6: registered for "SMS only", home network (applicable only when <AcTStatus> indicates E-UTRAN)<br>• 7: registered for "SMS only", roaming (applicable only when <AcTStatus> indicates E-UTRAN)<br>• 8: attached for emergency bearer services only (see 3GPP TS 24.008 [12] and 3GPP TS 24.301 [69] that specify the condition when the MS is considered as attached for emergency bearer services)<br>• 9: registered for "CSFB not preferred", home network (applicable only when <AcTStatus> indicates E-UTRAN)<br>• 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:<br>• 0: GSM<br>• 1: GSM COMPACT<br>• 2: UTRAN<br>• 3: GSM/GPRS with EDGE availability<br>• 4: UTRAN with HSDPA availability<br>• 5: UTRAN with HSUPA availability<br>• 6: UTRAN with HSDPA and HSUPA availability<br>• 7: E-UTRAN<br>• 8: EC-GSM-IoT (A/Gb mode)<br>• 9: E-UTRAN (NB-S1 mode)<br>• 255: the current <AcTStatus> value is invalid<br>Allowed values:<br>• SARA-R5 - 7 |
| <cause_type> | Number | <reject_cause> type. Allowed values:<br>• 0: indicates that <reject_cause> contains an EMM cause value, see 3GPP TS 24.301 [69] Annex A |
| <reject_cause> | Number | Cause of the failed registration. The value is of type as defined by <cause_type> |

### 7.11.4 Notes

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

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

  The registration is not started

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

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

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

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

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

**SARA-R5**

- The PIN insertion is not mandatory before the command execution.
- <stat>=9 and 10 are not supported.

## 7.12 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 |

### 7.12.1 Description

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

SARA-R5
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.

SARA-R5
The set command writes an entry in the selected list. 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.

SARA-R5
If in the +COPN list there are more than one PLMN with the same name in alphanumeric (short or long) format, the numeric format shall be used to add this PLMN <entry> in the preferred operator list; otherwise the result will be unpredictable.

### 7.12.2 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<br>OK |
| Read | AT+CPOL? | +CPOL: <index1>,<format>,<oper1>[,<GSM_AcT1>,<GSM_Compact_AcT1>,<UTRAN_AcT1>[,<E-UTRAN_AcT>]]<br>[+CPOL: <index2>,<format>,<oper2>[,<GSM_AcT2>,<GSM_Compact_AcT2>,<UTRAN_AcT2>[,<E-UTRAN_AcT>]]...]<br>OK | +CPOL: 1,0,"F SFR",1,0,1<br>+CPOL: 2,0,"TIM I",1,0,1<br>OK |
| Test | AT+CPOL=? | +CPOL: (list of supported<index>s),(list of supported <format>s)<br>OK | +CPOL: (1-30),(0-2)<br>OK |

### 7.12.3 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: |

| Parameter | Type | Description |
|---|---|---|
| | | • 0: long format alphanumeric <oper><br>• 1: short format alphanumeric <oper><br>• 2 (default value): numeric <oper> |
| <oper> / <opern> | String | Format indicated by <format> |
| <GSM_AcT> | Number | GSM access technology. Allowed values:<br>• 0: access technology not selected<br>• 1: access technology selected |
| <GSM_Compact_AcT> | Number | GSM compact access technology. Allowed values:<br>• 0: access technology not selected<br>• 1: access technology selected |
| <UTRAN_AcT> | Number | UTRA access technology. Allowed values:<br>• 0: access technology not selected<br>• 1: access technology selected |
| <E-UTRAN_AcT> | Number | E-UTRAN access technology. Allowed values:<br>• 0: access technology not selected<br>• 1: access technology selected |

# 7.13 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 |

## 7.13.1 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.

## 7.13.2 Syntax

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

## 7.13.3 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) |

# 7.14 Network selection control +PACSP

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

## 7.14.1 Description

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

- SARA-R5 - at the module boot time
- SARA-R5 - whenever the SIM/USIM issues the REFRESH proactive command related to the $EF_{CSP}$

For further information, see the AT&T Device Requirements [49].

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

SARA-R5
The command allows checking whether the $EF_{CSP}$ (Customer Service Profile) is available on the SIM/USIM card and, if available, what is the value of the PLMN mode bit; otherwise an error result code is provided ("+CME ERROR: operation not allowed" if +CMEE is set to 2).

SARA-R5
This functionality will typically be used in cases where AT&T subscribers internationally travel, or if there is a need to enable manual network selection functionality.

### 7.14.2 Syntax

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

### 7.14.3 Defined values

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

### 7.14.4 Notes

- If $EF_{CSP}$ is available, the PLMN mode bit forces the automatic network registration, according to the +COPS <mode> value which is loaded at boot from the selected profile or from the non volatile memory. The following table explains the behavior:

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

**SARA-R5**

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

## 7.15 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 |

### 7.15.1 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.

Configure the network simulator with a PLMN not present in the ROM PLMN list (+COPN).

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

### 7.15.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UDCONF=81,<integrity_check_ enabled> | OK | AT+UDCONF=81,0<br>OK |
| Read | AT+UDCONF=81 | +UDCONF: 81,<integrity_check_ enabled><br>OK | AT+UDCONF=81<br>+UDCONF: 81,1<br>OK |

### 7.15.3 Defined values

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

## 7.16 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 |

### 7.16.1 Description

Enables the protocol stack and network environment information collection.

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

Table 5 lists the supported <mode> parameter values:

| Modules | <mode>=0 | <mode>=2 | <mode>=3 | <mode>=5 |
|---|---|---|---|---|
| SARA-R5 | | * | | |

**Table 5: <mode> parameter applicability**

SARA-R5
Even when registered to home network, the command response still returns default serving cell data in the following cases:

- if the DUT loses serving cell after connection release and it is in the process of re-tuning on a new cell
- if radio link failure occurs and the DUT is unable to find a valid serving cell (eventually out of coverage event will occur and the DUT will be deregistered)

### 7.16.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Read | AT+UCGED? | **<mode>= 2, <rat>= 6:**<br>+UCGED: 2<br>6,<svc>,<MCC>,<MNC><br><EARFCN>,<Lband>,<ul_BW>,<dl_ BW>,<TAC>,<LcellId>,<P-CID>, <mTmsi>,<mmeGrId>,<mmeCode>, <RSRP>,<RSRQ>,<Lsinr>, <Lrrc>,<RI>,<CQI>,<avg_rsrp>, <totalPuschPwr>,<avgPucchPwr>, <drx>, <l2w>,<volte_mode>[, <meas_gap>,<tti_bundling>] | +UCGED: 2<br>6,0,001,01<br>2525,5,25,50,2b67,69f6bc7,111,0000 0000,ffff,ff,67,19,0.00,255,255,255, 67,11,255,0,255,255,0,0<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | OK | |

### 7.16.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | • 0: reporting disabled<br>• 2: short form reporting enabled<br>• 3: retrieve the short form text information report<br>• 5: RSRP and RSRQ reporting enabled |
| <rat> | Number | Current Radio Access Technology:<br>• 2: 2G<br>• 3: 3G<br>• 4: 4G<br>• 5: unknown. The parameter is set to a 5 until a network information update is not successfully performed through +UCGED=2 or when the MT is set to minimum functionality (+CFUN: 4, +CFUN: 19).<br>• 6: LTE Cat M1<br>• 7: NB1 |
| <svc> | Number | Current radio service state:<br>• 0: not known or not detectable<br>• 1: radio off<br>• 2: searching<br>• 3: no service<br>• 4: registered<br>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>. |
| <MCC_ex> | Number | Mobile Country Code decimal value. The range is 0-2457.<br>The 4095 value is to be considered not known or not detectable. |
| <MNC_ex> | Number | Mobile Network Code decimal value. The range is 0-2457.<br>The 4095 value is to be considered not known or not detectable. |
| <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:<br>• 0: the given <arfcn> is not part of band 1900<br>• 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:<br>• 0: GSM Enhanced Full Rate (12.2 kb/s)<br>• 1: GSM Full Rate (13.0 kb/s)<br>• 2: GSM Half Rate (5.6 kb/s)<br>• 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<br>• 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 |

| Parameter | Type | Description |
|---|---|---|
| | | • 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<br>• 255: not known or not detectable<br>See 3GPP TS 26.201 [92] for more details on GSM codecs used during a voice call<br>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:<br>• 1: band 1 (2 GHz)<br>• 2: band 2 (1900 MHz)<br>• 4: band 4 (2100 MHz)<br>• 5: band 5 (800 MHz)<br>• 8: band 8 (900 MHz)<br>• 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:<br>• 0: idle<br>• 1: URA_PCH<br>• 2: CELL_PCH<br>• 3: CELL_FACH<br>• 4: CELL_DCH<br>• 255: not known or not detectable |
| <rssi> | Number | UTRAN cell Received Signal Strength Indicator as defined in 3GPP TS 25.133 [85]:<br>• 0: less than -100 dBm<br>• 1..75: from -100 to -25 dBm with 1 dBm steps<br>• 76: -25 dBm or greater<br>• 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:<br>• 3: AMR NB (4.75 kb/s)<br>• 4: AMR NB (5.15 kb/s)<br>• 5: AMR NB (5.90 kb/s)<br>• 6: AMR NB (6.70 kb/s)<br>• 7: AMR NB (7.40 kb/s)<br>• 8: AMR NB (7.95 kb/s)<br>• 9: AMR NB (10.2 kb/s)<br>• 10: AMR NB (12.2 kb/s)<br>• 11: AMR WB (6.60 kb/s)<br>• 12: AMR WB (8.85 kb/s)<br>• 13: AMR WB (12.65 kb/s)<br>• 14: AMR WB (14.25 kb/s)<br>• 15: AMR WB (15.85 kb/s)<br>• 16: AMR WB (18.25 kb/s)<br>• 17: AMR WB (19.85 kb/s)<br>• 18: AMR WB (23.05 kb/s)<br>• 19: AMR WB (23.85 kb/s)<br>• 255: not known or not detectable<br>See 3GPP TS 26.201 [92] for more details on UMTS codecs used during a voice call. |

| Parameter | Type | Description |
|---|---|---|
| | | In case a set of speech codecs is assigned by the network, then the parameter reports the lowest one and this one is not necessary the one used. |
| <EARFCN> | Number | See <EARFCN>. |
| <Lband> | Number | See <Lband>. |
| <ul_BW> | Number | Number of Uplink Resource Blocks (see 3GPP TS 36.101 Table 5.6-1 [79]), 255 if not known or not detectable. |
| <dl_BW> | Number | Number of Downlink Resource Blocks (see 3GPP TS 36.101 Table 5.6-1 [79]), 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.<br>• SARA-R5 - The range goes from -32 to 32; 255 if not known or not detectable. |
| <Lrrc> | Number | 4G RRC state:<br>• 0: null<br>• 1: IDLE<br>• 2: ATTEMPT TO CONNECT<br>• 3: CONNECTED<br>• 4: LEAVING CONNECTED STATE<br>• 5: ATTEMPT LEAVING E-UTRA<br>• 6: ATTEMPT ENTERING E-UTRA<br>• 255: not known or not detectable |
| <RI> | Number | Rank Indicator value; 255 if not known or not detectable. It is updated every 480 ms with the value which has been most often reported to the network in the previous 480 ms period. See 3GPP TS 36.213 [108] section 7.2 and 3GPP TS 36.212 [109] section 5.2.2.6 for more details. |
| <CQI> | Number | Channel Quality Indicator value; 255 if not known or not detectable. It is updated every 480 ms with the value which has been most often reported to the network in the previous 480 ms period. See 3GPP TS 36.213 [108] section 7.2 for more details. |
| <avg_rsrp> | Number | Average value of last 10th Reference Signal Received Power (RSRP). |
| <totalPuschPwr> | Number | Mobile output power for PUSCH transmission averaged over 480 ms in dBm; 255 if not known or not detectable. |
| <avgPucchPwr> | Number | Mobile output power for PUCCH transmission averaged over 480 ms in dBm; 255 if not known or not detectable. |
| <drx> | Number | Discontinuous Reception "drx-Inactivity-Timer" value in ms; 0 if not known or not detectable. |
| <l2w> | Number | SIB3 LTE to WCDMA reselection criteria: (threshServingLow)x2 +(q-RxLevMin)x2; 255 if not known or not detectable. |
| <volte_mode> | Number | Reserved for future use. |
| <meas_gap> | Number | Measurement gap configuration:<br>• 0: disabled<br>• 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 [84])<br>• 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 [84]) |
| <tti_bundling> | Number | TTi (Transmission Time interval) bundling status:<br>• 0: off<br>• 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 [69] |
| <emm_state> | Number | EMM state value as defined in 3GPP TS 24.301 [69]. Allowed values:<br>• 0: EMM-NULL |

| Parameter | Type | Description |
|---|---|---|
| | | • 1: EMM-DEREGISTERED<br>• 2: EMM-REGISTERED-INITIATED<br>• 3: EMM-REGISTERED<br>• 4: EMM-TRACKING-AREA-UPDATING-INITIATED<br>• 5: EMM-SERVICE-REQUEST-INITIATED<br>• 6: EMM-DEREGISTERED-INITIATED<br>• 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> | String | Current Reference Signal Received Power (RSRP) expressed in dBm, the range goes from "-140.00" dBm to "-44.00" dBm. |
| <RSRQ_value> | String | Current Reference Signal Received Quality (RSRQ) expressed in dB, the range goes from "-20.00" dB to "-3.00" dB. |

# 7.17 Provide cell information +UCELLINFO

| +UCELLINFO | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | partial | No | No | No | < 5 s | +CME Error |

## 7.17.1 Description

Provides diagnostic information on the GSM, UMTS or LTE serving cell and on the neighbour cells. This information can be retrieved in two ways:

- Periodic reporting: it is started by enabling URC reporting with the set command; if the module is camped on a PLMN (regardless of its registration status), URCs periodically convey the main attributes of the serving cell and of the neighbour cells.
- One-shot query: it is triggered by issuing the read command.

## 7.17.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UCELLINFO=<mode>[,<timer_value>] | OK | AT+UCELLINFO=1<br>OK |
| Read | AT+UCELLINFO? | **2G cells:**<br>+UCELLINFO: <mode>,<type>,<MCC>,<MNC>,<LAC>,<CI>,<RxLev>[,<t_adv>[,<ch_type>,<ch_mode>]]<br>OK | +UCELLINFO: 0,0,222,1,D5BD,5265,36,1,255,255<br>OK |
| | | **3G cells:**<br>+UCELLINFO: <mode>,<type>,<MCC>,<MNC>,<LAC>,<CI>,<scrambling_code>,<dl_frequency>,<rscp_lev>,<ecn0_lev>[,<rrc_state>]<br>OK | +UCELLINFO: 0,2,222,1,EF8D,52D2388,49,10638,16,38,"ID"<br>OK |
| | | **4G serving cell:**<br>+UCELLINFO: <mode>,<type>,<MCC>,<MNC>,<CI>,<PhysCellID>,<TAC>,<RSRP>,<RSRQ>,<TA><br>OK | +UCELLINFO: 0,5,222,1,179291197,121,15011,26,18,0<br>OK |
| | | **4G neighbour cells:** | +UCELLINFO: 1,6,6400,200,27,18 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | +UCELLINFO: <mode>,<type>,<EARFCN>,<PhysCellID>,<RSRP>,<RSRQ><br><br>OK | OK |
| Test | AT+UCELLINFO=? | +UCELLINFO: (list of supported <mode>s)<br><br>OK | +UCELLINFO: (0-1)<br><br>OK |
| URC | | **2G cells:**<br><br>+UCELLINFO: <mode>,<type>,<MCC>,<MNC>,<LAC>,<CI>,<RxLev>[,<t_adv>[,<ch_type>,<ch_mode>]] | +UCELLINFO: 1,1,222,1,D5BD,5266,22 |
| | | **3G cells:**<br><br>+UCELLINFO: <mode>,<type>,<MCC>,<MNC>,<LAC>,<CI>,<scrambling_code>,<dl_frequency>,<rscp_lev>,<ecn0_lev>[,<rrc_state>] | +UCELLINFO: 1,2,222,1,EF8D,52D2388,49,10638,18,35,"ID" |
| | | **4G serving cell:**<br><br>+UCELLINFO: <mode>,<type>,<MCC>,<MNC>,<CI>,<PhysCellID>,<TAC>,<RSRP>,<RSRQ>,<TA> | +UCELLINFO: 1,5,222,1,179291197,121,15011,26,18,0 |
| | | **4G neighbour cells:**<br><br>+UCELLINFO: <mode>,<type>,<EARFCN>,<PhysCellID>,<RSRP>,<RSRQ> | +UCELLINFO: 1,6,6400,200,27,18 |

### 7.17.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Allowed values:<br>• 0: periodic reporting disabled<br>• 1: periodic reporting enabled<br>• 2: configure the URC periodic reporting interval |
| <timer_value> | Number | Periodic URC reporting interval. The range goes from 1 s to 65535 s, the default value is 5 s. This parameter is accepted only if <mode>=2. When modified, the new periodic URC reporting interval value is applied runtime. |
| <type> | Number | For 2G cells:<br>• 0: 2G serving cell<br>• 1: neighbour 2G cell<br><br>For 3G cells:<br>• 2: 3G serving cell or cell belonging to the Active Set<br>• 3: neighbour 3G cell<br>• 4: detected 3G cell<br><br>For 4G cells:<br>• 5: 4G serving cell<br>• 6: neighbour 4G cell |
| <MCC> | Number | See <MCC>. |
| <MNC> | Number | See <MNC>. |
| <LAC> | Number | See <LAC>. |
| <CI> | Number | See <CI>. |
| <RxLev> | Number | See <RxLev>. |
| <t_adv> | Number | See <t_adv>. |
| <ch_type> | Number | See <ch_type>. |
| <ch_mode> | Number | See <ch_mode>. |
| <scrambling_code> | Number | See <scrambling_code>. |
| <dl_frequency> | Number | See <dl_frequency>. |
| <rscp_lev> | Number | See <rscp_lev>. |

| Parameter | Type | Description |
|---|---|---|
| <ecn0_lev> | Number | See <ecn0_lev>. |
| <rrc_state> | String | See <rrc_state>. |
| <EARFCN> | Number | See <EARFCN>. |
| <PhysCellID> | Number | See <PhysCellID>. |
| <TAC> | Number | See <TAC>. |
| <RSRP> | Number | See <RSRP>. |
| <RSRQ> | Number | See <RSRQ>. |
| <TA> | Number | See <TA>. |

### 7.17.4 Notes

If the MT is 3G registered with an active radio connection (CELL_DCH):

- <MCC>, <MNC>, <LAC> and <CI> will be always invalid for 3G cells belonging to Active Set or Detected Set.
- The 3G serving cell data could be outdated. Use the Active Set data for any information regarding involved cells in the current radio connection.

**SARA-R5**

- The <LAC>, <RxLev>, <t_adv>, <ch_type>, <ch_mode>, <scrambling_code>, <dl_frequency>, <rscp_lev>, <ecn0_lev>, <rrc_state> parameters are not supported.
- The <TA> parameter is supported only in RCC_CONNECTED state. When in RCC_IDLE state the value 255 (not known or detectable) is returned.

## 7.18 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 |

### 7.18.1 Description

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

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

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

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

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

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

### 7.18.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UJAD=<op_code> | OK | AT+UJAD=1<br>OK |
| Read | AT+UJAD? | +UJAD: <op_code>[,<active>, <AcT>]<br>[...] | **If jamming detection disabled:**<br>+UJAD: 0<br>OK |

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

### 7.18.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | Jamming detection operation mode. Allowed values:<br>• 0 (default and factory-programmed value): smart jamming detection disabled<br>• 1: smart jamming detection enabled; the +UJAD URC may be generated |
| <active> | Number | Jamming detection status:<br>• 0: jamming not detected<br>• 1: jamming detected<br>• 2: jamming unknown |
| <AcT> | Number | Indicates the radio access technology:<br>• 0: GSM<br>• 7: LTE<br>• 9: E-UTRAN (NB-S1 mode) |

### 7.18.4 Notes

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

**SARA-R5**

- The <AcT> parameter is not supported, therefore the read command returns only one entry.
- <active>=2 (jamming unknown) is not supported.

## 7.19 Extended cell information +UMETRIC

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

### 7.19.1 Description

Provides the cell environment information that can be configured according with a bitmap (as per Table 6) and the <mode> parameter value:

- **<mode>=0**: disables the +UMETRIC URC.
- **<mode>=1**: a URC will be periodically issued providing the serving cell/neighbor cell/network information to the DTE. Set properly the <rep_id_bitmap> parameter as per syntax parameter (see Table 6). Only <rep_id_bitmap> and their specific configuration(s) will be displayed with tags. The periodic interval duration can be set by means of the <timer_value> parameter (see <mode>=5).
- **<mode>=2**: a URC will be periodically issued providing the serving cell/neighbor cell/network information to the DTE. Properly set the <rep_id_bitmap> parameter as per syntax parameter (see Table 6). Only <rep_id_bitmap> and their specific configuration(s) will be displayed without tags. The periodic interval duration can be set by means of the <timer_value> parameter (see <mode>=5).
- **<mode>=3**: the specific information report can be recovered using the read command. In this case the <mode> and <rep_id_bitmap> specific configuration(s) will be displayed with tags. Properly set the <rep_id_bitmap> as per syntax parameter (see Table 6).
- **<mode>=4**: the specific information report can be recovered using the read command. In this case the <mode> and <rep_id_bitmap> specific configuration(s) will be displayed without tags. Properly set the <rep_id_bitmap> as per syntax parameter (see Table 6).

- **<mode>=5**: configures in real-time the periodic timer value (<timer_value>) of the +UMETRIC URCs, that are enabled by means of <mode>=1 or <mode>=2.

Set the <mode> parameter to 3 or 4 to issue the read command. In the information text response to the read command the <rep_id_bitmap> parameter will not be displayed.

## 7.19.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+UMETRIC=<mode>[,<param1>] | OK | AT+UMETRIC=1,30<br>OK |
| **Disable URC reporting** | | | |
| Set | AT+UMETRIC=0,0 | OK | AT+UMETRIC=0,0<br>OK |
| **Configure cell environment information (<mode>=1, 2, 3, 4)** | | | |
| Set | AT+UMETRIC=<mode>,<rep_id_bitmap> | OK | AT+UMETRIC=1,30<br>OK |
| **Configure URCs reporting period** | | | |
| Set | AT+UMETRIC=5,<timer_value> | OK | AT+UMETRIC=1,5<br>OK |
| Read | AT+UMETRIC? | **<rep_id_bitmap>: LTE SERVING CELL INFO**<br>+UMETRIC: <mode>,serving_Band:<Lband>,servCell_Status:<servCell_Status>,servCell_Tac:<tac>,servCell_dlFreq:<dl_EARFCN>,servCell_ulFreq:<ul_EARFCN>,servCell_physCellId:<PhyCellID>,servCell_CellIdentity:<Lcellid>,servCell_mcc:<MCC>,servCell_mnc:<MNC>,servCell_csgInd:<csg_indication>,servCell_csgIdentity:<csg_id>,servCell_Rsrp:<RSRP>,servCell_Rsrq:<RSRQ>,servCell_Rssi:<rssi>,servCell_snr:<snr>,servCell_dlBandwidth:<dl_BW>,servCell_ulBandwidth:<ul_BW>,servCell_Type:<servCell_Type>,accessClass:<accessClass><br>OK | +UMETRIC: 3,serving_Band:1,servCell_Status:1,servCell_Tac:6F,servCell_dlFreq:300,servCell_ulFreq:18300,servCell_physCellId:1,servCell_CellIdentity:ff00ff8,servCell_mcc:01f,servCell_mnc:01ff,servCell_csgInd:0,servCell_csgIdentity:fffffff,servCell_Rsrp:80,servCell_Rsrq:12,servCell_Rssi:15,servCell_snr:20,servCell_dlBandwidth:25,servCell_ulBandwidth:50,servCell_Type:2,accessClass:8800<br>OK |
| | | **<rep_id_bitmap>: LTE NEIGHBOR CELL INFO for <n> cells**<br>+UMETRIC: <mode>,ncell_Band_cell1:<Lband>,ncell_Status_cell1:<ncell_Status_cell>,ncell_Tac_cell1:<tac>,ncell_dlFreq_cell1:<dl_EARFCN>,ncell_physCellId_cell1:<PhyCellID>,ncell_CellIdentity_cell1:<Lcellid>,ncell_csgInd_cell1:<csg_indication>,ncell_csgIdentity_cell1:<csg_id>,ncell_cell1_mcc_0:<MCC>,ncell_1_mnc_0:<MNC>,ncell_Rsrp_cell1:<RSRP>,ncell_Rsrq_cell1:<RSRQ>,ncell_Rssi_cell1:<rssi>,ncell_snr_cell1:<snr>,ncell_dlBandwidth_cell1:<dl_BW>,ncell_Type_cell1:<ncell_Type_cell><br>OK | +UMETRIC: 3,ncell_Band_cell1:1,ncell_Status_cell1:0,ncell_Tac_cell1:2,ncell_dlFreq_cell1:300,ncell_physCellId_cell1:1,ncell_CellIdentity_cell1:ff00ff8,ncell_csgInd_cell1:0,ncell_csgIdentity_cell1:fffffff,ncell_cell1_mcc_0:01f,ncell_1_mnc_0:01ff,ncell_Rsrp_cell1:80,ncell_Rsrq_cell1:12,ncell_Rssi_cell1:15,ncell_snr_cell1:20,ncell_dlBandwidth_cell1:2,ncell_Type_cell1:2<br>OK |
| | | **<rep_id_bitmap>: LTE SERVING CELL MEASUREMENT REPORT** | +UMETRIC: 3,measReport_Rsrp:66,measReport_Rsrq:20 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | +UMETRIC: <mode>, measReport_Rsrp: <RSRP>, measReport_Rsrq: <RSRQ><br><br>OK | OK |
| | | **<rep_id_bitmap>: LTE SERVING CELL SELECTION INFO**<br>+UMETRIC: <mode>,servCell_qrxlevmin:<servCell_qrxlevmin>, servCell_qrxlevminCE_r13:<servCell_qrxlevminCE_r13>,servCell_qrxlevminCE1_r13:<servCell_qrxlevminCE1_r13>,servCell_qualmin:<servCell_qualmin>, servCell_qualminCE_r13:<servCell_qualminCE_r13>,servCell_qualminCE1_r13:<servCell_qualminCE1_r13>, servCell_qrxlevminoffset:<servCell_qrxlevminoffset>,servCell_qualminoffset:<servCell_qualminoffset>,servCell_srxlev:<servCell_srxlev>,servCell_squal:<servCell_squal>,isEDRX_Allowed:<EDRX_allowed>,servCell_EMMstate:<emm_state>,servCell_EMMcause:<esm_cause><br><br>OK | +UMETRIC: 3,servCell_qrxlevmin:-60, servCell_qrxlevminCE_r13:0,servCell_qrxlevminCE1_r13:0,servCell_qualmin:-20 ,servCell_qualminCE_r13:0, servCell_qualminCE1:0,servCell_qrxlevminoffset:4,servCell_qualminoffset:4,servCell_ srxlev:100,servCell_squal:120,isEDRX_Allowed:0, servCell_EMMstate:0, servCell_EMMcause:0<br><br>OK |
| | | **<rep_id_bitmap>: LTE CONNECTION INFO**<br>+UMETRIC: <mode>, rrcState:<rrcState>, ciphering:<ciphering>, maxTransmittPower: <maxTXPower>, ue_service:<ue_service><br><br>OK | +UMETRIC: 3,rrcState:1,ciphering:1, maxTransmittPower:-10,ue_service:1<br><br>OK |
| | | **<rep_id_bitmap>: LTE CHANNEL INFO**<br><br>+UMETRIC: <mode>, channelMode:<channelMode>, channelType:<channelType><br><br>OK | +UMETRIC: 3,channelMode:3, channelType:1<br><br>OK |
| | | **<rep_id_bitmap>: EUTRAN DRX INFO**<br><br>+UMETRIC: <mode>,onDurationTimer:<onDurationTimer>,drx_InactivityTimer:<drx_InactivityTimer>, drx_RetransmissionTimer:<drxRetransmission_Timer>, longDRX_CycleStartOffset:<longDRX_CycleStartOffset>,shortDRX_Cycle:<shortDRX_Cycle>, drxShortCycleTimer: <drxShortCycle_Timer><br><br>OK | +UMETRIC: 3,onDurationTimer:2, drx_InactivityTimer:4,drx_RetransmissionTimer:1,longDRX_CycleStartOffset:1024,shortDRX_Cycle:7,drxShortCycleTimer:15<br><br>OK |
| | | **<rep_id_bitmap>: EUTRAN PHR INFO**<br>+UMETRIC: <mode>,periodicPHR_Timer:<periodicPHR_Timer>, prohibitPHR_Timer:<prohibitPHR_Timer>,dl_PathlossChange:<dl_PathlossChange>, extendedPHR:<extendedPHR><br><br>OK | +UMETRIC: 3,periodicPHR_Timer:2,prohibitPHR_Timer:0,dl_PathlossChange:4,extendedPHR:1<br><br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | **<rep_id_bitmap>: EUTRAN BARRING INFO**<br>+UMETRIC: <mode>, emergencyBarr:<emergencyBarr>, ac_moBarring_0:<ac_moBarring>,ac_BarringFactor_0:<ac_BarringFactor>, ac_BarringTime_0:<ac_BarringTime>, ac_BarringForSpecialAC_0:<ac_BarringSpecialAC>,eabCategory_0 :<eabCategory>,eabBarringBitmap_0 :<eabBarringBitmap><br>OK | +UMETRIC: 3,emergencyBarr:1,ac_moBarring_0:1,ac_BarringFactor_0:11,ac_BarringTime_0:5, ac_BarringForSpecialAC_0:f0,eabCategory_0:2, eabBarringBitmap_0:1<br>OK |
| | | **<rep_id_bitmap>: EUTRAN CONN MEAS CONFIG INFO**<br>+UMETRIC: <mode>,measurementID_0:<measurementID>,eventID_0:<eventID>,periodical_0 :<periodical>,offset_0:<offset>, threshold1_0_Rsrp:<RSRP>, threshold1_0_Rsrq:<RSRQ>, threshold2_0_Rsrp:<RSRP>, threshold2_0_Rsrq:<RSRQ>, reportOnLeave:<reportOnLeave><br>OK | +UMETRIC: 3,measurementID_0:1,eventID_0:1,periodical_0:1, offset_0:-20,threshold1_0_Rsrp:66, threshold1_0_Rsrq:20,threshold2_0_Rsrp:56,threshold2_0_Rsrq:15, reportOnLeave:1<br>OK |
| | | **<rep_id_bitmap>: LTE EQUIVALENT PLMN LIST**<br>+UMETRIC: <mode>,Equi_Mnc_0 :<MNC>,Equi_Mcc_0:<MCC><br>OK | +UMETRIC: 3,Equi_Mnc_0:ffff,Equi_Mcc_0:ffff<br>OK |
| | | **<rep_id_bitmap>: LTE UE STATS**<br>+UMETRIC: <mode>,UL_NumberOfRbIds:<num_UL_RBIDs>, CE_Level:<CE_level>,UL_RbId_Index:<UL_RBID_index>,UL_RbID:<UL_RBID>,UL_BuffSduCount:<UL_buff_SDU_count>,UL_RLC_Mode:<UL_RLC_mode>, DL_NumberOfRbIds:<num_DL_RBIDs>, DL_NumOfPcktsDropMac:<DL_pckts_drop_Mac>,DL_RbId_Index:<DL_RBID_index>,DL_RbId:<DL_RBID>, DL_NumOfMissingSNs:<DL_missing_SNs>,DL_NumOfInvldPkts:<DL__invld_pkts>,DL_RLF_Mode:<DL_RLF_mode>, total_cell_reselections:<total_cell_reselections>,total_radioLinkLoss:<total_radio_link_loss>, powerSavingMode:<power_saving_mode>,high_Mobility:<high_mobility>, connEstablishAttemptCount:<conn_establish_attempt_count>, connEstablishSuccessCount:<conn_establish_success_count>, connEstablishFailureCount:<conn_establish_failure_count>, reestablishmentAttemptCount:<re_establishment_attempt_count>, reestablishmentSuccessCount:<re_establishment_success_count>, reestablishmentFailureCount:<re_establishment_failure_count>, HO_AttemptCount:<HO_attempt_count>, HO_SuccessCount:<HO_success_count>,HO_FailureCount:<HO_ | +UMETRIC: 3,UL_NumberOfRbIds:0 ,CE_Level:0,DL_NumberOfRbIds:0 ,DL_NumOfPcktsDropMac:0 ,total_cell_reselections:0 ,total_radioLinkLoss:0, powerSavingMode:0,high_Mobility:0 ,connEstablishAttemptCount:0 ,connEstablishSuccessCount:0 ,connEstablishFailureCount:0, reestablishmentAttemptCount:0 ,reestablishmentSuccessCount:0 ,reestablishmentFailureCount:0 ,HO_AttemptCount:0,HO_SuccessCount:0,HO_FailureCount:0 ,EUTRAN_ConnReleaseCount:0, nas_num_of_attach:0, nas_num_of_tau:0, nas_num_of_service_request:0, nas_num_of_pdn_disconnect_req:0, nas_num_of_pdn_register_req:0, nas_num_of_auth:0, nas_num_of_bearer_resource_modify_req:0, nas_num_of_detach:0, nas_num_of_internal_detach_limit:0, nas_num_of_bearer_resource_alloc_req:0, nas_num_of_mt_sms_retry:0, nas_num_of_mo_sms_retry:0, nas_num_of_lpp_retransmission:0,nas_num_of_performance_attach:0,nas_num_of_performance_detach:0,nas_num_of_performance_deactivate:0,nas_num_of_performance_tracking:0 ,nas_num_of_performance_defaultBearer:0,nas_num_of_performance_dedicatedBearer:0 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | failure_count>,EUTRAN_ ConnReleaseCount:<EUTRAN_ conn_release_count>, nas_num_of_ attach:<nas_attach>,nas_num_of_ tau:<nas_tau>,nas_num_of_service_ request:<nas_service_request>, nas_num_of_pdn_disconnect_ req:<nas_pdn_disconnect_req>, nas_ num_of_pdn_register_req:<nas_ pdn_register_req>,nas_num_of_ auth:<nas_auth>,nas_num_of_ bearer_resource_modify_req:<nas_ bearer_resource_modify_req>,nas_ num_of_detach:<nas_detach>, nas_ num_of_internal_detach_limit:<nas_ internal_detach_limit>,nas_num_ of_bearer_resource_alloc_req:<nas_ bearer_resource_alloc_req>,nas_ num_of_mt_sms_retry:<nas_mt_ sms_retry>, nas_num_of_mo_sms_ retry:<nas_mo_sms_retry>,nas_ num_of_lpp_retransmission:<nas_ lpp_retransmission>,nas_num_ of_performance_attach:<nas_ performance_attach>, nas_num_ of_performance_detach:<nas_ performance_detach>,nas_num_ of_performance_deactivate:<nas_ performance_deactivate>,nas_num_ of_performance_tracking:<nas_ performance_tracking>, nas_num_ of_performance_defaultBearer:<nas_ performance_default_bearer>, nas_num_of_performance_ dedicatedBearer:<nas_performance_ dedicated_bearer>, nas_num_of_ performance_resourceModify:<nas_ performance_resource_modify>, nas_num_of_performance_ resourceSetup:<nas_performance_ resource_setup><br>OK | OK |
| | | **<rep_id_bitmap>: LTE CELL RESELECTION INFO**<br>+UMETRIC: <mode>,reselect_ Hysteresis:<reselect_Hysteresis>, reselection_Cause:<reselect_Cause><br>OK | +UMETRIC: 3,reselect_Hysteresis:2, reselection_Cause:2<br>OK |
| | | **<rep_id_bitmap>: LTE PAGING INFO**<br>+UMETRIC: <mode>, paginCycle:<paginCycle><br>OK | +UMETRIC: 3,paginCycle:2<br>OK |
| Test | AT+UMETRIC=? | +UMETRIC: (list of supported <mode>s),(list of supported <rep_id_ bitmap>s)<br>OK | +UMETRIC: (0-4),(0-16383)<br>OK |
| URC | | +UMETRIC: [<mode>] [(URC's specific tags and values)] | +UMETRIC: 3, UL_NumberOfRblds:0 ,CE_Level:0,DL_NumberOfRblds:0 ,DL_NumOfPcktsDropMac:0 ,total_cell_reselections:0 ,total_radioLinkLoss:0, powerSavingMode:0,high_Mobility:0 ,connEstablishAttemptCount:0 ,connEstablishSuccessCount:0 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | ,connEstablishFailureCount:0, reestablishmentAttemptCount:0 ,reestablishmentSuccessCount:0 ,reestablishmentFailureCount:0 ,HO_AttemptCount:0,HO_ SuccessCount:0,HO_FailureCount:0 ,EUTRAN_ConnReleaseCount:0, nas_num_of_attach:0, nas_num_ of_tau:0, nas_num_of_service_ request:0, nas_num_of_pdn_ disconnect_req:0, nas_num_of_ pdn_register_req:0, nas_num_ of_auth:0, nas_num_of_bearer_ resource_modify_req:0, nas_num_ of_detach:0, nas_num_of_internal_ detach_limit:0, nas_num_of_bearer_ resource_alloc_req:0, nas_num_ of_mt_sms_retry:0, nas_num_of_ mo_sms_retry:0, nas_num_of_lpp_ retransmission:0,nas_num_of_ performance_attach:0,nas_num_of_ performance_detach:0,nas_num_ of_performance_deactivate:0,nas_ num_of_performance_tracking:0 ,nas_num_of_performance_ defaultBearer:0,nas_num_of_ performance_dedicatedBearer:0 |

## 7.19.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Allowed values:<br>• 0: periodic reporting disabled<br>• 1: start the periodic refreshed dump for bitmap <rep_id_bitmap><br>• 2: start the periodic refreshed dump for bitmap <rep_id_bitmap> without tags<br>• 3: one shot dump for bitmap <rep_id_bitmap><br>• 4: one shot dump for bitmap <rep_id_bitmap> without tags<br>• 5: configure the <mode>=1 and <mode>=2 URCs periodic reporting interval |
| <rep_id_bitmap> | Number | Bitmask representing a subset of the available reports. The allowed range is 0-16383 (equivalent to bits 0x0000-0x3FFF). Bits set to 1 enable respective <rep_id> while bits set to 0 disables it. The default value is 0x03fff (all <rep_id_bitmap> enabled). |
| <timer_value> | Number | Periodic URC reporting interval. The range goes from 1 s to 65535 s, the default value is 5 s. When modified, the new periodic URC reporting interval value is applied runtime. |
| <rep_id> | String | See Table 6 for the list of allowed values. |
| <rep_desc> | String | See Table 6 for the list of allowed values. |
| <MCC> | Number | See <MCC> |
| <MNC> | Number | See <MNC> |
| <rssi> | Number | E-UTRAN cell Received Signal Strength Indicator as defined in 3GPP TS 25.133 [85]:<br>• 0: less than -100 dBm<br>• 1..75: from -100 to -25 dBm with 1 dBm steps<br>• 76: -25 dBm or greater<br>• 255: not known or not detectable |
| <ul_BW> | Number | Number of uplink Resource Blocks (see 3GPP TS 36.101 Table 5.6-1 [79]), 255 if not known or not detectable. |
| <dl_BW> | Number | Number of downlink Resource Blocks (see 3GPP TS 36.101 Table 5.6-1 [79]), 255 if not known or not detectable. |
| <tac> | Number | E-UTRAN cell Tracking Area Code in hexadecimal format; the range is 0h-FFFFh (2 octets), FFFF if not known or not detectable. |
| <LcellId> | Number | See <LcellId>. |
| <Lband> | Number | See <Lband>. |
| <dl_EARFCN> | Number | See <dl_EARFCN>. |

| Parameter | Type | Description |
|---|---|---|
| <ul_EARFCN> | Number | See <ul_EARFCN>. |
| <RSRP> | Number | See <RSRP>. |
| <RSRQ> | Number | See <RSRQ>. |
| <rrcState> | Number | 4G RRC state:<br>• 0: null<br>• 1: IDLE<br>• 2: ATTEMPT TO CONNECT<br>• 3: CONNECTED<br>• 4: LEAVING CONNECTED STATE<br>• 5: ATTEMPT LEAVING E-UTRA<br>• 6: ATTEMPT ENTERING E-UTRA<br>• 255: not known or not detectable |
| <PhysCellID> | Number | See <PhysCellID>. |
| <snr> | Number | Signal to noise ratio |
| <accessClass> | Number | Access class to which the UE belongs. Actual range is from 0 to 65535. -1 is the default value. |
| <csg_indication> | Number | Provides the indication about the CSG presence in boolean format |
| <csg_id> | Number | Identifies a closed subscriber group. The range goes from 0h to FFFFFFFh (28 bits), 0 000000 if not known or not detectable. |
| <servCell_Status> | Number | Serving cell status:<br>• 0: status measured<br>• 1: status not measured<br>• 2: status not detected |
| <ncell_Status_cell> | Number | Neighbor cell status:<br>• 0: status measured<br>• 1: status not measured<br>• 2: status not detected<br>• 3: status unknown |
| <ncell_Type_cell> | Number | Neighbor cell type:<br>• 0: intra-frequency neighbor cell detected<br>• 1: intra-frequency neighbor cell listed<br>• 2: inter-frequency neighbor cell detected<br>• 3: inter-frequency neighbor cell listed<br>• 4: inter-frequency neighbor cell unknown |
| <servCell_Type> | Number | Serving cell type:<br>• 0: no cell available<br>• 1: acceptable cell<br>• 2: suitable cell |
| <servCell_ qrxlevmin> | Number | Cell selection parameter $Q_{rxlevmin}$ as defined in the 3GPP TS 36.304 [119], applicable for intra-frequency neighbour cells. The range goes from -70 dB to -22 dB. The default value is 0 dB. |
| <servCell_ qrxlevminCE_r13> | Number | Cell selection parameter $Q_{rxlevmin\_CE}$ as defined in the 3GPP TS 36.304 [119], applicable for intra-frequency neighbour cells. The range goes from -70 dB to -22 dB. The default values is 0 dB. |
| <servCell_ qrxlevminCE1_r13> | Number | Cell selection parameter $Q_{rxlevmin\_CE1}$ as defined in the 3GPP TS 36.304 [119], applicable for intra-frequency neighbour cells. The range goes from -70 dB to -22 dB. The default values is 0 dB. |
| <servCell_qualmin> | Number | Actual parameter $Q_{QualMin}$ as defined in the 3GPP TS 36.304 [119]. It is used to indicate for cell selection/re-selection the required minimum received RSRQ level in the E-UTRA cell. The range goes -34 dB to -3 dB. The default value is 0 dB. |
| <servCell_ qualminCE_r13> | Number | Actual parameter $Q_{QualMin\_CE}$ as defined in the 3GPP TS 36.304 [119]. It is used to indicate for cell selection/re-selection the required minimum received RSRQ level in the E-UTRA cell. The range goes from -34 dB to -3 dB. The default value is 0 dB. |
| <servCell_ qualminCE1_r13> | Number | Actual parameter $Q_{QualMin\_CE1}$ as defined in the 3GPP TS 36.304 [119]. It is used to indicate for cell selection/re-selection the required minimum received RSRQ level in the E-UTRA cell. The range goes from -34 dB to -3 dB. The default value is 0 dB. |
| <servCell_ qrxlevminoffset> | Number | Actual cell selection parameter $Q_{rxlevminoffset}$ as defined in the 3GPP TS 36.304 [119] divided by 2 [dB]. It affects the minimum required Rx level in the cell. The actual range goes from -70 dB to -22 dB. The default value is 0 dB. |

| Parameter | Type | Description |
|---|---|---|
| <servCell_ qualminoffset> | Number | Cell selection parameter $Q_{qualminoffset}$ as defined in the 3GPP TS 36.304 [119]. It affects the minimum required quality level in the cell. The range goes from 1 dB to 8 dB. The default value is 0 dB. |
| <servCell_srxlev> | Number | Srxlev - Cell Selection RX level value (dB). |
| <servCell_squal> | Number | Squal - Cell Selection quality value (dB). Applicable only for FDD cells. |
| <EDRX_allowed> | Number | Indicates if eDRX is allowed by the network or not. Allowed values:<br>• 0: use of eDRX not allowed<br>• 1: use of eDRX allowed |
| <emm_state> | Number | EMM state value as defined in 3GPP TS 24.301 [69]. Allowed values:<br>• 0: EMM-NULL<br>• 1: EMM-DEREGISTERED<br>• 2: EMM-REGISTERED-INITIATED<br>• 3: EMM-REGISTERED<br>• 4: EMM-TRACKING-AREA-UPDATING-INITIATED<br>• 5: EMM-SERVICE-REQUEST-INITIATED<br>• 6: EMM-DEREGISTERED-INITIATED<br>• 7: undefined or invalid |
| <esm_cause> | Number | ESM cause value as defined in 3GPP TS 24.301 [69] |
| <ciphering> | Number | LTE ciphering status:<br>• 0: LTE ciphering on<br>• 1: LTE ciphering off |
| <maxTXPower> | Number | Maximum UE Transmit power level as received in SIB1(p-max). Actual range -30 to 33. The default value is 255. |
| <ue_service> | Number | UE Service status:<br>• 0: service present<br>• 1: out of service |
| <channelMode> | Number | Channel mode of current LTE connection:<br>• 0: emergency<br>• 1: high priority access<br>• 2: MT access<br>• 3: MO signaling<br>• 4: MO Data<br>• 5: delay tolerant access<br>• 6: connection not established |
| <channelType> | Number | Channel type of current LTE connection:<br>• 0: full duplex FDD<br>• 1: half duplex FDD<br>• 2: full duplex TDD<br>• 3: half duplex TDD |
| <onDurationTimer> | Number | Part of the DRX cycle during which UE actively monitors PDCCH.<br>• 0: PDCCH sub-frame 1<br>• 1: PDCCH sub-frame 2<br>• 2: PDCCH sub-frame 3<br>• 3: PDCCH sub-frame 4<br>• 4: PDCCH sub-frame 5<br>• 5: PDCCH sub-frame 6<br>• 6: PDCCH sub-frame 8<br>• 7: PDCCH sub-frame 10<br>• 8: PDCCH sub-frame 20<br>• 9: PDCCH sub-frame 30<br>• 10: PDCCH sub-frame 40<br>• 11: PDCCH sub-frame 50<br>• 12: PDCCH sub-frame 60<br>• 13: PDCCH sub-frame 80<br>• 14: PDCCH sub-frame 100<br>• 15: PDCCH sub-frame 200<br>• 16: not configured |

| Parameter | Type | Description |
|---|---|---|
| <drx_InactivityTimer> | Number | Denotes the number of inactive consecutive PDCCH-subframe(s) that will activate short DRX cycle.<br>• 0: PDCCH sub-frame 1<br>• 1: PDCCH sub-frame 2<br>• 2: PDCCH sub-frame 3<br>• 3: PDCCH sub-frame 4<br>• 4: PDCCH sub-frame 5<br>• 5: PDCCH sub-frame 6<br>• 6: PDCCH sub-frame 8<br>• 7: PDCCH sub-frame 10<br>• 8: PDCCH sub-frame 20<br>• 9: PDCCH sub-frame 30<br>• 10: PDCCH sub-frame 40<br>• 11: PDCCH sub-frame 50<br>• 12: PDCCH sub-frame 60<br>• 13: PDCCH sub-frame 80<br>• 14: PDCCH sub-frame 100<br>• 15: PDCCH sub-frame 200<br>• 16: PDCCH sub-frame 300<br>• 17: PDCCH sub-frame 500<br>• 18: PDCCH sub-frame 750<br>• 19: PDCCH sub-frame 1280<br>• 20: PDCCH sub-frame 1920<br>• 21: PDCCH sub-frame 2560<br>• 22: PDCCH sub-frame 0_V1020<br>• 23: not configured |
| <drx_Retransmission_Timer> | Number | Specifies the maximum number of consecutive PDCCH-subframe(s) the UE must remain active expecting a DL retransmission:<br>• 0: PDCCH sub-frame 1<br>• 1: PDCCH sub-frame 2<br>• 2: PDCCH sub-frame 3<br>• 3: PDCCH sub-frame 4<br>• 4: PDCCH sub-frame 5<br>• 5: PDCCH sub-frame 6<br>• 6: PDCCH sub-frame 8<br>• 7: PDCCH sub-frame 16<br>• 8: PDCCH sub-frame 24<br>• 9: PDCCH sub-frame 33<br>• 10: PDCCH sub-frame 0_V1130<br>• 11: not configured |
| <longDRX_CycleStartOffset> | Number | Long DRX cycle offset value. |
| <shortDRX_Cycle> | Number | Short DRX cycle value is number of sub-frames:<br>• 1: sub-frame 2<br>• 2: sub-frame 5<br>• 3: sub-frame 8<br>• 4: sub-frame 10<br>• 5: sub-frame 16<br>• 6: sub-frame 20<br>• 7: sub-frame 32<br>• 8: sub-frame 40<br>• 9: sub-frame 64<br>• 10: sub-frame 80<br>• 11: sub-frame 128<br>• 12: sub-frame 160<br>• 13: sub-frame 256<br>• 14: sub-frame 320<br>• 15: sub-frame 512 |

| Parameter | Type | Description |
|---|---|---|
| | | • 16: sub-frame 640<br>• 17: not configured |
| <drxShortCycle_ Timer> | Number | Duration of the short DRX cycle in multiples of shortDRXCycle. Denotes the number of consecutive subframe(s) the UE shall follow the short DRX cycle after the DRX Inactivity Timer has expired |
| <periodicPHR_ Timer> | Number | Timer for PHR reporting in 3GPP TS 36.321 [139]. Value in number of sub-frames.<br>• 0: sub-frame 10<br>• 1: sub-frame 20<br>• 2: sub-frame 50<br>• 3: sub-frame 100<br>• 4: sub-frame 200<br>• 5: sub-frame 500<br>• 6: sub-frame 1000<br>• 7: infinity<br>• 8: not configured |
| <prohibitPHR_ Timer> | Number | Timer for PHR reporting in 3GPP TS 36.321 [139]. Value in number of sub-frames.<br>• 0: sub-frame 0<br>• 1: sub-frame 10<br>• 2: sub-frame 20<br>• 3: sub-frame 50<br>• 4: sub-frame 100<br>• 5: sub-frame 200<br>• 6: sub-frame 500<br>• 7: sub-frame 1000<br>• 8: not configured |
| <dl_ PathlossChange> | Number | DL Path loss Change and the change of the required power back off due to power management (as allowed by P-MPRc [42]) for PHR reporting in 3GPP TS 36.321 [139]. Value expressed in dB.<br>• 0: dB1<br>• 1: dB3<br>• 2: dB6<br>• 3: infinity<br>• 8: not configured |
| <extendedPHR> | Number | Indicates if power headroom shall be reported using the Extended Power Headroom Report MAC control element defined in 3GPP TS 36.321 [139]. Value expressed in dB.<br>• 0: extended PHR On<br>• 1: extended PHR Off |
| <emergencyBarr> | Number | Indicates if emergency barrier is on or off:<br>• 0: emergency barrier on<br>• 1: emergency barrier off |
| <ac_moBarring> | Number | Access Class MO Barring type. Allowed values:<br>• 0: MO signaling<br>• 1: MO data<br>• 2: not configured |
| <ac_BarringFactor> | Number | If the random number drawn by the UE is lower than this value, access is allowed.<br>• 0: P00<br>• 1: P05<br>• 2: P10<br>• 3: P15<br>• 4: P20<br>• 5: P25<br>• 6: P30<br>• 7: P40<br>• 8: P50<br>• 9: P60<br>• 10: P70<br>• 11: P75<br>• 12: P80 |

| Parameter | Type | Description |
|---|---|---|
| | | • 13: P85<br>• 14: P90<br>• 15: P95<br>• 16: not configured |
| <ac_BarringTime> | Number | Mean access barring time value expressed in seconds:<br>• 0: S4<br>• 1: S8<br>• 2: S16<br>• 3: S32<br>• 4: S64<br>• 5: S128<br>• 6: S256<br>• 7: S512<br>• 8: not configured |
| <ac_ BarringSpecialAC> | Number | Access class barring for AC 11-15. The first/ leftmost bit is for AC 11, the second bit is for AC 12, and so on. |
| <eabCategory> | Number | Indicates the category of UEs for which EAB applies. Value a corresponds to all UEs, value b corresponds to the UEs that are neither in their HPLMN nor in a PLMN that is equivalent to it, and value c corresponds to the UEs that are neither in the PLMN listed as most preferred PLMN of the country where the UEs are roaming in the operator-defined PLMN selector list on the USIM, nor in their HPLMN nor in a PLMN that is equivalent to their HPLMN, see 3GPP TS 22.011 [140].<br>• 0: category A<br>• 1: category B<br>• 2: category C<br>• 3: not configured |
| <eabBarringBitmap> | Number | Extended access class barring for AC 0-9. The first/leftmost bit is for AC 0, the second bit is for AC 1, and so on. |
| <measurementID> | Number | Measurement report identity. Default value is 255. |
| <eventID> | Number | Event ID. Allowed values:<br>• 1: event A1<br>• 2: event A2<br>• 3: event A3<br>• 4: event A4<br>• 5: event A5<br>The default value is 255. |
| <periodical> | Number | Type of periodical measurement configuration to be performed. Allowed values:<br>• 0: report Strongest cell<br>• 1: REPORT CGI<br>• 2: not applicable |
| <offset> | Number | Offset value to be used in E-UTRA measurement report triggering condition for event A3. |
| <reportOnLeave> | Number | Report on leave status:<br>• 0: true<br>• 1: false<br>• 2: not confirmed |
| <num_UL_RBIDs> | Number | Number of radio bearer identities configured on uplink by the network |
| <CE_level> | Number | Current coverage enhancement (CE) level. The range is 0-3. |
| <UL_RBID_index> | Number | Radio bearer identity (RBID) index of the configured <UL_RBID> for uplink |
| <UL_RBID> | Number | Radio bearer identity (RBID) configured on uplink by the network |
| <UL_buff_SDU_ count> | Number | Number of uplink SDUs buffered on PDCP per RBID |
| <UL_RLC_mode> | String | Configured radio link control (RLC) mode per RBID on uplink. Allowed values:<br>• L2_RLC_AM: acknowledged mode<br>• L2_RLC_UM: unacknowledged mode |
| <num_DL_RBIDs> | Number | Number of radio bearer identities configured on downlink by the network |
| <DL_pckts_drop_ Mac> | Number | Number of downlink packets drop at MAC |

| Parameter | Type | Description |
|---|---|---|
| <DL_RBID_index> | Number | Radio bearer identity (RBID) index of the configured <DL_RBID> for downlink |
| <DL_RBID> | Number | Radio bearer identity (RBID) configured on downlink by the network |
| <DL_missing_SNs> | Number | Number of missing SNs on downlink per RBID |
| <DL_invld_pkts> | Number | Number of invalid packets received per RBID |
| <DL_RLF_mode> | Number | Configured radio link control (RLC) mode per RBID on downlink. Allowed values:<br>• L2_RLC_AM: acknowledged mode<br>• L2_RLC_UM: unacknowledged mode |
| <total_cell_reselections> | Number | Total number of cell re-selections |
| <total_radio_link_loss> | Number | Total number of radio link loss |
| <power_saving_mode> | Number | Power saving mode status. Allowed values:<br>• 0: enabled<br>• 1: disabled |
| <high_mobility> | Number | High Mobility status. Allowed values:<br>• 0: detected<br>• 1: not detected |
| <conn_establish_attempt_count> | Number | Attempted connection establishments |
| <conn_establish_success_count> | Number | Number of successful connection establishments |
| <conn_establish_failure_count> | Number | Number of failed connection establishments |
| <re_establishment_attempt_count> | Number | Number of attempted connection re-establishments |
| <re_establishment_success_count> | Number | Number of successful connection re-establishments. |
| <re_establishment_failure_count> | Number | Number of failed connection re-establishments |
| <HO_attempt_count> | Number | Total number of attempted handover |
| <HO_success_count> | Number | Number of successful handover |
| <HO_failure_count> | Number | Number of failed handover |
| <EUTRAN_conn_release_count> | Number | Number of connection releases by network |
| <nas_attach> | Number | Number of attach attempts with the network |
| <nas_tau> | Number | Number of tracking area update attempts |
| <nas_service_request> | Number | Number of service request attempts |
| <nas_pdn_disconnect_req> | Number | Number of PDN disconnect request attempts |
| <nas_pdn_register_req> | Number | Number of PDN register attempts |
| <nas_auth> | Number | Number of authentication request attempts |
| <nas_bearer_resource_modify_req> | Number | Number of bearer resource modification requests to network |
| <nas_detach> | Number | Number of detach attempts |
| <nas_internal_detach_limit> | Number | Number of internal detach retries |
| <nas_bearer_resource_alloc_req> | Number | Number of bearer resource allocation attempts |
| <nas_mt_sms_retry> | Number | Number of MT SMS retry attempts |
| <nas_mo_sms_retry> | Number | Number of MO SMS retry attempts |
| <nas_lpp_retransmission> | Number | Number of LPP re-transmission request attempts |

| Parameter | Type | Description |
|---|---|---|
| <nas_performance_attach> | Number | Number of attach triggered at NAS |
| <nas_performance_detach> | Number | Number of detach triggered at NAS |
| <nas_performance_deactivate> | Number | Number of PDN deactivation triggered at NAS |
| <nas_performance_tracking> | Number | Number of tracking update triggered at NAS |
| <nas_performance_default_bearer> | Number | Number of default bearer established at NAS |
| <nas_performance_dedicated_bearer> | Number | Number of dedicated bearer established at NAS |
| <nas_performance_resource_modify> | Number | Number of bearer resource modification requests at NAS |
| <nas_performance_resource_setup> | Number | Number of bearer resource allocation requests at NAS |
| <reselect_Hysteresis> | Number | $Q_{hyst}$ as defined in 3GPP TS 36.304 [119] expressed in dB. Allowed values:<br>• 0: 0 dB<br>• 1: 1 dB<br>• 2: 2 dB<br>• 3: 3 dB<br>• 4: 4 dB<br>• 5: 5 dB<br>• 6: 6 dB<br>• 7: 8 dB<br>• 8: 10 dB<br>• 9: 12 dB<br>• 10: 14 dB<br>• 11: 16 dB<br>• 12: 18 dB<br>• 13: 20 dB<br>• 14: 22 dB<br>• 15: 24 dB<br>• 16: not configured |
| <reselect_Cause> | Number | Cell reselection cause. Allowed values:<br>• 0: service cell not suitable<br>• 1: better ranked cell found<br>• 2: system information reception failure<br>• 3: system information update<br>• 4: Radio Link Failure<br>• 5: RRC connection release<br>• 6: re-selection not occurred |
| <paginCycle> | Number | Configured paging cycle. Allowed values:<br>• 0: 32 radio frames<br>• 1: 64 radio frames<br>• 2: 128 radio frames<br>• 3: 256 radio frames<br>• 4: not configured |
| <param1> | Number | Content depends on the related <mode> (see above) |

## 7.19.4 Notes

- The following are the values of <rep_id> and <rep_desc> parameter:

| <rep_id_bitmap> | <rep_id> | <rep_desc> | Remarks |
|---|---|---|---|
| 1 | LTE00 | LTE SERVING CELL INFO | |
| 2 | LTE01 | LTE NEIGHBOR CELL INFO for <n> cells | Maximum of 6 PLMN IDs (MNC, MCC) can be configured. If no information is |

| <rep_id_bitmap> | <rep_id> | <rep_desc> | Remarks |
|---|---|---|---|
| | | | available then first index elements are set to default values |
| 3 | LTE02 | LTE SERVING CELL MEASUREMENT REPORT | |
| 4 | LTE03 | LTE SERVING CELL SELECTION INFO | |
| 5 | LTE04 | LTE CONNECTION INFO | |
| 6 | LTE05 | LTE CHANNEL INFO | |
| 7 | LTE06 | EUTRAN DRX INFO | |
| 8 | LTE07 | EUTRAN PHR INFO | |
| 9 | LTE08 | EUTRAN BARRING INFO | Maximum of 2 ACs (access class) information. Maximum of 6 EAB (Extended Access Barring) information. If no information is available then first index elements are set to default values |
| 10 | LTE09 | EUTRAN CONN MEAS CONFIG INFO | Maximum of 32 measurement IDs can be sent. If no information is available then first index elements are set to default values |
| 11 | LTE10 | LTE EQUIVALENT PLMN LIST | Maximum of 6 PLMN IDs (MNC, MCC) can be configured). If no information is available then first index elements are set to default values |
| 12 | LTE11 | LTE UE STATS | If some values are not set in the UE, they are not reported in the read command response. |
| 13 | LTE12 | LTE CELL RESELECTION INFO | |
| 14 | LTE13 | LTE PAGING INFO | |

**Table 6: Bitmask meaning the <rep_id> and <rep_desc> parameter**

# 7.20 Edit Verizon wireless APN table +VZWAPNE

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

## 7.20.1 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.

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

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | <apntype>s),range of supported <apnb>s),(list of supported <apned>s),(list of supported <apntime>s)<br>OK | OK |

### 7.20.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <wapn> | Number | APN list entry |
| <apncl> | Number | APN class |
| <apnni> | String | Network identifier:<br>• "IMS" or "VZWIMS": Verizon IMS PDN, factory-programmed value for <apncl>=1 entry<br>• "VZWADMIN": Verizon Administrative PDN, factory-programmed for <apncl>=2 entry<br>• "VZWINTERNET": Verizon Internet PDN, factory-programmed for <apncl>=3 entry<br>• "VZWAPP": Verizon Application PDN, factory-programmed for <apncl>=4 entry<br>• "ENTERPRISE": Verizon Enterprise PDN, factory-programmed for <apncl>=6 entry<br>• "THINGSPACE": Verizon Thingspace PDN, factory-programmed for <apncl>=7 entry |
| <apntype> | String | • "IPv6": IPv6 type<br>• "IPv4v6" (factory-programmed value): IPv4 and IPv6 type |
| <apnb> | String | APN bearer:<br>• "LTE" (factory-programmed value): LTE bearer used |
| <apned> | String | Enable/disable the APN:<br>• "Enabled" (factory-programmed value): APN enabled<br>• "Disabled": APN disabled |
| <apntime> | Number | APN inactivity timer value in minutes.<br>• SARA-R5 - The range goes from 0 to 1023.<br>The value '0' (factory-programmed value) sets the timer to infinity. |

### 7.20.4 Notes

**SARA-R5**

- Do not use the set command in MNO profiles different from Verizon (see the +UMNOPROF AT command).

## 7.21 Read RSRP values +VZWRSRP

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

### 7.21.1 Description

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

### 7.21.2 Syntax

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

### 7.21.3 Defined values

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

## 7.22 Read RSRQ values +VZWRSRQ

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

### 7.22.1 Description

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

### 7.22.2 Syntax

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

### 7.22.3 Defined values

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

## 7.23 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 |

### 7.23.1 Description

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

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

☞ SARA-R5
The command setting is persistent across PSM cycles.

☞ SARA-R5
The information text response of the read command returns the URC configuration (<n>) and the signaling connection status (<mode>).

### 7.23.2 Syntax

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

### 7.23.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <n> | Number | URC configuration:<br>• 0: +CSCON URC disabled<br>• 1: URC +CSCON: <mode> enabled<br>• 2: URC +CSCON: <mode>[,<state>] enabled<br>• 3: URC +CSCON: <mode>[,<state>[,<access>]] enabled<br>Allowed values:<br>• SARA-R5 - 0 (factory-programmed value), 1 |
| <mode> | Number | Indicates the signaling connection status:<br>• 0: idle<br>• 1: connected |
| <state> | Number | Allowed values:<br>• 0: UTRAN URA_PCH<br>• 1: UTRAN Cell_PCH<br>• 2: UTRAN Cell_FACH<br>• 3: UTRAN Cell_DCH<br>• 4: GERAN CS connected<br>• 5: GERAN PS connected<br>• 6: GERAN CS and PS connected<br>• 7: E-UTRAN connected |
| <access> | Number | Indicates the radio access technology:<br>• 4: E-UTRAN FDD |

## 7.24 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 | No | - | +CME Error |

### 7.24.1 Description

Activates or deactivates the Radio Policy Manager (RPM) feature for SIM cards not belonging to AT&T network operator.

Generally a UE aggressively retries the registration procedure until it is successful and behaves similarly in case the PDP context activation procedure fails. This behaviour may cause signalling overload and consequently prolonged network outage. To avoid these scenarios and provide a more efficient access to the network, the RPM feature controls the number of network accesses per service type over a fixed amount of time. For more details on the RPM feature see AT&T Device Requirements [49] and GSMA Connection Efficiency [131].

Some network rejection error causes require specific behaviours which the RPM feature does not alter (see the 3GPP TS 24.008 [12]).

### 7.24.2 Syntax

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

### 7.24.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Indicates the action to perform:<br>• 0 (factory-programmed value): RPM feature deactivated<br>• 1: RPM feature activated |

## 7.25 Radio Policy Manager (RPM) configuration +URPMCONF

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

### 7.25.1 Description

Configures the Radio Policy Manager (RPM) related parameters.

The parameters are grouped in different sets:

- SARA-R5 **PLMN SIM card based check configuration**: it sets PLMNs in MCC.MNC format, for which the RPM functionality will be active.
  - SARA-R5 - at most 15 PLMNs are set
- **Current RPM configuration**: the parameters can only be read
- **Default RPM parameter setting stored in the module**: the parameters can only be read

### 7.25.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+URPMCONF=<op_code>,..... | OK | |
| **PLMN SIM card based check configuration** | | | |
| • SARA-R5 | | | |
| Set | AT+URPMCONF=0,<PLMN>[,<PLMN>[,<PLMN>[,<PLMN>[,<PLMN>[,<PLMN>[,<PLMN>[,<PLMN>[,<PLMN>[,<PLMN>[,<PLMN>]]]]]]]]]]] | OK | AT+URPMCONF=0,"222.88","123.456","987.65","222.10","222.01","123.55"<br>OK |
| • SARA-R5 | | | |
| Read | AT+URPMCONF? | +URPMCONF: 0,<PLMN>,<PLMN>,<PLMN>,<PLMN>,<PLMN>,<PLMN>,<PLMN>,<PLMN>,<PLMN>,<PLMN>,<PLMN>,<PLMN>,<PLMN><br>+URPMCONF: 1,<RPM_active>,<SIM_RPM_setting>,<N1>,<T1>,<F1>,<F2>,<F3>,<F4>,<LR1>,<LR2>,<LR3> | +URPMCONF: 0,"222.88","fff.ff","fff.ff","fff.ff","fff.ff","fff.ff","fff.ff","fff.ff","fff.ff","fff.ff","fff.ff","fff.ff","fff.ff","fff.ff"<br>+URPMCONF: 1,0,0,0,0,0,0,0,0,0,0<br>+URPMCONF: 2,1,20,60,60,30,60,30<br>+URPMCONF: 3,1,1,10,60,30,60,30<br>+URPMCONF: 4,"310.30","310.170","310.280","310.380","310.410","310.560","310.650","310.950","311.180", |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | +URPMCONF: 2,<ATT_RPM_enabled_flag_m>,<ATT_N1_m>,<ATT_T1_m>,<ATT_F1_m>,<ATT_F2_m>,<ATT_F3_m>,<ATT_F4_m><br>+URPMCONF: 3,<RPM_enabled_flag_m>,<N1_m>,<T1_m>,<F1_m>,<F2_m>,<F3_m>,<F4_m><br>+URPMCONF: 4,<ATT_PLMN>,<ATT_PLMN>,<ATT_PLMN>,<ATT_PLMN>,<ATT_PLMN>,<ATT_PLMN>,<ATT_PLMN>,<ATT_PLMN>,<ATT_PLMN>,<ATT_PLMN>,<ATT_PLMN>,<ATT_PLMN><br>OK | "312.670","313.100","313.110","313.120","313.130","313.140"<br>OK |
| Test | AT+URPMCONF=? | +URPMCONF: (list of the supported <op_code>s)<br>OK | +URPMCONF: (0)<br>OK |

### 7.25.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | Type of operation:<br>• 0: PLMN SIM card based check configuration<br>• 1: current RPM configuration |
| <PLMN> | String | PLMN in MCC.MNC format. "FFF.FF" indicates empty PLMN; the range goes from 000.00 to 999.999. The factory-programmed value is empty. |
| <RPM_active> | Number | Indicates the action to perform:<br>• 0: RPM feature is currently not active<br>• 1: RPM feature is currently active |
| <SIM_RPM_setting> | Number | Indicates whether the inserted SIM card contains RPM parameter setting:<br>• 0: the inserted SIM card does not contain the RPM parameter setting<br>• 1: the inserted SIM card contains the RPM parameter setting |
| <N1>,<T1>,<F1>,<F2>,<F3>,<F4>,<LR1>,<LR2>,<LR3> | Number | See the Radio Policy Manager Requirements [131]. |
| <RPM_enabled_flag_m>,<N1_m>,<T1_m>,<F1_m>,<F2_m>,<F3_m>,<F4_m> | Number | Default RPM parameter setting stored in the module. See the Radio Policy Manager Requirements [131]. |

### 7.25.4 Notes

**SARA-R5**

- The parameters <F1>, <F2>, <F3>, <F4>, <LR3> are not used.

## 7.26 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 |

### 7.26.1 Description

Configures the UEs extended discontinuous reception (eDRX) parameters. The command controls whether the UE wants to apply the eDRX or not, as well as the requested eDRX cycle and paging time window values for each specified type of radio access technology.

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

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

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

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

☞ SARA-R5
If the set command is issued and any of the optional parameters is omitted, the module applies the last set values.

☞ SARA-R5
The set command is applied runtime if the parameters are changed with respect to the previously saved values.

## 7.26.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CEDRXS=[<mode>[,<AcT_type>[,<Requested_eDRX_cycle>[,<Requested_paging_time_window>]]]] | OK | AT+CEDRXS=1,4,"0101","0101"<br>OK |
| Read | AT+CEDRXS? | +CEDRXS: [<AcT_type>,<Requested_eDRX_cycle>,<Requested_paging_time_window><br>[...]<br>[+CEDRXS: <AcT_type>,<Requested_eDRX_cycle>,<Requested_paging_time_window>]]<br>OK | +CEDRXS: 4,"0101","0001"<br>OK |
| Test | AT+CEDRXS=? | +CEDRXS: (list of supported <mode>s),(list of supported <AcT_type>s),(list of supported <Requested_eDRX_cycle>s),(list of supported <Requested_paging_time_window>s)<br>OK | +CEDRXS: (0-3),(3,4,5),("0000"-"1111"),("0000"-"1111")<br>OK |
| URC | | +CEDRXP: <AcT_type>[,<Requested_eDRX_cycle>[,<Assigned_eDRX_cycle>[,<Assigned_paging_time_window>]]] | +CEDRXP: 4,"1010","1001","1101" |

## 7.26.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Indication to disable or enable the use of eDRX in the UE. Allowed values:<br>• 0 (default and factory-programmed value): use of eDRX disabled<br>• 1: use of eDRX enabled<br>• 2: enable the use of eDRX and enable the +CEDRXP URC<br>• 3: disable the use of eDRX and reset all other parameters for eDRX to factory-programmed values |
| <AcT_type> | Number | Indicates the type of access technology:<br>• 2: GPRS/eGPRS<br>• 4: E-UTRAN (WB-S1 mode)<br>• 5: E-UTRAN (NB-S1 mode)<br>Allowed values: |

| Parameter | Type | Description |
|---|---|---|
| | | • SARA-R5 - 4 |
| <Requested_eDRX_cycle> | String | See <Requested_eDRX_cycle>. |
| <Assigned_eDRX_cycle> | String | See <Assigned_eDRX_cycle>. |
| <Requested_paging_time_window> | String | See <Requested_paging_time_window>. |
| <Assigned_paging_time_window> | String | See <Assigned_paging_time_window>. |

### 7.26.4 Notes

**SARA-R5**

- The PIN insertion is not mandatory before the command execution.
- The <Requested_paging_time_window> parameter is not supported in read and test command. Use the +CEDRXP URC or the +CEDRXRDP command to retrieve the <Requested_eDRX_cycle>, the <Assigned_eDRX_cycle_value> and the <Assigned_paging_time_window>.
- The <mode> and <AcT_type> parameters are not optional in set command.

## 7.27 eDRX read dynamic parameters +CEDRXRDP

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

### 7.27.1 Description

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

### 7.27.2 Syntax

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

### 7.27.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <AcT_type> | Number | Indicates the type of radio access technology:<br>• 0: use of eDRX disabled<br>• 2: GSM (A/Gb mode)<br>• 4: E-UTRAN (WB-S1 mode)<br>• 5: E-UTRAN (NB-S1 mode)<br>Allowed values:<br>• SARA-R5 - 0, 4 |
| <Requested_eDRX_cycle> | String | See <Requested_eDRX_cycle>. |
| <Assigned_eDRX_cycle> | String | See <Assigned_eDRX_cycle>. |

| Parameter | Type | Description |
|---|---|---|
| <Assigned_paging_time_window> | String | See <Assigned_paging_time_window>. |

# 7.28 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 |

## 7.28.1 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
  - SARA-R5 - by means of the AT+CFUN=16 AT command

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

☞ SARA-R5
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:

- SARA-R5 - Set the <MNO> parameter to the currently selected profile and reboot the module (AT+CFUN=16) to make the change effective

☞ SARA-R5
If the regulatory (<MNO>=0) or GCF-PTCRB (<MNO>=201) profile is selected, the LwM2M client is disabled even if +ULWM2M: 0 (LwM2M client enabled). For more details, see the +ULWM2M AT command.
When changing the <MNO> parameter value, only LwM2M data structures are accordingly updated, so the whole LwM2M object database is erased. Note that the <MNO> parameter setting does not impact +ULWM2MCONFIG or +ULWM2MCONFIGEXT AT commands.

u-blox cellular modules are certified according to all the capabilities and options stated in the Protocol Implementation Conformance Statement document (PICS) of the module. The PICS, according to 3GPP TS 51.010-2 [66], 3GPP TS 34.121-2 [67], 3GPP TS 36.521-2 [94] and 3GPP TS 36.523-2 [95], 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.

### 7.28.1.1 SIM ICCID/IMSI selection

If the <MNO> parameter is set to 1, the Mobile Network Operator profile is selected according to the recognized SIM Issuer Identifier Number (IIN); if no SIM IIN in the list (iccid_list) matches the current one, stored in the file system, the module derives the current MNO from the IMSI, searching in the MNOs list (mno_list) present in file system (<MNO_detected>). The module applies the configuration implied by the current <MNO_detected> value and, after the mandatory reboot triggered by the user:

- it starts the MNO detection algorithm at every boot, after the PIN has been inserted, if needed, and
- issues a URC any time the <MNO_detected> value changes, if <urc_notification_enabled> is set to 1.

Depending on the <reset> value and if the <MNO_detected> value is changed, the module reboot can be either automatic or manual:

- If the <MNO_detected> value is valid, and the automatic power cycle is enabled (<reset> parameter is set to 1), then the module will autonomously reboot as if AT+CFUN=16 were entered. In this case the URC, if enabled, simply warns the user that the module is about to power cycle.
- If automatic power cycle is disabled and the URC notification is enabled (<urc_notification_enabled>=1), the URC warns the user that a module reboot is required in order to have the correct configuration applied.

If the <MNO_detected> value does not map to any of the pre-defined MNOs AT&T (<MNO>=2) or Verizon (<MNO>=3), the configuration applied after the reboot is the global one (<MNO>=90).

Until the ICCID/IMSI selection algorithm has been completed at least once, the <MNO_detected> parameter in the information text response to the read command is empty. The read command in polling shall be used to understand when the ICCID/IMSI selection algorithm is finished and the reset is possible.

#### 7.28.1.1.1 MCC MNC and ICCID list

The MCC MNC list (mno_list) and the ICCID list (iccid_list) are stored in the file system using the "MNO" tag; for more details on the operation that are allowed on these files, see File tags. The maximum entries number in the MCC MNC list and ICCID list is 126 and the file overall maximum size is 1024 bytes. If the iccid_list file is present, the ICCID matching has higher priority with respect to the mno_list file. By factory-programmed configuration no iccid_list file is stored in the module file system. The iccid_list format is the following:

```
MNO1%ICCID1%ICCID2%MNO2%ICCID3%ICCID4%ICCID5
```

The ICCID can be the complete 10 bytes ICCID (see ETSI TS 102.221 [74]) or an incomplete ICCID. If an incomplete ICCID is used, the selection algorithm will recognize all the ICCIDs starting with the same bytes. For example, if the list is `ATT%8949001007140022660%555555`, all the AT&T SIMs with the ICCID 8949001007140022660 and with the ICCIDs in the range 5555550000000000000 - 5555559999999999999 are recognized.

The iccid_list and mno_list files are set to their factory-programmed values if a firmware update is performed; they are not modified by the +UFACTORY AT command.

## 7.28.2 Syntax

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

## 7.28.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <MNO> | Number | Mobile Network Operator (MNO) profile:<br>• 0: undefined / regulatory. For more details, see Notes.<br>• 1: SIM ICCID/IMSI select<br>• 2: AT&T |

| Parameter | Type | Description |
|---|---|---|
| | | • 3: Verizon<br>• 4: Telstra<br>• 5: T-Mobile US<br>• 6: China Telecom<br>• 8: Sprint<br>• 19: Vodafone<br>• 20: NTT DoCoMo<br>• 21: Telus<br>• 28: SoftBank<br>• 31: Deutsche Telekom<br>• 32: US Cellular<br>• 39: SKT<br>• 90: global<br>• 100: standard Europe<br>• 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.<br>• 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.<br>• 201: GCF-PTCRB. This profile is meant only for conformance testing.<br>Allowed values depend on the module series:<br>• SARA-R5 - 0, 1, 2, 3, 90 (factory-programmed value), 100, 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.<br>☞ SARA-R5<br>If the SIM IIN does not match any <MNO>, the global <MNO>=90 is applied and shown. If the SIM is not inserted, the last valid <MNO> remains active, but it is not shown; when the SIM will be inserted, the algorithm will start automatically. |
| <reset> | Number | Configure the automatic reset. Allowed values:<br>• 0: the automatic reset is disabled; the user shall reboot the module by itself<br>• 1: the automatic reset is enabled<br>It shall be issued only if <MNO>=1. |
| <urc_notification_enabled> | Number | Configure the URC notification. Allowed values:<br>• 0: URC is not issued if the <MNO_detected> value changes<br>• 1: URC is issued any time the <MNO_detected> value changes<br>It shall be issued only if <MNO>=1. |

## 7.28.4 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.

**SARA-R5**

- If <MNO>=0 the profile selected is regulatory (for more details on profile capabilities, see the PICS document of the device).
- The PIN insertion is not mandatory before the command execution.
- The information text response to the test command provides the list of supported <MNO> values.

# 7.29 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 |

## 7.29.1 Description

Sets the supported LTE-M / 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-M / NB-IoT band. The GSM bands supported are set by means of a bitmask where specific bits correspond to 850 / 900 / 1800 / 1900 bands.

☞ SARA-R5
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 [66], 3GPP TS 34.121-2 [67], 3GPP TS 36.521-2 [94] and 3GPP TS 36.523-2 [95], is a statement of the implemented and supported capabilities and options of a device. If the user changes the command settings during the certification process, the PICS of the application device integrating a u-blox cellular module must be changed accordingly.

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

☞ SARA-R5
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.

## 7.29.2 Syntax

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

## 7.29.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <RAT> | Number | Indicates the Radio Access Technology (RAT):<br>• 0: LTE Cat M1<br>• 1: LTE Cat NB1<br>• 2: GSM<br>Allowed values:<br>• SARA-R5 - 0 |
| <bitmask1> | Number | Depending on the <RAT> parameter value, configures the bitmask for LTE or GSM bands. When <RAT>=0 (LTE Cat M1) or <RAT>=1 (LTE Cat NB1), it indicates the bandmask for LTE bands 1 through 64. Each bit enables/disables a band:<br>• Bit 0: band 1<br>• Bit 1: band 2<br>• Bit 2: band 3 |

| Parameter | Type | Description |
|---|---|---|
| | | • Bit 3: band 4<br>• ..<br>• Bit 63: band 64<br>The factory-programmed value for LTE-M bands is:<br>• SARA-R5 - 185473183 (bands 1,2,3,4,5,8,12,13,18,19,20,25,26 and 28)<br>The factory-programmed value for NB-IoT bands is:<br>• SARA-R5 - LTE Cat NB1 RAT is not supported<br>When <RAT>=2 (GSM), it indicates bandmask for GSM bands 800 / 900 / 1800 / 1900. The following bit enables/disables a band:<br>• Bit 8: DCS 1800<br>• Bit 9: ESGM 900<br>• Bit 20: GSM 850<br>• Bit 22: PCS 1900<br>If any other bit of the bitmask is set to 1, the module return an error result code is issued. |
| <bitmask2> | Number | When <RAT>=0 (LTE Cat M1) or <RAT>=1 (LTE Cat NB1), it indicates the bandmask for LTE bands 65 through 128. Each bit enables/disables a band:<br>• Bit 0: band 65<br>• Bit 1: band 66<br>• Bit 2: band 67<br>• Bit 3: band 68<br>• ..<br>• Bit 63: band 128<br>The default value is 0 (all bands from 65 to 128 disabled).<br>If <RAT>=2 (GSM) the parameter is not supported. |

### 7.29.4 Notes

**SARA-R5**

- If not changed with the set command, the read command returns the active bands for the currently selected MNO profile (see +UMNOPROF).
- The test command returns the bands supported by the module regardless of the current settings, which correspond to the factory-programmed values.
- The test command response is in decimal integer format (as it is the read command response and input parameters configured by the set command), e.g. +UBANDMASK: (0-1),18446744073709551615, 18446744073709551615
- The <bitmask1> and <bitmask2> parameters of the set command could be also in hexadecimal (or octal) format if prefix 0x (0) is present.

## 7.30 Retrieve coverage enhancement mode information +CEINFO

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

### 7.30.1 Description

Configures the current coverage enhancement (CE) mode reporting URC. After enabling the URC reporting (<reporting>=1), the +CEINFO URC is issued to return the current CE mode information: thereafter, if either the parameter <CE_enabled> or <UE_state> or <downlink_repetition_factor> or <uplink_repetition_factor> changes, a +CEINFO URC will be issued.

### 7.30.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CEINFO=<reporting> | OK | AT+CEINFO=1 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | OK |
| Read | AT+CEINFO? | +CEINFO: <reporting>,<CE_enabled>,<UE_state>,<downlink_repetition_factor>,<uplink_repetition_factor>,<RSRP_value>,<CINR><br>OK | +CEINFO: 1,1,R,8,32,-120,10<br>OK |
| Test | AT+CEINFO=? | +CEINFO: (list of supported <reporting>s)<br>OK | +CEINFO: (0-1)<br>OK |
| URC | | +CEINFO: <reporting>,<CE_enabled>,<UE_state>,<downlink_repetition_factor>,<uplink_repetition_factor>,<RSRP_value>,<CINR> | +CEINFO: 1,1,R,8,32,-120,10 |

### 7.30.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <reporting> | Number | Enables/disables the +CEINFO URC. Allowed values:<br>• 0 (default value): +CEINFO URC disabled<br>• 1: +CEINFO URC enabled |
| <CE_enabled> | Number | Indicates whether the serving cell supports CE mode A/B. Allowed values:<br>• 0: CE mode A/B disabled<br>• 1: CE mode A/B enabled |
| <UE_state> | String | UE state. Allowed values:<br>• I: idle<br>• R: RACH<br>• C: connected to the network |
| <downlink_repetition_factor> | Number | Downlink repetition factor. The range goes from 0 to 65535, 0 if not known or detectable.<br>If the UE state is idle (<UE_state>=I) or RACH (<UE_state>=R), the downlink repetition factor is set to mpdcch-NumRepetition according to current radio condition (i.e. RSRP) and prach-ParametersListCE-r13 in SIB2 if access technology is LTE-M.<br>If the UE state is connected (<UE_state>=C), the downlink repetition factor is set to mpdcch-NumRepetition for the radio bearer if access technology is LTE-M.<br>For more details, see the 3GPP TS 36.331 [88]. |
| <uplink_repetition_factor> | Number | Uplink repetition factor. The range goes from 0 to 65535, 0 if not known or detectable.<br>If the UE state is idle (<UE_state>=I), the uplink repetition factor is set to numRepetitionPerPreambleAttempt according to the current radio condition.<br>If the UE state is RACH (<UE_state>=R), the uplink repetition factor is set to numRepetitionPerPreambleAttempt selected by UE.<br>If the UE state is RACH (<UE_state>=C), the uplink repetition factor is set to repetition number for PUSCH if access technology is LTE-M.<br>For more details, see the 3GPP TS 36.331 [88]. |
| <RSRP_value> | Number | Current Reference Signal Received Power (RSRP) expressed in dBm. The range goes from -140 dBm to -44 dBm, 0 if not known or not detectable. |
| <CINR> | Number | Carrier-to-Interference and Noise Ratio (CINR) expressed in dBm. The range goes from -23 dB to 40 dB, 0 if not known or not detectable. |

# 8 Device lock

## 8.1 Enter PIN +CPIN

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

### 8.1.1 Description

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

### 8.1.2 Syntax

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

### 8.1.3 Defined values

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

### 8.1.4 Notes

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

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

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

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

**SARA-R5**

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

## 8.2 Read remaining SIM PIN attempts +UPINCNT

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

### 8.2.1 Description

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

### 8.2.2 Syntax

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

### 8.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <PIN_attempts> | Number | Number of remaining attempts to enter PIN |
| <PIN2_attempts> | Number | Number of remaining attempts to enter PIN2 |
| <PUK_attempts> | Number | Number of remaining attempts to enter PUK |
| <PUK2_attempts> | Number | Number of remaining attempts to enter PUK2 |
| <lock_type> | Number | Allowed values:<br>• 1: request number of remaining attempts to enter for PIN 1<br>• 2: request number of remaining attempts to enter for PIN 2<br>• 3: request number of remaining attempts to enter for PUK 1<br>• 4: request number of remaining attempts to enter for PUK 2<br>• 5: request number of remaining attempts to enter for Network Operator Lock<br>• 6: request number of remaining attempts to enter for Network-Subset Lock<br>• 7: request number of remaining attempts to enter for Service Provider Lock<br>• 8: request number of remaining attempts to enter for Corporate lock<br>• 9: request number of remaining attempts to enter for IMSI lock |
| <Attempts_left> | Number | Number of attempts left before blocked (0 means blocked, or not used) |
| <Timer_Penalty> | Number | Provides the time in minutes to wait before the possible next tries |

### 8.2.4 Notes

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

**SARA-R5**

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

## 8.3 Facility lock +CLCK

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

### 8.3.1 Description

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

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

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

### 8.3.2 Syntax

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

### 8.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <fac> | String | Facility values. Allowed values (for the applicability to the module see Table 7):<br>• "SC": SIM (PIN enabled/disabled)<br>• "PN": Network Personalisation (see the 3GPP TS 22.022 [28])<br>• "PU": network sUbset Personalisation (see the 3GPP TS 22.022 [28])<br>• "PP": service Provider Personalisation (see the 3GPP TS 22.022 [28])<br>• "PC": Corporate Personalisation (see the 3GPP TS 22.022 [28])<br>• "PS": SIM/USIM Personalisation (see the 3GPP TS 22.022 [28])<br>• "FD": SIM fixed dialling phonebook feature<br>• "AO": BAR (Bar All Outgoing Calls)<br>• "OI": BOIC (Bar Outgoing International Calls)<br>• "OX": BOIC-exHC(Bar Outgoing International Calls except to Home Country)<br>• "AI": BAIC (Bar All Incoming Calls)<br>• "IR": BIC-Roam (Bar Incoming Calls when Roaming outside the home country)<br>• "AB": All Barring services (applicable only for <mode>=0)<br>• "AG": All outGoing barring services (applicable only for <mode>=0)<br>• "AC": All inComing barring services (applicable only for <mode>=0)<br>• "CS": CNTRL (lock CoNTRoL surface (e.g. phone keyboard)) (see the 3GPP TS 27.007 [2])<br>• "PF": Lock Phone to the very First inserted SIM/UICC card (see the 3GPP TS 27.007 [2])<br>• "NT": Barr incoming calls from numbers Not stored to TA memory (see the 3GPP TS 27.007 [2]) |

| Parameter | Type | Description |
|---|---|---|
| | | • "NM": Barr incoming calls from numbers Not stored to MT memory (see 3GPP TS 27.007 [2])<br>• "NS": Barr incoming calls from numbers Not stored to SIM/UICC memory (see the 3GPP TS 27.007 [2])<br>• "NA": Barr incoming calls from numbers Not stored in any memory (see the 3GPP TS 27.007 [2]) |
| <mode> | Number | • 0: unlock<br>• 1: lock<br>• 2: query status |
| <status> | Number | • 0: not active<br>• 1: active |
| <passwd> | String | Shall be the same as password specified for the facility from the MT user interface or with the +CPWD command |
| <class> | Number | Sum of numbers each representing a class of information. The default value is 7 (voice + data + fax):<br>• 1: voice<br>• 2: data<br>• 4: FAX<br>• 8: short message service<br>• 16: data circuit sync<br>• 32: data circuit async<br>• 64: dedicated packet access<br>• 128: dedicated PAD access |

### 8.3.4 Notes

| Module series | SC | PN | PU | PP | PC | PS | FD | AO | OI | OX | AI | IR | AB | AG | AC | CS | PF | NT | NM | NS | NA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SARA-R5 | x | x | x | | | x | x | | | | | | | | | | | | | | |

**Table 7: Lock applicability (<fac> allowed values)**

**SARA-R5**

- Reboot the module to make effective the lock/unlock configuration.
- The FDN check for PS data calls is not supported.

## 8.4 Change password +CPWD

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

### 8.4.1 Description

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

### 8.4.2 Syntax

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

### 8.4.3 Defined values

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

### 8.4.4 Notes

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

## 8.5 Custom SIM lock +USIMLCK

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

### 8.5.1 Description

Allows locking the module to work only with user-defined sets of SIM cards (e.g. a subset of networks, with a specified SIM card). According to the 3GPP TS 22.022 [28] there are different kinds of lock as follows:

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

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

### 8.5.2 Syntax

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

### 8.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <facility> | String | Personalization type, which can be:<br>• "PN" Network personalization<br>• "PU" Networks subset personalization<br>• "PS" SIM/USIM personalization |
| <pers_data> | String | Data for device personalization. The contents depend on the selected <facility>.<br>• If <facility> is "PN":<br><pers_data> is in the format:<br>"MCC1.MNC1min[-MNC2max][,MCC2.MNC2min[-MNC2max]... [,MCCn.MNCnmin[-MNCnmax]]"<br>It contains a list of comma-separated pairs of MCCs and MNC ranges.<br>o SARA-R5 - The maximum number of MCC-MNC personalisations is 25<br>• If <facility> is "PU":<br><pers_data> is in the format: |

| Parameter | Type | Description |
|---|---|---|
| | | "MCC1.MNC1min[-MNC2max][,MCC2.MNC2min[-MNC2max]... [,MCC10.MNC10min[-MNC10max]]:MSIN1[,MSIN2...[,MSIN10]]"<br>It contains a list of comma-separated pairs of MCCs+MNC ranges as above; a list of comma-separated MSIN(s) or ranges of MSINs is appended after the MCC/MNC range using a ':' as separator. At most 10 personalizations can be simultaneously configured.<br>MSINs can be written with wildcards ('*') with the syntax: [*[*]]D1[D2[...]] (one wildcard for each MSIN digit to skip) followed by one or more digits.<br>It is possible to use ranges of MSIN digits; in this case the minimum and maximum values should have the same number of wildcard and the same number of digits.<br>In addition it is possible to concatenate more MSIN ranges with the comma separator (example: "123.456:56,**70-**72"). In this case all ranges must create a non empty set since MSIN comma separator behavior is an AND operator: an empty set means that any SIM is accepted<br>• If <facility> is "PS":<br><pers_data> contains a list of at most 10 IMSIs; the format of the string is: "IMSI1, IMSI2,...,IMSIn" |
| <pwd> | String | Password to enable/disable the personalization. The password length goes from 6 to 16 digits. |
| <status> | Number | • 0: feature set but disabled<br>• 1: feature set and enabled |

## 8.5.4 Notes

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

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

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

# 9 Phonebook

## 9.1 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 |

### 9.1.1 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").

### 9.1.2 Syntax

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

### 9.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <storage> | String | Phonebook memory storage:<br>• "SM": SIM phonebook (depending on SIM card, it may not be available when the FDN is enabled)<br>• "AP": USIM application phonebook (depending on SIM card, it may not be available when the FDN is enabled)<br>• "FD": SIM fixed dialling phonebook (only valid with PIN2)<br>• "LD": SIM last-dialling phonebook<br>• "BN": SIM barred-dialling-number phonebook (only valid with PIN2)<br>• "SN": SIM service-dialling-number phonebook (read only)<br>• "EC": SIM emergency-call-codes phonebook (read only)<br>• "ON": Own number phone-book (read/write); the content is also shown by +CNUM<br>• "BL": Blacklist phonebook (delete only)<br>• "EN": SIM/USIM (or MT) emergency number<br>• "DC": MT dialed calls list (+CPBW may not be applicable for this storage)<br>For the values allowed by each module series, see Table 8. |
| <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 |

### 9.1.4 Notes

| Module series | "SM" | "AP" | "FD" | "LD" | "BN" | "SN" | "EC" | "ON" | "BL" | "EN" | "DC" |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SARA-R5 | • | | • | • | • | • | | • | | • | • |

**Table 8: Phonebook memory storage (<storage>) allowed values**

- <storage>="SM" and <storage>="AP" definitions from 3GPP TS 27.007 [2]:

- o "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.
- o "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.

**SARA-R5**

- The <password> parameter is required only for updating the PIN2-code locked <storage>s (see the +CPBW AT command) not for reading them (see the +CPBR or +CPBF AT commands).

# 9.2 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 |

## 9.2.1 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:

- SARA-R5 - the entry is returned and the displayed <type> is always 0.

## 9.2.2 Syntax

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

## 9.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <index1>, <index2>, <index> | Number | Range of location numbers of phonebook memory |

| Parameter | Type | Description |
|---|---|---|
| <number> | String | Phone number of format <type> |
| <type> | Number | Type of address octet (see the 3GPP TS 24.008 [12] 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 [12] 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> |
| <alength> | Number | Maximum length of field <adnumber> |
| <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> |

### 9.2.4 Notes

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

## 9.3 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 |

### 9.3.1 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.

### 9.3.2 Syntax

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

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

### 9.3.3 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 [12] 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:<br>• 0 (default value): phonebook entry not hidden<br>• 1: phonebook entry hidden |
| <adnumber> | String | Additional phone number of format <adtype> |
| <adtype> | Number | Type of address octet (see the 3GPP TS 24.008 [12] 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> |
| <alength> | Number | Maximum length of field <adnumber> |
| <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> |

### 9.3.4 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 [2]).

## 9.4 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 |

### 9.4.1 Description

Stores the phonebook entry in the current phonebook memory storage (selectable with +CPBS) 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

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>):

- SARA-R5 - an entry with no number and <type>=255 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 +CPBW is not applicable for the storages "SN", "EC" (read only storages), while it is applicable to "LD" storage only to delete an item.

## 9.4.2 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>]<br>OK | AT+CPBW=5,"091137880",,"u-blox"<br>OK |
| | | | AT+CPBW=,"091137880",,"u-blox"<br>+CPBW: 5<br>OK |
| Read | AT+CPBW? | +CPBW: <written_index><br>OK | +CPBW: 1<br>OK |
| Test | AT+CPBW=? | +CPBW: (list of supported <index>s),<nlength>,(list of supported <type>s),<tlength>[,<glength>[,<alength>[,<slength>[,<elength>[,<siplength>[,<tellength>]]]]]]<br>OK | +CPBW: (1-250),40,(129,145),18<br>OK |
| | | +CPBW: 0<br>OK | +CPBW: 0<br>OK |

## 9.4.3 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> |

| Parameter | Type | Description |
|---|---|---|
| <hidden> | Number | Indicates if the entry is hidden or not:<br>• 0 (default value): phonebook entry not hidden<br>• 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> |
| <alength> | Number | Maximum length of field <adnumber> |
| <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 |

### 9.4.4 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 command (see the 3GPP TS 27.007 [2]).

# 10 Short Messages Service

## 10.1 Introduction

For a complete overview of SMS, see 3GPP TS 23.040 [8] and 3GPP TS 27.005 [15].

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

### 10.1.1 Class 0 SMS

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

- SARA-R5 - all incoming SMSes stored in <mem3> (preferred memory for storing the received SMS, see +CPMS) with increasing index.

### 10.1.2 <index> parameter range

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

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

- SARA-R5
  - Values between 1 and 100: SMS stored in ME.
  - Values between 1 and n: SMS stored in SIM (n depends on SIM card used).
  - MT storage is not supported.

**BM** (Broadcast Message):

- SARA-R5 - Values between 1 and 10.

**SR** (Status Report)

- SARA-R5 - Status Report storage is not supported.

### 10.1.3 Limitations

The following limitations apply related to the SMS usage:

**Single SMS**

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

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

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

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

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

A concatenated SMS can have as many as 255 parts.

## 10.2 Select message service +CSMS

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

### 10.2.1 Description

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

### 10.2.2 Syntax

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

### 10.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <service> | Number | Allowed values:<br>• 0: see 3GPP TS 23.040 [8] and 3GPP TS 23.041 [9]; syntax of AT commands is compatible with 3GPP TS 27.005 [15] phase 2; phase 2+ features may be supported if no new command syntax is required<br>• 1: see 3GPP TS 23.040 [8] and 3GPP TS 23.041 [9]; syntax of AT commands is compatible with 3GPP TS 27.005 [15] phase 2+ |
| <mt> | Number | Mobile terminated messages:<br>• 0: not supported<br>• 1: supported |
| <mo> | Number | Mobile originated messages:<br>• 0: not supported<br>• 1: supported |
| <bm> | Number | Broadcast messages:<br>• 0: not supported<br>• 1: supported |

### 10.2.4 Notes

**SARA-R5**

- 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.

## 10.3 Preferred message storage +CPMS

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

### 10.3.1 Description

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

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

### 10.3.2 Syntax

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

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

### 10.3.3 Defined values

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

### 10.3.4 Notes

- SARA-R5 - the factory-programmed value is "ME", "ME" and "ME".

**SARA-R5**

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

## 10.4 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 |

### 10.4.1 Description

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

### 10.4.2 Syntax

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

### 10.4.3 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:<br>• 0 (default and factory-programmed value): PDU mode<br>• 1: text mode |

## 10.5 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 |

### 10.5.1 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).

### 10.5.2 Syntax

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

### 10.5.3 Defined values

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

## 10.6 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 |

### 10.6.1 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).

### 10.6.2 Syntax

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

### 10.6.3 Defined values

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

## 10.7 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 |

### 10.7.1 Description

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

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

### 10.7.2 Syntax

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

### 10.7.3 Defined values

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

## 10.8 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 |

### 10.8.1 Description

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

SARA-R5

The SMSes of class 0 (normally displayed via MMI) are indicated on DTE via URC +CMTI: <mem3>,<index> where <mem3> is the preferred memory for storing the received SMS and <index> is the first free storage position in <mem3>.

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

## 10.8.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CNMI=[<mode>[,<mt>[,<bm>[,<ds>[,<bfr>]]]]] | OK | AT+CNMI=1,1<br>OK |
| Read | AT+CNMI? | +CNMI: <mode>,<mt>,<bm>,<ds>,<bfr><br>OK | +CNMI: 0,0,0,0,0<br>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)<br>OK | +CNMI: (0-2),(0-3),(0-3),(0-2),(0-1)<br>OK |
| URC | | +CMTI: <mem>,<index> | +CMTI: "SM",5 |
| URC | | **Text mode (+CMGF=1):**<br>+CMT: <oa>,[<alpha>],<scts>[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>]<CR><LF><data> | +CMT: "+393475234652",,"14/11/21,11:58:23+01"<br>Hello world |
| | | **PDU mode (+CMGF=0):**<br>+CMT: ,<length><CR><LF><pdu> | |
| URC | | **Text mode (+CMGF=1):**<br>+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<br>Hello! |
| | | **PDU mode (+CMGF=0):**<br>+UCMT: <pdu_length><CR><LF><pdu> | |
| URC | | +CBMI: <mem>,<index> | +CBMI: "BM",48 |
| URC | | **Text mode (+CMGF=1):**<br>+CBM: <sn>,<mid>,<dcs>,<page>,<pages><CR><LF><data> | +CBM: 271,1025,1,1,1<br>The quick brown fox jumps over the lazy dog 0123456789 |
| | | **PDU mode (+CMGF=0):**<br>+CBM: <length><CR><LF><pdu> | |
| URC | | +CDSI: <mem>,<index> | +CDSI: "MT",2 |
| URC | | **Text mode (+CMGF=1):**<br>+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):**<br>+CDS: <length><CR><LF><pdu> | |

## 10.8.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Controls the processing of URCs specified within this command:<br>• 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) |

| Parameter | Type | Description |
|---|---|---|
| | | • 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<br>• 2: buffer URCs in the MT when the serial link is busy (e.g. data-transfer); otherwise forward them directly to the DTE<br>• 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):<br>• 0 (default and factory-programmed value): No SMS-DELIVER indications are routed to the TE<br>• 1: if SMS-DELIVER is stored in the MT, indication of the memory location is routed to the DTE using the +CMTI URC<br>• 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<br>• 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):<br>• 0 (default and factory-programmed value): no CBM indications to the DTE<br>• 1: if the CBM is stored in the MT, an indication of the used memory location is routed to DTE using the +CBMI URC<br>• 2: new CBMs are routed directly to the DTE using the +CBM URC<br>• 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:<br>• 0 (default and factory-programmed value): no SMS-STATUS-REPORTs are routed to the DTE<br>• 1: SMS-STATUS-REPORTs are routed to the DTE using the +CDS URC<br>• 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:<br>• 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).<br>• 1: MT buffer of URCs defined within this command is cleared when <mode> 1...3 is entered |
| <mem> | String | Same as defined in +CPMS Defined Values |
| <index> | Number | Storage position |
| <length> | Number | Two meanings:<br>• in text mode: number of characters<br>• in PDU mode: PDU's length in octets without the Service Center's address. In example: 0391214301000381 66F6000004E374F80D: this is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length>=13. |
| <pdu> | String | Protocol data unit: each 8-bit octet is presented as two IRA character long hexadecimal numbers, e.g. octet with integer value 42 is presented to TE as two characters 2A (IRA 50 and 65) |
| <oa> | String | Originator address |
| <scts> | String | Service center time stamp in time-string format, see the <dt> |
| <data> | String | In the case of SMS: 3GPP TS 23.040 [8] TP-User-Data in text mode responses; format:<br>• if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used:<br>o if TE character set other than "HEX" (see the +CSCS command in 3GPP TS 27.007 [2]): ME/TA converts GSM alphabet into current TE character set according to rules of Annex A |

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

## 10.8.4 Notes

**SARA-R5**

- <mode> = 3 is not supported.
- The incoming SMS/CBM URC indications will be displayed only on the AT interface where the last +CNMI command was set. As a general rule, the command should be issued by the DTE:
  - After start-up

  - After using the Z and &F command (which reset the command configuration)
  - Whenever the incoming SMS URCs indications are requested on a different AT interface
- <ds> = 2 is not supported.
- The +UCMT URC is not supported.

# 10.9 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 |

## 10.9.1 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).

## 10.9.2 Syntax

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

## 10.9.3 Defined values

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

# 10.10 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 |

## 10.10.1 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.

## 10.10.2 Syntax

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

## 10.10.3 Defined values

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

| Parameter | Type | Description |
|---|---|---|
| <fo> | Number | First octet of the SMS TPDU (see 3GPP TS 23.040 [8]) |
| <pid> | Number | TP-Protocol-Identifier (default 0); see the 3GPP TS 23.040 [8] |
| <dcs> | Number | Data Coding Scheme |
| <sca> | String | Service center address field |
| <tosca> | Number | Type of address of <sca> - octet in Number format (for more details see the 3GPP TS 24.008 [12]); default 145 when string includes '+', otherwise default 129 |
| <length> | Number | Two meanings:<br>• in text mode: number of characters<br>• 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 [8] TP-User-Data in text mode responses; format:<br>• if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used:<br>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<br>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))<br>• 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))<br>In the case of CBS: 3GPP TS 23.041 [9] CBM Content of Message in text mode responses; format:<br>• if <dcs> indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used:<br>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<br>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<br>• 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:<br>• Relative format: validity period starting from when the SMS is received by the SMSC, in range 0-255 (default value 167); for more details see the 3GPP TS 23.040 [8]<br><vp> — Validity period value<br>0 to 143 — (TP-VP + 1) x 5 minutes (i.e. 5 minutes intervals up to 12 hours)<br>144 to 167 — 12 hours + ((TP-VP -143) x 30 minutes)<br>168 to 196 — (TP-VP - 166) x 1 day<br>197 to 255 — (TP-VP - 192) x 1 week<br>• Absolute format: absolute time of the validity period termination in string format ("yy/MM/dd,hh:mm:ss+zz") (see the 3GPP TS 23.040 [8]); the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56 |
| <mr> | Number | Message reference |
| <ra> | String | Recipient address field |
| <tora> | Number | Type of address of <ra> - octet |
| <dt> | String | Discharge time in format "yy/MM/dd,hh:mm:ss+zz"; the time zone is expressed in steps of 15 minutes. The range goes from -48 to +56 |
| <st> | Number | Status of an SMS STATUS-REPORT |
| <ct> | Number | TP-Command-Type (default 0) |
| <mn> | Number | See the 3GPP TS 23.040 [8] TP-Message-Number in integer format |
| <cdata> | String | TP-Command-Data in text mode responses |
| <sn> | Number | CBM serial number |

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

## 10.11 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 |

### 10.11.1 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 [13] to the network. The MT shall automatically disable routing to the TE by setting both <mt> and <ds> values of +CNMI to zero. If the command is executed, but no acknowledgement is expected, or some other MT related error occurs, the +CMS ERROR: <err> error result code is returned.

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

### 10.11.2 Syntax

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

### 10.11.3 Defined values

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

## 10.12 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 |

### 10.12.1 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".

SARA-R5
Some SMS messages are displayed only when issuing AT+CSDH=1 (detailed SMS header information).

### 10.12.2 Syntax

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

| Type | Syntax | Response | Example |
|---|---|---|---|
| | **PDU mode (+CMGF=0):**<br>AT+CMGL[=<stat>] | **Command successful:**<br>+CMGL: <index>,<stat>,[<alpha>], <length><br><pdu><br>[+CMGL: <index>,<stat>,[<alpha>], <length>]<br><pdu> [...] | AT+CMGL=1<br>+CMGL: 305,1,,57 079193432900 1185440ED0D637396C7EBBCB0 000909092708024802A050 003000303DEA0584CE60 205D974791994769BDF3A90 DB759687E9F534FD0DA2C9603419<br>OK |
| Test | AT+CMGL=? | +CMGL: (list of supported <stat>s)<br>OK | +CMGL: ("REC UNREAD","REC READ","STO UNSENT","STO SENT", "ALL")<br>OK |

## 10.12.3 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:<br>• 0: in PDU mode or "REC UNREAD" in text mode: received unread SMS messages<br>• 1: in PDU mode or "REC READ" in text mode: received read SMS messages<br>• 2: in PDU mode or "STO UNSENT" in text mode: stored unsent SMS messages<br>• 3: in PDU mode or "STO SENT" in text mode: stored sent SMS messages<br>• 4: in PDU mode or "ALL" in text mode: all SMS messages |
| <index> | Number | Storage position |
| <oa> | String | Originator address |
| <alpha> | String | Alphanumeric representation of <da> or <oa> corresponding to the entry found in the phonebook 3GPP TS 24.008 [12]. The parameter is not managed. |
| <scts> | String | Service center time stamp in time-string format; see the <dt> parameter |
| <tooa> | Number | Type of address of <oa> - octet |
| <length> | Number | Two meanings:<br>• in text mode: number of characters<br>• in PDU mode: PDU's length in octets without the Service Center's address. In example 039121430100038166F6000004E374F80D: this is a PDU with Service Center's number +1234, that generates the address 03912143 (4 octets). Thus in this case <length> = 13. |
| <data> | String | This is the TP-User-Data in text mode; the decoding depends on the DCS (Data Coding Scheme) and the FO (First Octect) of the SMS header 3GPP TS 23.040 [8]; format:<br>• if DCS indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used:<br>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<br>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))<br>• 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))<br>In the case of CBS: 3GPP TS 23.041 [9] CBM Content of Message in text mode responses; format:<br>• if DCS indicates that 3GPP TS 23.038 [7] GSM 7 bit default alphabet is used:<br>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<br>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<br>if DCS indicates that 8-bit or UCS2 data coding scheme is used: ME/TA converts each 8-bit octet into two IRA character long hexadecimal number |
| <da> | String | Destination address |
| <toda> | Number | Type of address of <da> - octet |

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

## 10.13 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 |

### 10.13.1 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.

### 10.13.2 Syntax

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

### 10.13.3 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 |

| Parameter | Type | Description |
|---|---|---|
| <length> | Number | Two meanings:<br>• in text mode: number of characters<br>• 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 [8] RP-User-Data element of RP-ACK PDU; the format is same as for <PDU> in case of SMS |

### 10.13.4 Notes

**SARA-R5**

- The <ackpdu> parameter is not supported.

## 10.14 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 |

### 10.14.1 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.

### 10.14.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | **Text mode (+CMGF=1):**<br>AT+CMGW[=<oa/da>[,<tooa/toda>[,<stat>]]]<CR><br>text is entered<Ctrl-Z/ESC> | +CMGW: <index><br>OK | AT+CMGW="091137880"<CR><br>> This is the text<Ctrl-Z><br>+CMGW: 303<br>OK |
| | **PDU mode (+CMGF=0):**<br>AT+CMGW=<length>[,<stat>]<CR><br>PDU is given<Ctrl-Z/ESC> | +CMGW: <index><br>OK | AT+CMGW=13<CR><br>> 0391214301000381 66F600000 4E374F80D<Ctrl-Z><br>+CMGW: 303<br>OK |
| Test | AT+CMGW=? | OK | |

### 10.14.3 Defined values

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

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

## 10.15 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 |

### 10.15.1 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.

### 10.15.2 Syntax

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

### 10.15.3 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 |

## 10.16 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 |

### 10.16.1 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 [7] and the 3GPP TS 23.040 [8].

### 10.16.2 Syntax

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

### 10.16.3 Defined values

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

| Bit 3 | Bit 4 | Format |
|---|---|---|
| 0 | 0 | Validity period not present |
| 0 | 1 | Validity period present, relative format |
| 1 | 0 | Reserved |
| 1 | 1 | Validity period present, absolute format |

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

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

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

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

## 10.17 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 |

### 10.17.1 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.

SARA-R5
When deleting a message from an empty location, the module returns the "OK" final result code.

### 10.17.2 Syntax

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

### 10.17.3 Defined values

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

## 10.18 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 |

### 10.18.1 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.

SARA-R5
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.

### 10.18.2 Syntax

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

### 10.18.3 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 [12]); the default value is 145 when string includes '+', otherwise the default is 129. |

## 10.19 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 |

### 10.19.1 Description

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

### 10.19.2 Syntax

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

### 10.19.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Allowed values:<br>• 0 (default value and factory-programmed value): message types specified in <mids> and <dcss> accepted<br>• 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 [9], 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 [7], chapter 5. |

### 10.19.4 Notes

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

## 10.20 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 |

### 10.20.1 Description

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

### 10.20.2 Syntax

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

### 10.20.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Allowed values:<br>• 0 (default value): disabled<br>• 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<br>• 2: keep permanently enabled. The link is closed after each send sequence, but <mode> is not switched back to 0 |

## 10.21 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 |

### 10.21.1 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".

### 10.21.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | **Text mode (+CMGF=1):**<br>AT+UCMGP=<index> | **(SMS-DELIVER)**<br>+UCMGP: <stat>,<oa>,[<alpha>],<scts>[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>]<br><data><br>OK | AT+UCMGP=303<br>+UCMGP: "REC UNREAD","+393488535999",,"07/04/05,18:02:28+08",145,4,0,0,"+393492000466",145,93 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | **(SMS-SUBMIT)**<br>+UCMGP: <stat>,<da>,[<alpha>][,<toda>,<fo>,<pid>,<dcs>,[<vp>],<sca>,<tosca>,<length>]<br><data><br>OK | You have a missed called. Free information provided by your operator.<br>OK |
| | | **(SMS-STATUS-report)**<br>+UCMGP: <stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st><br>OK | |
| | | **(SMS-COMMAND)**<br>+UCMGP: <stat>,<fo>,<ct>[,<pid>,[<mn>],[<da>],[<toda>],<length><br>[<cdata>]]<br>OK | |
| | | **(CBM storage)**<br>+UCMGP: <stat>,<sn>,<mid>,<dcs>,<page>,<pages><br><data><br>OK | |
| | **PDU mode (+CMGF=0):**<br>AT+UCMGP=<index> | +UCMGP: <stat>,[<alpha>],<length><br><pdu><br>OK | AT+UCMGP=1<br>+UCMGP: 0,,40<br>07919343290020000 40C9193230982<br>66140000807032804521801 8D4F29CF<br>E06B5CBF379F87C4EBF41E434082E7F<br>DBC3<br>OK |
| Test | AT+UCMGP=? | OK | |

## 10.21.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <index> | Number | Storage position |

# 11 V24 control and V25ter

## 11.1 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).

## 11.2 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 |

### 11.2.1 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.

SARA-R5
On the AUX UART interface the command is not effective.

SARA-R5
Setting a 7-wire UART configuration or a 5-wire UART configuration (see the +USIO AT command), the command is not effective.

### 11.2.2 Syntax

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

### 11.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <value> | Number | Indicates the behavior of circuit 109<br>• 0: DCE always presents ON condition on circuit 109<br>• 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 |

### 11.2.4 Notes

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

## 11.3 Circuit 108/2 behavior &D

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

### 11.3.1 Description

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

### 11.3.2 Syntax

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

### 11.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <value> | Number | Allowed values:<br>• 0: the DCE ignores circuit 108/2<br>• 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<br>• 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 |

### 11.3.4 ~+++ behavior

- A special meaning of the &D value is provided for the ~+++ sequence during a PSD data transfer with PPP L2 protocol (this is outside the V25-ter specification scope). The ~+++ causes context deactivation during a PSD data transfer session for the AT&D0 and AT&D2 value (the +++ return to on-line command mode is provided for each &D value during a CSD data call)
- A different implementation for the ~+++ is done with the &D1 value: the PSD data transfer is escaped and system returns in the on-line command state. The ATO command is used to resume the PSD data transfer session

SARA-R5
During the on-line command mode different AT commands can be sent but data calls in PSD on-line command mode cannot be granted.

For more details, see the ITU-T Recommendation V250 [19], ITU-T V.25ter Recommendation [20] and ITU-T V.32 Recommendation [21].

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

### 11.3.5 DTR, +++ behavior

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

**Table 9: CSD data mode**

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

**Table 10: PSD data mode**

### 11.3.6 Notes

- The ON/OFF DTR transition in direct link forces the DCE into command mode. In case of AT&D0 the DTR transition is ignored, also in direct link.
- The escape sequence for the PSD data mode with a L2 protocol different from the PPP is not ~+++, and it could be not supported. For more information, see the S2 notes.

**SARA-R5**

- On the AUX UART interface, the DTR line is always considered to ON state (even if the AUX UART does not support the DTR line).
- Setting a 5-wire UART configuration (see the +USIO AT command), on the UART interface the DTR line is always considered to ON state (even if the UART does not support the DTR line).

## 11.4 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 |

### 11.4.1 Description

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

SARA-R5
On the AUX UART interface the command is not effective.

SARA-R5
Setting a 7-wire UART configuration or a 5-wire UART configuration (see the +USIO AT command), the command is not effective.

### 11.4.2 Syntax

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

### 11.4.3 Defined values

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

### 11.4.4 Notes

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

## 11.5 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 |

### 11.5.1 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

### 11.5.2 Syntax

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

### 11.5.3 Defined values

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

### 11.5.4 Notes

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

**SARA-R5**

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

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

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

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

**PPP Octet-stuffed framing and transparency**

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

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

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

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

**ACCM negotiation for XON/XOFF chars during PPP LCP negotiation**

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

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

| 02 | 06 | Async Control Character Map |

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

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

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

**Application to XON/XOFF flow control implementation in the module**

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

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

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

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

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

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

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

## 11.6 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 |

### 11.6.1 Description

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

The following restrictions must be reminded:

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

### 11.6.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ICF=[<format>[,<parity>]] | OK | AT+ICF=3,1 |

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

### 11.6.3 Defined values

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

### 11.6.4 Notes

**SARA-R5**

- The PIN insertion is not mandatory before the command execution.
- The <format> parameter cannot be set to 4.
- If the parameters are omitted they are set to <format> = 3 and <parity> = 1.
- The factory-programmed values are <format> = 3 and <parity> = 1.

## 11.7 DTE-DCE local flow control +IFC

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

### 11.7.1 Description

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

SARA-R5
The SW flow control (XON/XOFF) activation is only allowed in case of the text transmission: the binary data cannot be transmitted because it may contain the special flow control characters (XON/XOFF). For the SW flow control enhancement, allowing its usage during a PSD call with PPP L2 protocol, see SW flow control enhancement for PSD data transfer with PPP L2 protocol in the AT&K command description.

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

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

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

### 11.7.2 Syntax

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

### 11.7.3 Defined values

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

### 11.7.4 Notes

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

**SARA-R5**

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

## 11.8 Set flow control \Q

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

### 11.8.1 Description

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

SARA-R5
The SW flow control (XON/XOFF) activation is only allowed in case of the text transmission:
the binary data cannot be transmitted because it may contain the special flow control characters (XON/XOFF).
For the SW flow control enhancement, allowing its usage during a PSD call with PPP L2 protocol, see the SW flow control enhancement for PSD data transfer with PPP L2 protocol in the AT&K command description.

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

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

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

### 11.8.2 Syntax

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

### 11.8.3 Defined values

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

### 11.8.4 Notes

**SARA-R5**

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

## 11.9 UART data rate configuration +IPR

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

### 11.9.1 Description

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

SARA-R5
The command settings are ignored when the AT command interface runs either on the USB or on the SPI interface. The DCE sends the "OK" final result code but the command will have no effect.

### 11.9.2 Syntax

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

### 11.9.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <rate> | Number | Allowed baud rates expressed in b/s (0, if present, means autobauding):<br>• SARA-R5 - 0 (default and factory-programmed value), 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600, 3000000, 3250000 |

### 11.9.4 Notes

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

### 11.9.5 Autobauding description

**SARA-R5**

Only "one shot" automatic baud rate detection is implemented and detected only at module start-up.

- If automatic baud rate detection is set in the active memory profile, the baud rate is detected once at the module power on
- Since autobauding is implemented as "one shot" autobauding, any setting of AT+IPR=0 should be avoided; the only exception is in case the autobauding setting has been replaced by a fixed rate setting in the stored profile. In this case the module has started without autobauding and the host needs to reactivate it
- If the module starts with the autobauding active, after the detection, the +IPR read command returns the detected baud rate, while the +IPR value in the active profile (displayed as result of AT&V) does not change (it continues to be 0, otherwise the +IPR setting should be changed every time an AT command setting is changed and the profile saved in the NVM via the AT&W command). As a result, the only way to change the +IPR value in the profile is by issuing an +IPR set command (e.g. AT+IPR=115200 sets a fixed rate on the UART and determines a start-up at a fixed rate of 115200 b/s in case the active profile is saved via AT&W)
- After AT+IPR=0, the run-time configuration of the AT interface is updated (AT&V shows the new setting in the active profile), but the setting is effective only at the next start-up (if and only if the active configuration is saved in the stored AT profile)
- As a consequence of the previous point, if AT+IPR=0 the +IPR read command continues to return the current set baud rate (and not the 0 value). This is an exception and it creates a discrepancy between the value in the profile and the value returned by the +IPR read command, but it allows autobauding re-activation and a coherent result of the +IPR read command
- Autobauding values which can be detected are: 9600, 19200, 38400, 57600, 115200, 230400, 460800 and 921600 b/s
- If the system starts in autobauding (i.e. the <rate> parameter of +IPR is 0) the first "at" or "AT" sequence provided to the module detects the baud rate. For example the first command sent from the DTE at any rate can be: AT+CPIN="1234"
- Characters different than "AT" are ignored during the baud rate detection since the hardware detection sequence is triggered on the "at" or "AT" sequence. "At" or "aT" sequences are invalid: both detection characters must be small or capital
- The echo is produced or not according to ATE configuration. The echo is only produced for a valid detection string and only after the detection completion, that is there will be a one character delay between the received characters and the echo generation (the echo will start only after "at" or "AT" reception)
- If the UART power saving is enabled, the command for the baud rate detection should be sent to the DTE before the module enters idle mode for the first time
- Autobauding result can be unpredictable with spurious characters if power saving is entered and the flow control is disabled. If the hardware flow control is present, the DTE can be synchronized with the power saving cycle through the module CTS line i.e. the delivery of the "AT" sequence during the module wake up can be granted by the DTE and power saving can be exited correctly. Disable the power saving if no hardware flow control is set at start up
- If automatic baud rate detection is active, greeting messages or URCs before baud rate detection are not sent but buffered. They are sent as first data at the detected baud rate as soon as detection is completed (before any echo of the command or response). The greeting message is sent at the specified baud rate only when the baud rate setting in the profile is other than autobauding
- <rate>=0 does not affect the AT+ICF command (character framing configuration), since the automatic frame recognition is not supported.

## 11.10 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 |

### 11.10.1 Description

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

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

SARA-R5
It is the complementary command to the escape sequence, or to the other actions (DTR ON to OFF transition, see table in Circuit 108/2, +++ behavior for the different &D: summarizing tables) that cause the DCE to switch from online data state to online command state.

### 11.10.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Action | ATO | <response> | ATO<br>CONNECT |

### 11.10.3 Defined values

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

### 11.10.4 Notes

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

## 11.11 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 |

### 11.11.1 Description

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

### 11.11.2 Syntax

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

### 11.11.3 Defined values

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

### 11.11.4 Notes

**SARA-R5**

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

| Data call command | L2 protocol | Description | ATS2 behavior |
|---|---|---|---|
| AT+CGDATA="M-HEX",1 | HEX | u-blox specific | Escape sequence detection is only done for +++ (plus carriage return). ATS2 is not effective. No timing constraints. |
| AT+CGDATA="M-RAW_IP",1 | RAW-IP | PSD call: Transfer IP packet directly | Break detection is not supported |
| AT+CGDATA="PPP",1 | PPP | PSD call: Same of ATD*99***1# (e.g. dial-up) | Escape sequence detection is only done for ~+++. ATS2 is not effective.<br>There is not a timing constraint (see the S12 AT command) for ~+++ (++ + is incapsulated in a PPP frame) |
| ATD1234 | | CSD call | The command is effective if issued in both command and online command mode (where applicable) |
| AT+USODL=0 | | PSD call: Direct Link mode | The command is effective |
| AT+USOWR=0,3 | | PSD call: AT socket (not transparent) | Break detection is not supported |

**Table 11: ATS2 handling for different data call scenarios**

**SARA-R5**

- The <value> parameter is not mandatory.

## 11.12 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 |

### 11.12.1 Description

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

### 11.12.2 Syntax

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

### 11.12.3 Defined values

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

### 11.12.4 Notes

**SARA-R5**

- The PIN insertion is not mandatory before the command execution.
- The <value> parameter is not mandatory.

## 11.13 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 |

### 11.13.1 Description

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

### 11.13.2 Syntax

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

### 11.13.3 Defined values

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

### 11.13.4 Notes

**SARA-R5**

- The PIN insertion is not mandatory before the command execution.
- The <value> parameter is not mandatory.

## 11.14 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 |

### 11.14.1 Description

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

### 11.14.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | ATS5=<value> | OK | ATS5=8 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | OK |
| Read | ATS5? | <value> | 008 |
| | | OK | OK |

### 11.14.3 Defined values

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

### 11.14.4 Notes

**SARA-R5**

- The PIN insertion is not mandatory before the command execution.
- The <value> parameter is not mandatory.

## 11.15 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 |

### 11.15.1 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.

### 11.15.2 Syntax

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

### 11.15.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <value> | Number | Range 1 - 255. The answer to the read command is in "xxx" format.<br>• SARA-R5 - The default value is 60 s |

### 11.15.4 Notes

**SARA-R5**

- The set command has no effect and shall be issued always with the <value> parameter.
- The command setting is not stored in the personal profile.
- The read command returns always 60.

## 11.16 Escape prompt delay (EPD) S12

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

### 11.16.1 Description

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

Furthermore, the timeout is:

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

### 11.16.2 Syntax

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

### 11.16.3 Defined values

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

### 11.16.4 Notes

**SARA-R5**

- The <value> parameter is not mandatory.

## 11.17 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 |

### 11.17.1 Description

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

### 11.17.2 Syntax

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

### 11.17.3 Defined values

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

## 11.18 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 |

### 11.18.1 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.

### 11.18.2 Syntax

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

### 11.18.3 Defined values

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

## 11.19 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 |

### 11.19.1 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.

### 11.19.2 Syntax

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

### 11.19.3 Defined values

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

# 11.20 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 |

## 11.20.1 Description

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

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

☞ SARA-R5
For more details on the settings stored in the profiles, see the Appendix B.1.

## 11.20.2 Syntax

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

## 11.20.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <value> | Number | Profile index, optional parameter. Allowed values:<br>• SARA-R5 - 0 (default value), 1 |

# 11.21 Set to factory defined configuration &F

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

## 11.21.1 Description

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

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

☞ SARA-R5
For more details on the settings stored in the profiles, see the Parameters stored in profiles.

## 11.21.2 Syntax

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

## 11.21.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <value> | Number | Only 0 allowed |

## 11.22 Store current configuration &W

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

### 11.22.1 Description

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

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

### 11.22.2 Syntax

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

### 11.22.3 Defined values

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

## 11.23 Display current configuration &V

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

### 11.23.1 Description

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

SARA-R5
Since not all configuration items are listed with this command, see the example below for the list of the displayed configuration items. Appendix B.1 provides the complete list of the configuration items stored in the profiles.

### 11.23.2 Syntax

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

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | STORED PROFILE 1: &C1, &D1, &S1, &K3, E1, Q0, V1, X4, S00:000, S02:043, S03:013, S04:010, S05:008, S07:060, +CBST:007, 000, 001, +CRLP:061, 061, 048, 006, +CR:000, +CRC:000, +IPR:0, +COPS:0,0, FFFFF, +ICF:3,1, +UPSV: 0, +CMGF:0, +CNMI:1,0,0,0,0, +USTS: 0<br><br>OK |

## 11.24 Designate a default reset profile &Y

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

### 11.24.1 Description

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

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

### 11.24.2 Syntax

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

### 11.24.3 Defined values

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

# 12 SIM management

## 12.1 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 |

### 12.1.1 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.

SARA-R5
The PIN insertion is not mandatory before the command execution.

### 12.1.2 Syntax

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

### 12.1.3 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 [17] and ETSI TS 102 221 [74] |
| <response> | String | Response to the command passed on by the SIM to the MT (3GPP TS 51.011 [17] and ETSI TS 102 221 [74]) |

## 12.2 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 |

### 12.2.1 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.

SARA-R5
The PIN insertion is not mandatory before the command execution.

### 12.2.2 Syntax

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

### 12.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <command> | Number | Allowed values:<br>• 176: read binary<br>• 178: read record<br>• 192: get response<br>• 214: update binary<br>• 220: update record<br>• 242: status<br>• 203: retrieve data<br>• 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 [18]. |
| <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 [17] and ETSI TS 102 221 [74]. |
| <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 [74] (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 [74]. |
| <sw1>, <sw2> | Number | Contains SIM information about the execution of the actual command and can be (more details in 3GPP TS 51.011 [17] and ETSI TS 102 221 [74]).<br>Status words examples for 2G SIM cards:<br>• 0x90 0x00: normal ending of the command<br>• 0x9F 0xXX: length XX of the response data<br>• 0x92 0x0X: command successful but after using an internal retry routine X times<br>• 0x92 0x40: memory problem<br>• 0x94 0x00: no EF selected<br>• 0x94 0x02: out of range (invalid address)<br>• 0x94 0x04: file ID not found; pattern not found<br>• 0x94 0x08: file is inconsistent with the command<br>• 0x98 0x02: no CHV initialized<br>• 0x98 0x04: access condition not fullfiled / unsucc. CHV verify / authent.failed<br>• 0x98 0x08: in contradiction with CHV status<br>• 0x98 0x10: in contradiction with invalidation status<br>• 0x98 0x40: unsucc. CHV-verif. or UNBLOCK CHV-verif. / CHV blocked / UNBL.blocked<br>• 0x67 0xXX: incorrect parameter P3<br>• 0x6A 0x81: function not supported<br>• 0x6A 0x82: file not found<br>• 0x6B 0xXX: incorrect parameter P1 or P2<br>• 0x6D 0xXX: unknown instruction code given in the command<br>• 0x6E 0xXX: wrong instruction class given in the command<br>• 0x6F 0xXX: technical problem with no diagnostic given<br>Status words examples for 3G SIM cards:<br>• 0x90 0x00: normal ending of the command |

| Parameter | Type | Description |
|---|---|---|
| | | • 0x91 0xXX: length XX of the response data<br>• 0x63 0xCX: command successful but after using an internal retry routine X times<br>• 0x62 0x00: no information given, state of non volatile memory unchanged<br>• 0x64 0x00: no information given, state of non-volatile memory unchanged<br>• 0x65 0x00: no information given, state of non-volatile memory changed<br>• 0x65 0x81: memory problem<br>• 0x67 0x00: wrong length<br>• 0x69 0x85: conditions of use not satisfied<br>• 0x69 0x86: command not allowed (no EF selected)<br>• 0x69 0x82: security status not satisfied<br>• 0x62 0x81: part of returned data may be corrupted<br>• 0x6A 0x81: function not supported<br>• 0x6A 0x82: file not found<br>• 0x6A 0x83: record not found<br>• 0x6B 0x00: wrong parameter(s) P1, P2<br>• 0x6D 0x00: instruction code not supported or invalid<br>• 0x6E 0x00: instruction code not supported or invalid<br>• 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 [17] and the ETSI TS 102 221 [74]). 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. |

### 12.2.4 Notes

**SARA-R5**

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

## 12.3 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 |

### 12.3.1 Description

Reads the language from the SIM.

The read syntax will display the most preferred language from the preferred language list in:

- SARA-R5 - the $EF_{LI}$ (6F05) file. If the $EF_{LI}$ file does not exist, the preferred language is read from $EF_{PL}$ (2F05) file.

### 12.3.2 Syntax

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

### 12.3.3 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 |

## 12.4 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 |

### 12.4.1 Description

Returns the type of application which is present on the ICC or UICC.

SARA-R5
The command needs the SIM module to work correctly.

### 12.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Read | AT+UUICC? | +UUICC: <state> | +UUICC: 1 |
| | | OK | OK |

### 12.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <state> | Number | • 0: 2G SIM (SIM application present)<br>• 1: 3G SIM (USIM application present)<br>• 2: 4G SIM (USIM and ISIM applications present) |

### 12.4.4 Notes

**SARA-R5**

- <state>=0 (2G SIM) is not supported.

## 12.5 Customer service profile +UCSP

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

### 12.5.1 Description

Reads the customer service profile (CSP) from the SIM. The CSP indicates the services that are user accessible.

The syntax +UCSP (if the <service_group> parameter is not issued) displays all the service groups.

If CSP information is not available on the SIM, the "+CME ERROR: SIM Failure" error result code is returned when trying to interrogate all or one of the service groups.

### 12.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UCSP[=<service group>] | +UCSP: <service_group>,<services><br>[+UCSP: <service_group>, <services><br>[...]]<br>OK | AT+UCSP=6<br>+UCSP=6,10000000<br>OK |
| Test | AT+UCSP=? | +UCSP: (list of supported <service group>s)<br>OK | +UCSP: (1-9,c0,d5)<br>OK |

### 12.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <service_group> | Number | Service group (1-9, c0, d5) |
| <services> | Number | Services of one service group in bit-format beginning with the most significant bit of the service byte |

### 12.5.4 Notes

**SARA-R5**

- The <service group> parameter is mandatory.

## 12.6 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 |

### 12.6.1 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.

### 12.6.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UDCONF=50,<sim_hot_insertion> | OK | AT+UDCONF=50,1<br>OK |
| Read | AT+UDCONF=50 | +UDCONF: 50,<sim_hot_insertion><br>OK | AT+UDCONF=50<br>+UDCONF: 50,1<br>OK |

### 12.6.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <sim_hot_insertion> | Number | SIM hot insertion setting. Allowed values:<br>• 0 (factory-programmed value): SIM hot insertion disabled<br>• 1: SIM hot insertion enabled |

### 12.6.4 Notes

**SARA-R5**

- 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.
- 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).

## 12.7 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 |

### 12.7.1 Description

Asks the MT to discover what applications are available for selection on the UICC. According to ETSI TS 102.221 [74], 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.

### 12.7.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CUAD[=<option>]<br>OK | +CUAD: <response>[,<active_application>[,<AID>]]<br>OK | AT+CUAD=1<br>+CUAD: 61124F10A0000000871002FFFFFFFF89060400FFFFFFFFFFFFFFFFFFFFFFFFFF9000,2,A0000000871002FFFFFFFF89060400FF<br>OK |
| Test | AT+CUAD=? | +CUAD: (list of supported <option>s)<br>OK | +CUAD: (0,1)<br>OK |

### 12.7.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <option> | Number | • 0 (default value): no parameters requested in addition to <response><br>• 1: include <active_application> |
| <response> | String | Content of the $EF_{DIR}$ in hexadecimal format |
| <active_application> | Number | Active application:<br>• 0: no SIM or USIM active<br>• 1: active application is SIM<br>• 2: active application is USIM, followed by <AID><br>• 3: active application is ISIM, followed by <AID> |
| <AID> | String | AID of active USIM in hexadecimal format |

### 12.7.4 Notes

**SARA-R5**

- The SIM (2G) application is not supported.

## 12.8 Open logical channel +CCHO

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

### 12.8.1 Description

Causes the MT to return <sessionid> to allow the TE to identify a channel that is being allocated by the currently selected UICC, which is attached to ME. The currently selected UICC will open a new logical channel, select the

application identified by the <dfname> received with this command and return a session Id as the response. The ME shall restrict the communication between the TE and the UICC to this logical channel.

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

SARA-R5
The <sessionid> is to be used when sending commands with +CRLA or +CGLA commands.

### 12.8.2 Syntax

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

### 12.8.3 Defined values

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

## 12.9 Close logical channel +CCHC

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

### 12.9.1 Description

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

### 12.9.2 Syntax

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

### 12.9.3 Defined values

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

## 12.10 Generic UICC logical channel access +CGLA

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

### 12.10.1 Description

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

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

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

☞ SARA-R5
Compared to the +CRLA command, the definition of +CGLA allows TE to take more control over the UICC-MT interface. The locking and unlocking of the interface may be done by a special <command> value or automatically by TA/MT (by interpreting <command> parameter). If the TE application does not use the unlock command (or does not send a <command> causing automatic unlock) in a certain timeout value, the MT may release the locking.

☞ SARA-R5
The PIN insertion is not mandatory before the command execution.

### 12.10.2 Syntax

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

### 12.10.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <sessionid> | Number | Identifier of the session to be used to send the APDU commands to the UICC. It is mandatory to send the commands to the UICC when targeting applications on the smart card using a logical channel other than the default channel (channel "0").<br>☞ SARA-R5<br>The <sessionid> range (257 - 259) maps to logical channels (1 - 3). Logical channel '0' is the default channel for UICC communication and cannot be closed. |
| <length> | Number | Length of the characters that are sent to TE in <command> or <response> (two times the actual length of the command or response) |
| <command> | String | Command passed on by the MT to the UICC in the format as described in 3GPP TS 31.101 [73] (hexadecimal character format; see +CSCS AT command) |
| <response> | String | Response to the command passed on by the UICC to the MT in the format as described in 3GPP TS 31.101 [73] (hexadecimal character format; see +CSCS AT command) |

## 12.11 Restricted UICC logical channel access +CRLA

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

### 12.11.1 Description

By using this command instead of +CGLA, the TE application has easier but more limited access to the UICC database. The set command transmits to the MT the UICC <command> and its required parameters. The MT internally handles, for the selected UICC, all the UICC-MT interface locking and file selection routines. As response to the command, the MT sends the actual UICC information parameters and response data. An MT error result code may be returned when the command cannot be passed to the UICC, but the failure in the execution of the command in the UICC 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 UICC by another AT interface or by internal clients (e.g. BIP, IMS).

☞ SARA-R5
The PIN insertion is not mandatory before the command execution.

### 12.11.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CRLA=<sessionid>,<command>[,<fileid>[,<P1>,<P2>,<P3>[,<data>[,<pathid>]]]] | +CRLA: <sw1>,<sw2>[,<response>]<br>OK | AT+CRLA=11791,176,28419,0,0,256<br>+CRLA: 144,0,800 D746573742E33677070 2E636F6DFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF<br>OK |
| Test | AT+CRLA=? | OK | |

### 12.11.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <sessionid> | Number | Identifier of the session to be used to send the APDU commands to the UICC. It is mandatory to send commands to the UICC when targeting applications on the smart card using a logical channel other than the default channel (channel "0").<br>☞ SARA-R5<br>The <sessionid> range (257 - 259) maps to logical channels (1 - 3). Logical channel '0' is the default channel for UICC communication and cannot be closed. |
| <command> | Number | Command passed on by the MT to the UICC, see the 3GPP TS 31.101 [73]:<br>• 176: READ BINARY<br>• 178: READ RECORD<br>• 192: GET RESPONSE<br>• 214: UPDATE BINARY<br>• 220: UPDATE RECORD<br>• 242: STATUS<br>• 203: RETRIEVE DATA<br>• 219: SET DATA |
| <fileid> | Number | Identifier of an elementary datafile on UICC. Mandatory for every command except STATUS. The values are described in ETSI TS 102.221 [74]. The range depends on the actual UICCand is defined in 3GPP TS 31.101 [73]. |
| <P1> | Number | Parameter passed on by the MT to the UICC. The values are described in 3GPP TS 31.101 [73]. Mandatory for every command except GET RESPONSE and STATUS. |
| <P2> | Number | Parameter passed on by the MT to the UICC. The values are described in 3GPP TS 31.101 [73]. Mandatory for every command except GET RESPONSE and STATUS. |
| <P3> | Number | Parameter passed on by the MT to the UICC. The values are described in 3GPP TS 31.101 [73]. Mandatory for every command except GET RESPONSE and STATUS. |
| <data> | String | Information which shall be written to the SIM (hexadecimal character format; see +CSCS AT command) |

| Parameter | Type | Description |
|---|---|---|
| <pathid> | String | Contains the path of an elementary file on the UICC in hexadecimal format. This parameter shall only be used in the mode "select by path from current DF" as defined in ETSI TS 102.221 [74]. |
| <sw1> | Number | Information from the UICC about the execution of the actual command. This parameter is delivered to the TE in both cases, on successful or failed execution of the command. For examples of Status Words, see the +CRSM AT command. |
| <sw2> | Number | Additional information depending on <sw1>. This parameter is delivered to the TE in both cases, on successful or failed execution of the command. For examples of Status Words, see the +CRSM AT command. |
| <response> | String | Response of a successful completion of the command previously issued (hexadecimal character format; see +CSCS). The 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 3GPP TS 31.101 [73]). After the READ BINARY, READ RECORD or RETRIEVE DATA command the requested data will be returned. The parameter is not returned after a successful UPDATE BINARY, UPDATE RECORD or SET DATA command. |

## 12.12 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 |

### 12.12.1 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).

### 12.12.2 Syntax

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

### 12.12.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Bitmask representing which indications the +UUSIMSTAT URC is allowed to report.<br>See Table 12 for the meaning of each bit. The factory-programmed value is 0. |
| <state> | Number | • 0: SIM card not present<br>• 1: PIN needed<br>• 2: PIN blocked<br>• 3: PUK blocked<br>• 4: (U)SIM not operational<br>• 5: (U)SIM in restricted use (FDN or BDN active)<br>• 6: (U)SIM operational (registration may be initiated)<br>• 7: SIM phonebook ready to be used (when the SIM application is active)<br>• 8: USIM phonebook ready to be used (when the USIM application is active) |

| Parameter | Type | Description |
|---|---|---|
| | | • 9: (U)SIM toolkit REFRESH proactive command successfully concluded<br>• 10: (U)SIM toolkit REFRESH proactive command unsuccessfully concluded<br>• 11: PPP connection active, (U)SIM toolkit REFRESH proactive command delayed till PPP deactivation<br>• 12: voice call active, (U)SIM toolkit REFRESH proactive command delayed till call release<br>• 13: CSD call active, (U)SIM toolkit REFRESH proactive command delayed till call release |

## 12.12.4 Notes

- <state>=9 and 10 will not be reported when dedicated (+CFUN: 6) or raw (+CFUN: 9) mode is active.
- Table 12 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 12: <mode> bitmask meaning**

**SARA-R5**

- <state>=7, 8, 9, 10, 11, 12 and 13 are not reported.

# 13 SIM toolkit

## 13.1 Introduction

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

SARA-R5
Once the SIM toolkit interface has been enabled via AT+CFUN=6 or AT+CFUN=9 commands, the DTE is notified SIM toolkit commands and events via URC and can interact with the SIM through appropriate STK AT commands. If the DTE does not issue Terminal response to those SIM toolkit commands waiting for user intervention, after a timeout the module will autonomously return a negative terminal response to the UICC card and notify the DTE.

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

For more details on the command description and parameters, see 3GPP TS 51.014 [40].

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

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

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

The STK commands related to the Bearer Independent Protocol, i.e. Open Channel, Close Channel, Receive Data, Send Data, Get Channel Status and the events Data Available and Channel Status, are autonomously managed by the device without the intervention from the TE, unless the dedicated mode is active and the Open Channel command requires the user intervention (see ETSI TS 102 223 [43]).

## 13.2 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 |

### 13.2.1 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.

### 13.2.2 Syntax

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

### 13.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Indicates whether the +UUBIP URC is enabled or not:<br>• 0 (factory-programmed value): BIP status indication disabled<br>• 1: BIP status indication enabled<br>• 2: OPEN CHANNEL, CLOSE CHANNEL and CHANNEL STATUS EVENT status indications enabled<br>Allowed values:<br>• SARA-R5 - 0, 1 |
| <ev_cmd> | Number | Indicates the event download's tag or proactive command's tag. Allowed values:<br>• 10: Channel status event<br>• 64: Open channel proactive command<br>• 65: Close channel proactive command<br>• 66: Receive data proactive command<br>• 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 [43]) |

## 13.3 Terminal profile +UCATPROF

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

### 13.3.1 Description

Allows reading and changing the current terminal profile (i.e. the list of SIM Application Toolkit facilities supported by the terminal, see ETSI TS 102 223 [43]) sent to the SIM card; if the terminal profile has changed, it is downloaded to the SIM card. Changes in the terminal profile are not persistent after reboot. The SIM card may use this information to filter the proactive commands sent to the module. This command does not actually remove/add any functionality from/to the module.

### 13.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UCATPROF=<length>,<data> | OK | AT+UCATPROF=2,"1F7F"<br>OK |
| Read | AT+UCATPROF? | +UCATPROF: <length>,<data><br>OK | +UCATPROF:17,"FFFFFFFF7F0300DF7F00000000010A0003"<br>OK |
| Test | AT+UCATPROF=? | OK | |

### 13.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <length> | Number | Length in bytes of data sent to DTE in <data> |
| <data> | String | Terminal profile data coded in hexadecimal format |

# 14 Packet switched data services

## 14.1 PDP contexts and parameter definition

### 14.1.1 Primary and secondary PDP contexts

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

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

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

| PDP context type | Activation procedure |
|---|---|
| Primary | Used to establish a logical connection through the network from the UE to the GGSN with a specifically negotiated Quality of Service (QoS).<br><br>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.<br><br>The two contexts may have different QoS profiles, which makes the feature useful for applications that have different QoS requirements (e.g. IP multimedia); QoS is applied based on port number addressing. |

SARA-R5
At most 2 secondary PDP contexts may be associated to a primary PDP context and at most 2 secondary PDP contexts can be activated, since the maximum number of PDP contexts, both normal and secondary, is always 3.

### 14.1.2 Multiple PDP contexts

Two PDP context types are defined:

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

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

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

### 14.1.3 Parameter definition

#### 14.1.3.1 <APN>

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

The maximum length of the parameter is:

- SARA-R5 - 99 characters (the maximum length of coded APN is 100 octets, see 3GPP TS 23.003 [96], subclause 9.1)

#### 14.1.3.2 <cid>

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

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

| Product | Max number of definable PDP contexts | Max number of active PDP contexts |
|---|---|---|
| SARA-R5 | 12 (see SARA-R5 notes) | 7 |

SARA-R5
The <cid> range goes from 0 to 11.
<cid> values 0 and 1 cannot be used for emergency services.
<cid>=1 is mapped to the initial default EPS bearer (see Primary and secondary PDP contexts) with default parameters.
Its configuration can be done with +CGDCONT AT command.

#### 14.1.3.3 <PDP_addr>

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

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

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

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

#### 14.1.3.4 <PDP_type>

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

- "IP": Internet Protocol (IETF STD 5)
- "NONIP": Non IP
- "IPV4V6": virtual <PDP_type> introduced to handle dual IP stack UE capability (see the 3GPP TS 24.301 [69])
- "IPV6": Internet Protocol, version 6 (see RFC 2460 [25])

## 14.2 PPP LCP handshake behaviour

When a data call is initiated by means of D* AT command, the module switches to PPP mode just after the CONNECT intermediate result code. The first step of the PPP procedure is the LCP handshake, in this phase the behaviour of module series differ between them.

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

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

**SARA-R5**
The module starts sending the LCP configuration packets by its side (up to 10 retries every 3 s). If no valid LCP response packet is received from the TE, the module drops the PDP context and returns the NO CARRIER final result code.

## 14.3 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 |

### 14.3.1 Description

Defines the printing format of IPv6 address parameters of the other AT commands. See RFC 4291 [75] for details of the IPv6 address format.

SARA-R5
The affected parameters are:

- In +CGTFT and +CGTFTRDP the <remote_address_and_subnet_mask> parameter
- 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

### 14.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CGPIAF=[<IPv6_AddressFormat>[,<IPv6_SubnetNotation>[,<IPv6_LeadingZeros>[,<IPv6_CompressZeros>]]]] | OK | AT+CGPIAF=1,1,1,1<br>OK |
| Read | AT+CGPIAF? | +CGPIAF: <IPv6_AddressFormat>,<IPv6_SubnetNotation>,<IPv6_LeadingZeros>,<IPv6_CompressZeros><br>OK | +CGPIAF: 0,0,0,0<br>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)<br>OK | +CGPIAF: (0-1),(0-1),(0-1),(0-1)<br>OK |

### 14.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <IPv6_AddressFormat> | Number | Defines the IPv6 address format:<br>• 0 (default value): IPv4-like dot-notation used. IP address and subnetwork mask if applicable, are dot-separated<br>• 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:<br>• 0 (default value): both IP address and subnet mask are explicitly stated, separated by a space<br>• 1: the printout format is applying / (forward slash) subnet-prefix Classless Inter-Domain Routing (CIDR) |

| Parameter | Type | Description |
|---|---|---|
| <IPv6_ LeadingZeros> | Number | Defines whether leading zeros are omitted or not. The setting does not apply if <IPv6_ AddressFormat>=0:<br>• 0 (default value): leading zeros omitted<br>• 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:<br>• 0 (default value): no zero compression<br>• 1: use zero compression |

### 14.3.4 Notes

**SARA-R5**

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

## 14.4 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 |

### 14.4.1 Description

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

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

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

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

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

SARA-R5
After the PDP context activation, the information text response to the read command provides the configuration negotiated with the network (similarly to +CGTFTRDP and +CGCONTRDP AT commands).

### 14.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CGDCONT=[<cid>[,<PDP_ type>[,<APN>[,<PDP_addr>[, <d_comp>[,<h_comp>[, <IPv4AddrAlloc>[,<request_ type>[,<P-CSCF_discovery>[, <IM_CN_Signalling_Flag_Ind>[, <NSLPI>[,<secure_PCO>[,<IPv4_ MTU_discovery>[,<Local_Addr_ Ind>]]]]]]]]]]]]] | OK | **IPv4 example**<br>AT+CGDCONT=1,"IP","APN_name", "1.2.3.4",0,0<br>OK<br>**IPv4v6 example**<br>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<br>OK<br>**IPv6 example**<br>AT+CGDCONT=1,"IPV6","APN","0.0.0 .0.0.0.0.0.0.0.0.0.0.0.0",0,0<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| Read | AT+CGDCONT? | +CGDCONT: <cid>,<PDP_type>,<APN>,<PDP_addr>,<d_comp>,<h_comp>[,<IPv4AddrAlloc>,<request_type>,<P-CSCF_discovery>,<IM_CN_Signalling_Flag_Ind>[,<NSLPI>[,<secure_PCO>[,<IPv4_MTU_discovery>[,<Local_Addr_Ind>]]]]]<br><br>[+CGDCONT: <cid>,<PDP_type>,<APN>,<PDP_addr>,<d_comp>,<h_comp>[,<IPv4AddrAlloc>,<request_type>,<P-CSCF_discovery>,<IM_CN_Signalling_Flag_Ind>[,<NSLPI>[,<secure_PCO>[,<IPv4_MTU_discovery>[,<Local_Addr_Ind>]]]]]]<br><br>OK | +CGDCONT: 1,"IP","web.omnitel.it","91.80.140.199",0,0,0,2,0,0,0,0,0,0<br><br>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 <request_type>s),(list of supported <P-CSCF_discovery>s),(list of supported <IM_CN_Signalling_Flag_Ind>s),(list of supported <NSLPI>s),(list of supported <secure_PCO>s),(list of supported <IPv4_MTU_discovery>s),(list of supported <Local_Addr_Ind>s)<br><br>[+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 <request_type>s),(list of supported <P-CSCF_discovery>s),(list of supported <IM_CN_Signalling_Flag_Ind>s),(list of supported <NSLPI>s),(list of supported <secure_PCO>s),(list of supported <IPv4_MTU_discovery>s),(list of supported <Local_Addr_Ind>s)]<br><br>OK | +CGDCONT: (0-11),"IP",,,(0-2),(0-4),(0,1),(0,3),(0,1),(0,1),(0,1),(0,1),(0,1),(0,1)<br><br>+CGDCONT: (0-11),"IPV6",,,(0-2),(0-4),(0,1),(0,3),(0,1),(0,1),(0,1),(0,1),(0,1),(0,1)<br><br>+CGDCONT: (0-11),"IPV4V6",,,(0-2),(0-4),(0,1),(0,3),(0,1),(0,1),(0,1),(0,1),(0,1),(0,1),(0,1)<br><br>OK |

### 14.4.3 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:<br>• 0 (default value): off<br>• 1: on (predefined compression type i.e. V.42bis data compression)<br>• 2: V.42bis data compression<br>• 3: V.44 |
| <h_comp> | Number | PDP header compression; it can have the values:<br>• 0 (default value): off<br>• 1: on (predefined compression type, i.e. RFC1144)<br>• 2: RFC1144<br>• 3: RFC2507 |

| Parameter | Type | Description |
|---|---|---|
| | | • 4: RFC3095<br>☞ <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:<br>• 0 (default value): IPv4 Address Allocation through NAS Signalling<br>• 1: IPv4 Address Allocated through DHCP |
| <emergency_ indication> | Number | Indicates whether the PDP context is for emergency bearer services or not:<br>• 0 (default value): PDP context is not for emergency bearer services<br>• 1: PDP context is for emergency bearer services |
| <request_type> | Number | Indicates the type of PDP context activation request for the PDP context:<br>• 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)<br>• 1: PDP context is for emergency bearer services<br>• 2 (default value): PDP context is for new PDP context establishment<br>• 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 [82] annex B and annex L:<br>• 0 (default value): preference of P-CSCF address discovery not influenced by +CGDCONT<br>• 1: preference of P-CSCF address discovery through NAS Signalling<br>• 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:<br>• 0: PDP context is not for IM CN subsystem-related signalling only<br>• 1: PDP context is for IM CN subsystem-related signalling only |
| <NSLPI> | Number | Indicates the NAS signalling priority requested for the corresponding PDP context:<br>• 0 (default value): indicates that the PDP context has to be activated with the value for the low priority indicator configured in the MT.<br>• 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".<br>The MT utilises the NSLPI information provided as specified in 3GPP TS 24.301 [69] and 3GPP TS 24.008 [12]. |
| <secure_PCO> | Number | Specifies if security protected transmission of PCO is requested or not (applicable for EPS only):<br>• 0 (default value): Security protected transmission of PCO is not requested.<br>• 1: Security protected transmission of PCO is requested. |
| <IPv4_MTU_ discovery> | Number | Influences how the MT/TA requests to get the IPv4 MTU size:<br>• 0 (default value): Preference of IPv4 MTU size discovery not influenced by +CGDCONT.<br>• 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:<br>• 0 (default value): indicates that the MS does not support local IP address in TFTs.<br>• 1: indicates that the MS supports local IP address in TFTs. |

### 14.4.4 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)<br>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 |

| Command | Response | Description |
|---|---|---|
| AT+CGDCONT? | +CGDCONT: 2,"IP","internet","0.0.0.0",0,0<br>+CGDCONT: 1,"IP","STATREAL","0.0.0.0",0,0<br>+CGDCONT: 3,"IP","tim.ibox.it","0.0.0.0",0,0<br>OK | Read command |

**SARA-R5**

- 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"
- The default value assigned to the <cid> parameter when not specified is 0.
- <cid> values 0 and 1 cannot be used with <request_type>=1 (i.e. emergency services).
- In all the +UMNOPROF AT command configuration, except for the Verizon (see the +UMNOPROF AT command, <MNO>=3) configuration, the +CGDCONT entries are synchronized at power on to the entries of the LwM2M object 11 "APN connection profile" instances. Update of instances in LwM2M database (see Lightweight M2M) will cause update of the +CGDCONT entries. Create / delete / update of EPS bearers by means of the +CGDCONT AT command will cause create / delete / update of instances in LwM2M database (see Lightweight M2M). It is possible for the LwM2M AT&T server to disable a certain APN by setting resource 3 "APN Enable status" to "false". This would cause the corresponding APN to be deactivated automatically and its activation, triggered by any client including AT+CGACT, will be locally rejected.
- In Verizon configuration (see the +UMNOPROF AT command, <MNO>=3) the EPS bearers with the <cid> parameter in range from 1 to 7 are defined by default and are aligned to the entries of the Verizon APN table (see the +VZWAPNE AT command).
- <d_comp>=3 is not supported.
- The module automatically accepts the Mobile Terminated EPS bearers.
- The <cid> of a mobile terminated EPS bearer is assigned following the rules below:
  - the first not defined <cid> in the ordered list = [11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 0];
  - if all <cid>s are defined, the first not active <cid> defined as secondary PDP context in the ordered list = [11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 0];
  - if all <cid>s are defined and all <cid>s defined as secondary PDP contexts are active, the first not active <cid> defined as primary PDP context in the ordered list = [11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 0].

# 14.5 IPv6 configuration +UDCONF=66

| +UDCONF=66 | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | NVM | No | - | +CME Error |

## 14.5.1 Description

Configures the IPv6 support. If <IPv6_conf>=3 (IPv6 interface identifier randomization) it is mandatory to provide the <IID_mode> parameter.

If IPv6 is not supported, also IPv4v6 is not supported.

The configuration will be effective at the next module power-on.

## 14.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **IPv6 configuration** | | | |
| Set | AT+UDCONF=66,<IPv6_conf> | OK | AT+UDCONF=66,1<br>OK |
| Read | AT+UDCONF=66 | +UDCONF: 66,<IPv6_conf> | AT+UDCONF=66 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | OK | +UDCONF: 66,0<br>OK |
| **IPv6 IID is used by IPSS/TRECK during Neighbor Discovery Protocol (NDP) for Router Solicitation (RS)** | | | |
| Set | AT+UDCONF=66,3,<IID_mode> | OK | AT+UDCONF=66,3,1<br>OK |
| Read | AT+UDCONF=66,3 | +UDCONF: 66,3,<IID_mode><br>OK | AT+UDCONF=66,3<br>+UDCONF: 66,3,1<br>OK |

### 14.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <IPv6_conf> | Number | IPv6 support enable / disable. Allowed values:<br>• 0: IPv6 support disabled<br>• 1 (factory-programmed value): IPv6 support enabled; IPv6 stateless address autoconfiguration is available only for LTE (the Router Solicitation is transmitted at EPS bearer activation)<br>• 2: IPv6 support enabled; IPv6 stateless address autoconfiguration is available for every RAT (the Router Solicitation is transmitted at PDP context/EPS bearer activation)<br>• 3: IPv6 interface identifier (IID) randomization |
| <IID_mode> | Number | IID randomization mode. Allowed values:<br>• 0 (default value): use the network assigned interface identifier (IID). During the IPv6 configuration the IID is received from the network<br>• 1: use a random IID. According the <AT&T> device requirements 13340 [49] (CDR-CDS-183, IPv6 Addressing) a random IID shall be used |

### 14.5.4 Notes

**SARA-R5**

- <IPv6_conf>=0, 1, 2 are not supported.
- The factory-programmed value of <IPv6_conf> parameter is 3.

## 14.6 Packet switched data configuration +UPSD

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

### 14.6.1 Description

Sets or reads all the parameters in a specific packet switched data (PSD) profile. The command is used to set up the PDP context parameters for an internal context, i.e. a data connection using the internal IP stack and related AT commands for sockets.

To set all the parameters of the PSD profile a set command for each parameter needs to be issued.

☞ In the read command, if only the first parameter is issued, the module returns all the parameters of the given PSD profile, and lists them in separated lines.

### 14.6.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UPSD=<profile_id>,<param_tag>,<param_val> | OK | AT+UPSD=0,1,"apn.provider.com"<br>OK |
| Read | AT+UPSD=<profile_id>,<param_tag> | +UPSD: <profile_id>,<param_tag>,<param_val><br>OK | AT+UPSD=0,1<br>+UPSD: 0,1,"apn.provider.com" |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | OK |
| | AT+UPSD=<profile_id> | +UPSD: <profile_id>,0,<param_val0> | AT+UPSD=0 |
| | | +UPSD: <profile_id>,1,<param_val1>... | +UPSD: 0,0,0 |
| | | +UPSD: <profile_id>,x,<param_valx> | +UPSD: 0,1,"apn.provider.com" |
| | | OK | +UPSD: 0,2,"username" |
| | | | +UPSD: 0,4,"0.0.0.0" |
| | | | ... |
| | | | +UPSD: 0,19,0 |
| | | | OK |

### 14.6.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <profile_id> | Number | PSD profile identifier. Allowed values:<br>• SARA-R5 - 0-6 |
| <param_tag> | Number | Allowed values:<br>• 0: protocol type - the allowed values of <param_val> parameter are:<br>o 0 (default value): IPv4<br>o 1: IPv6<br>o 2: IPv4v6 with IPv4 preferred for internal sockets<br>o 3: IPv4v6 with IPv6 preferred for internal sockets<br>• 1: APN - <param_val> defines the APN text string, e.g. "apn.provider.com"; the maximum length is 99. The default value is an empty string.<br>• 2: username - <param_val> is the user name text string for the authentication phase. The default value is an empty string. The maximum length is 64 characters.<br>• 3: password - <param_val> is the password text string for the authentication phase. Note: the AT+UPSD read command with <param_tag> = 3 is not allowed and the read all command does not display it. The maximum length is 64 characters.<br>• 4: DNS1 - <param_val> is the text string of the primary DNS address. IPv4 DNS addresses are specified in dotted decimal notation form (i.e. four numbers in range 0-255 separated by periods, e.g. "xxx.yyy.zzz.www"). IPv6 DNS addresses are specified in standard IPv6 notation form (2001:DB8:: address compression is allowed). The default value is "0.0.0.0".<br>• 5: DNS2 - <param_val> is the text string of the secondary DNS address. IPv4 DNS addresses are specified in dotted decimal notation form (i.e. four numbers in range 0-255 separated by periods, e.g. "xxx.yyy.zzz.www"). IPv6 DNS addresses are specified in standard IPv6 notation form (2001:DB8:: address compression is allowed). The default value is "0.0.0.0".<br>• 6: authentication - the <param_val> parameter selects the authentication type:<br>o 0 (default value): none<br>o 1: PAP<br>o 2: CHAP<br>o 3: automatic selection of authentication type (none/CHAP/PAP)<br>• 7: IP address - <param_val> is the text string of the static IP address given by the ISP in dotted decimal notation form (i.e. four numbers in range 0-255 separated by periods, e.g. "xxx.yyy.zzz.www"). The default value is "0.0.0.0". Note: IP address set as "0.0.0.0" means dynamic IP address assigned during PDP context activation<br>• 8: data compression - the <param_val> parameter refers to the default parameter named <d_comp> and selects the data compression type:<br>o 0 (default value): off<br>o 1: predefined, i.e. V.42bis<br>o 2: V.42bis<br>• 9: header compression - the <param_val> parameter refers to the default parameter named <h_comp> and selects the header compression type:<br>o 0 (default value): off<br>o 1: predefined, i.e. RFC1144<br>o 2: RFC1144<br>o 3: RFC2507 |

| Parameter | Type | Description |
|---|---|---|
| | | o 4: RFC3095<br>• 100: map the +UPSD profile to the specified <cid> in the +CGDCONT table.<br>o 0: map the current profile to default bearer PDP ID<br>o 1: map the current profile to <cid> 1<br>o 2: map the current profile to <cid> 2<br>o 3: map the current profile to <cid> 3<br>o 4: map the current profile to <cid> 4<br>o 5: map the current profile to <cid> 5<br>o 6: map the current profile to <cid> 6<br>o 7: map the current profile to <cid> 7<br>o 8: map the current profile to <cid> 8<br>Allowed values:<br>• SARA-R5 - 0, 1, 4, 5, 100 |

### 14.6.4 Notes

**SARA-R5**

- Set the APN by means of +UPSD AT command before to use <param_tag>=100.
- If <param_tag>= 100 (profile to <cid> mapping) the <param_val> default value is 8 (map the current profile to <cid> 8) and <param_val>=0 is not supported.
- The authentication parameters can be configured by means of the +UAUTHREQ AT command. All the other advanced parameters (e.g. QoS) can be configured using the standard 3GPP AT commands. In both cases the <cid> to be used shall be the one mapped to the +UPSD profile (through <param_tag> = 100).

## 14.7 Packet switched data action +UPSDA

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

### 14.7.1 Description

Performs the requested action for the specified PSD profile.

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

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

### 14.7.2 Syntax

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

### 14.7.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <profile_id> | Number | PSD profile identifier, in range 0-6 |
| <action> | Number | • 0: reset; it clears the specified profile resetting all the parameters to their factory-programmed values<br>• 1: store; it saves all the parameters in NVM<br>• 2: load: it reads all the parameters from NVM |

| Parameter | Type | Description |
|---|---|---|
| | | • 3: activate; it activates a PDP context with the specified profile, using the current parameters<br>• 4: deactivate; it deactivates the PDP context associated with the specified profile |
| <result> | Number | • 0: action successful<br>• Different values mean an unsuccessful action (the codes are listed in the Appendix A.1) |
| <ip_addr> | String | The IP address assigned to the activated PDP context. |

### 14.7.4 Notes

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

## 14.8 Packet switched network-assigned data +UPSND

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

### 14.8.1 Description

Returns the current (dynamic) network-assigned or network-negotiated value of the specified parameter for the active PDP context associated with the specified PSD profile.

### 14.8.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UPSND=<profile_id>,<param_tag> | +UPSND: <profile_id>,<param_tag>,<dynamic_param_val><br>OK | AT+UPSND=2,0<br>+UPSND: 2,0,"151.9.78.170"<br>OK |

### 14.8.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <profile_id> | Number | PSD profile identifier, in range 0-6 |
| <param_tag> | Number | Index representing a network-assigned or network-negotiated parameter:<br>• 0: IP address: dynamic IP address assigned during PDP context activation;<br>• 1: DNS1: dynamic primary DNS address;<br>• 2: DNS2: dynamic secondary DNS address;<br>• 3: QoS precedence: network assigned precedence class of the QoS;<br>• 4: QoS delay: network assigned delay class of the QoS;<br>• 5: QoS reliability: network assigned reliability class of the QoS;<br>• 6: QoS peak rate: network assigned peak rate value of the QoS;<br>• 7: QoS mean rate: network assigned mean rate value of the QoS<br>• 8: PSD profile status: if the profile is active the return value is 1, 0 otherwise<br>• 9: 3G QoS delivery order<br>• 10: 3G QoS erroneous SDU delivery<br>• 11: 3G QoS extended guaranteed downlink bit rate<br>• 12: 3G QoS extended maximum downlink bit rate<br>• 13: 3G QoS guaranteed downlink bit rate |

| Parameter | Type | Description |
|---|---|---|
| | | • 14: 3G QoS guaranteed uplink bit rate<br>• 15: 3G QoS maximum downlink bit rate<br>• 16: 3G QoS maximum uplink bit rate<br>• 17: 3G QoS maximum SDU size<br>• 18: 3G QoS residual bit error rate<br>• 19: 3G QoS SDU error ratio<br>• 20: 3G QoS signalling indicator<br>• 21: 3G QoS source statistics descriptor<br>• 22: 3G QoS traffic class<br>• 23: 3G QoS traffic priority<br>• 24: 3G QoS transfer delay |
| <dynamic_param_val> | String | Network-assigned or network-negotiated value of the parameter specified in <param_tag> |

### 14.8.4 Notes

**SARA-R5**

- The values of <param_tag> greater than 8 are not supported.

## 14.9 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 |

### 14.9.1 Description

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

☞ The user should not enter colliding requests (e.g. AT+CGATT=1 and AT+CGATT=0) on different communication ports, because this might cause interoperability issues in case overlapping attach and detach requests are not handled by the network, and could result in an unpredictable registration state. Similarly, when notified of a mobile terminated GPRS detach event (e.g. via +CGEV URC), it is recommended to wait a few seconds before entering AT+CGATT=0 in order to let the pending attach procedure (automatically triggered by the module in most cases) successfully end.

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

### 14.9.2 Syntax

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

### 14.9.3 Defined values

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

| Parameter | Type | Description |
|---|---|---|
| | | • 1 (default value): attached |

## 14.10 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 |

### 14.10.1 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.

☞ SARA-R5
In Verizon configuration (see the +UMNOPROF AT command), always specify the <cid> parameter when activating or deactivating a context, otherwise an error result code is provided.

### 14.10.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CGACT=[<status>[,<cid>[,...]]] | OK | AT+CGACT=1,1<br>OK |
| Read | AT+CGACT? | [+CGACT: <cid>,<status><br>[+CGACT: <cid>,<status><br>[...]]]<br>OK | +CGACT: 1,1<br>OK |
| Test | AT+CGACT=? | +CGACT: (list of supported <status>s)<br>OK | +CGACT: (0-1)<br>OK |

### 14.10.3 Defined values

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

### 14.10.4 Notes

**SARA-R5**

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

## 14.11 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 |

### 14.11.1 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.

In case of error the final result code NO CARRIER or +CME ERROR: <error> is displayed.

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

☞ SARA-R5
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 M-HEX as L2 protocol and AT&D2 is used, the channel is switched back to command mode but the PDP context remains active.

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

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

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

The following table shows some examples:

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

A packet is sent if one of the following conditions is met:

- the length field is terminated with <CR>
- the length value is equal to # characters of hex-sequence and it is terminated with <CR>
- the input is terminated with a character not equal to a hex digit and <CR>

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

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

### 14.11.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CGDATA=[<L2P>[,<cid>]] | CONNECT | AT+CGDATA="PPP",1 |

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

### 14.11.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <L2P> | String | Layer 2 protocol to be used between the DTE and MT; allowed values:<br>• "PPP" (default value)<br>• "M-HEX"<br>• "M-RAW_IP"<br>• "M-OPT-PPP"<br>☞ The application on the remote side must support the selected protocol as well. |
| <cid> | Number | See <cid>. |

### 14.11.4 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.

### 14.11.5 Usage of +CGDATA command

| Command sent by DTE | DCE response | Description |
|---|---|---|
| AT+CMEE=2 | OK | Use verbose error result codes |
| AT&D0 | OK | |
| AT+CGDCONT=1,"IP","web.omnitel.it" | OK | Define two PDP contexts |
| AT+CGDCONT=2,"IP","internet" | OK | |
| AT+CGACT=1,2 | OK | Activate PDP context 2 |
| AT+CGDATA="M-HEX",1 | CONNECT | Activate PDP context 1 and establish mandatory L2 protocol between DTE and MT |
| 1100 | DATA<br><br>OK | Send one packet of 100 bytes |
| cid=2 | OK | Switch to the already activated context 2 |
| ~+++ | NO CARRIER | Only the first activated context or the last used is closed |

## 14.12 Enter PPP state/GPRS dial-up D*

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

### 14.12.1 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.

### 14.12.2 Syntax

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

### 14.12.3 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:<br>• "PPP" (default value)<br>• "M-HEX"<br>• "M-RAW_IP"<br>• "M-OPT-PPP"<br>☞ The application on the remote side must support the selected protocol as well. |
| <cid> | Number | See <cid> |

### 14.12.4 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***#.

## 14.13 Show PDP address +CGPADDR

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

### 14.13.1 Description

Returns a list of PDP addresses for the specified context identifiers. Only defined PDP contexts are displayed.

If the <cid> parameter is omitted, the addresses for all defined contexts are returned.

### 14.13.2 Syntax

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

### 14.13.3 Defined values

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

## 14.14 Packet switched event reporting +CGEREP

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

### 14.14.1 Description

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

### 14.14.2 Syntax

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

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | +CGEV: VZW_SUBS_ACTION_ NORMAL (0) - No restriction to data traffic | |
| | | +CGEV: REJECT <PDP_type>,<PDP_ addr> | |
| | | +CGEV: NW REACT <PDP_type>, <cid> | |
| | | +CGEV: NW ACT <PDP_type>,<cid> | |

### 14.14.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Controls the processing of URCs specified within this command. Allowed values:<br>• 0 (default value): buffer URCs in the MT; if the buffer is full the oldest ones will be discarded<br>• 1: discard URCs when V.24 link is reserved (online); otherwise forward them directly to the DTE<br>• 2: buffer URCs in the MT when link reserved (online) and flush them to the DTE when the link becomes available; otherwise forward them directly to the DTE |
| <bfr> | Number | Controls the effect on buffered codes when <mode> 1 or 2 is entered. Allowed values:<br>• 0 (default value): MT buffer of URCs defined within this command is cleared when <mode> 1 or 2 is entered<br>• 1: MT buffer of URCs defined within this command is flushed to the DTE when <mode> 1 or 2 is entered (OK is given before flushing the codes) |
| <cid> | Number | See <cid> |
| <reason> | Number | Indicates whether the reason why the context activation request for PDP type IPv4v6 was not granted:<br>• 0: IPv4 only allowed<br>• 1: IPv6 only allowed<br>• 2: single address bearers only allowed<br>• 3: single address bearers only allowed and MT initiated context activation for a second address type bearer was not successful |
| <cid_other> | Number | Indicates whether the context identifier allocated by MT for an MT initiated context of a second address type |
| <p_cid> | Number | Numeric parameter that identifies the particular PDP context definition, specified using +CGDCONT, to which a secondary PDP context definition will be associated using +CGDSCONT.<br>This parameter is only locally valid on the interface TE-MT. |
| <event_type> | Number | Indicates whether the event is informational or whether the TE has to acknowledge it:<br>• 0: informational event<br>• 1: information request: acknowledgement required |
| <change_reason> | Number | Indicates what kind of change occurred:<br>• 1: TFT only changed<br>• 2: QoS only changed<br>• 3: both TFT and QoS changed |
| <PDP_type> | Number | See <PDP_type> |
| <PDP_addr> | Number | See <PDP_addr> |
| <class> | String | GPRS mobile class. Allowed values:<br>• "A": class A mode of operation (A/Gb mode), or CS/PS mode of operation (Iu mode) (highest mode of operation)<br>• "B": class B (circuit-switched and packet-switched data alternatively supported)<br>• "CG": class C (one service only) in GPRS mode<br>• "CC": class C (one service only) in circuit-switched (GSM) mode |

### 14.14.4 Explanation of URCs

| URC | Remarks |
|---|---|
| +CGEV: ME PDN ACT <cid>[,<reason>[,<cid_other>]] | The MT has activated a primary context. |

| URC | Remarks |
|---|---|
| +CGEV: ME ACT <p_cid>,<cid>,<event_type> | The network has responded to a MT initiated secondary context activation. |
| +CGEV: ME PDN DEACT <cid> | The MT has forced a primary context deactivation. |
| +CGEV: ME DEACT <PDP_type>,<PDP_addr>,[<cid>] | The MT has forced a context deactivation. |
| +CGEV: ME DEACT,<p_cid>,<cid>,0 | The UE has forced a secondary context deactivation. |
| +CGEV: ME DEACT <p_cid>,<cid>,<event_type> | The MT has forced a secondary context deactivation. |
| +CGEV: ME MODIFY <cid>,<change_reason>,<event_type> | The MT has forced a context modification. |
| +CGEV: ME DETACH | The mobile station has forced a GPRS detach |
| +CGEV: ME CLASS <class> | The mobile station has forced a change of MT class; the highest available class is reported. |
| +CGEV: NW PDN ACT <cid>[,<reason>] | The network has activated a primary context. |
| +CGEV: NW ACT <p_cid>,<cid>,<event_type> | The network has forced a secondary context activation. |
| +CGEV: NW PDN DEACT <cid> | The network has forced a primary context deactivation. |
| +CGEV: NW DEACT <p_cid>,<cid>,0 | The network has forced a secondary context deactivation. |
| +CGEV: NW DEACT <p_cid>,<cid>,<event_type> | The network has forced a secondary context deactivation. |
| +CGEV: NW DEACT <PDP_type>,<PDP_addr>,[<cid>] | The network has forced a context deactivation. |
| +CGEV: NW MODIFY <cid>,<change_reason>,<event_type> | The network has forced a context modification. |
| +CGEV: NW DETACH | The network has forced a GPRS detach |
| +CGEV: NW CLASS <class> | The network has forced a change of MT class (e.g. due to service detach); the highest available class is reported. |
| +CGEV: VZW_SUBS_ACTION_NORMAL (0) - No restriction to data traffic | No restriction to data traffic. The URC is provided only on Verizon network.<br>SARA-R5<br>Not supported. |
| +CGEV: REJECT <PDP_type>,<PDP_addr> | The context activation is rejected.<br>SARA-R5<br>Not supported. |
| +CGEV: NW REACT <PDP_type>,<cid> | The network has forced a context re-activation.<br>SARA-R5<br>Not supported. |
| +CGEV: NW ACT <PDP_type>,<cid> | The network has forced a context activation.<br>SARA-R5<br>Not supported. |

## 14.15 GPRS network registration status +CGREG

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

### 14.15.1 Description

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

- +CGREG: <stat> if <n>=1 and there is a change in the GPRS network registration status in GERAN/UTRAN
- +CGREG: <stat>[,<lac>,<ci>[,<AcT>,<rac>]] if <n>=2 and there is a change of the network cell in GERAN/UTRAN

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.

## 14.15.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CGREG=[<n>] | OK | AT+CGREG=1<br>OK |
| Read | AT+CGREG? | If <n>=0 or 1:<br>+CGREG: <n>,<stat><br>OK | +CGREG: 0,4<br>OK |
| | | If <n>=2:<br>+CGREG: <n>,<stat>[,<lac>,<ci>[,<AcT>,<rac>]]<br>OK | +CGREG: 2,1,"61EF","7D58A3",2,"14"<br>OK |
| Test | AT+CGREG=? | +CGREG: (list of supported <n>s)<br>OK | +CGREG: (0-2)<br>OK |
| URC | | If <n>=1:<br>+CGREG: <stat> | +CGREG: 1 |
| | | If <n>=2:<br>+CGREG: <stat>[,<lac>,<ci>[,<AcT>,<rac>]] | +CGREG: 1,"4E54","44A5" |

## 14.15.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <n> | Number | • 0 (default value and factory-programmed value): network registration URC disabled<br>• 1: network registration URC enabled<br>• 2: network registration and location information URC enabled |
| <stat> | Number | • 0: not registered, the MT is not currently searching an operator to register to<br>• 1: registered, home network<br>• 2: not registered, but MT is currently searching a new operator to register to<br>• 3: registration denied<br>• 4: unknown (e.g. out of GERAN/UTRAN coverage)<br>• 5: registered, roaming<br>• 8: attached for emergency bearer services only (see 3GPP TS 24.008 [12] and 3GPP TS 24.301 [69] 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:<br>• 0: GSM<br>• 1: GSM COMPACT<br>• 2: UTRAN<br>• 3: GSM/GPRS with EDGE availability<br>• 4: UTRAN with HSDPA availability<br>• 5: UTRAN with HSUPA availability<br>• 6: UTRAN with HSDPA and HSUPA availability<br>• 7: E-UTRAN<br>• 8: EC-GSM-IoT (A/Gb mode) |

| Parameter | Type | Description |
|---|---|---|
| | | • 9: E-UTRAN (NB-S1 mode)<br>• 255: the current <AcT> value is invalid<br>Allowed values:<br>• SARA-R5 - 7 |
| <rac> | String | One byte routing area in hexadecimal format |

### 14.15.4 Notes

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

**SARA-R5**

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

## 14.16 Manual deactivation of a PDP context H

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

### 14.16.1 Description

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

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

### 14.16.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Action | ATH | OK | |

## 14.17 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 |

### 14.17.1 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.

### 14.17.2 Syntax

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

### 14.17.3 Defined values

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

## 14.18 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 |

### 14.18.1 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.

### 14.18.2 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<br>OK |
| Read | AT+CGDSCONT? | +CGDSCONT: <cid>,<p_cid>,<d_comp>,<h_comp>[,<IM_CN_Signalling_Flag_Ind>]<br>[+CGDSCONT: <cid>,<p_cid>,<d_comp>,<h_comp>[,<IM_CN_Signalling_Flag_Ind>]<br>[...]]<br>OK | +CGDSCONT: 2,1,0,0,0<br>OK |
| Test | AT+CGDSCONT=? | +CGDSCONT: (list of supported <cid>s),(list of <cid>s for defined primary contexts),(list of supported <d_comp>s),(list of supported <h_comp>s)[,(list of supported <IM_CN_Signalling_Flag_Ind>)]<br>OK | +CGDSCONT: (1-8),(4,8),(0-2),(0-2),(0-1)<br>OK |

### 14.18.3 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.<br>This parameter is only locally valid on the interface TE-MT. |
| <d_comp> | Number | PDP data compression; it can have the values:<br>• 0 (default value): off<br>• 1: on (predefined compression type i.e. V.42bis data compression)<br>• 2: V.42bis data compression |
| <h_comp> | Number | PDP header compression; it can have the values:<br>• 0 (default value): off<br>• 1: on (predefined compression type, i.e. RFC1144)<br>• 2: RFC1144<br>• 3: RFC2507 |

| Parameter | Type | Description |
|---|---|---|
| | | • 4: RFC3095<br>☞ <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:<br>• 0: PDP context is not for IM CN subsystem-related signalling only<br>• 1: PDP context is for IM CN subsystem-related signalling only |

### 14.18.4 Notes

**SARA-R5**

- If not specified the following values are assumed:
  - <cid>: 1
  - <IM_CN_Signalling_Flag_Ind>: 0
- <d_comp> and <h_comp> are accepted but any compression is not performed

## 14.19 UE modes of operation for EPS +CEMODE

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

### 14.19.1 Description

Sets the MT to operate according to the specified mode of operation for EPS, see 3GPP TS 24.301 [69]. If the requested operation mode is not supported, an error result code is returned.

☞ u-blox cellular modules are certified according to all the capabilities and options stated in the Protocol Implementation Conformance Statement document (PICS) of the module. The PICS, according to 3GPP TS 51.010-2 [66], 3GPP TS 34.121-2 [67], 3GPP TS 36.521-2 [94] and 3GPP TS 36.523-2 [95], 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.

### 14.19.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CEMODE=[<mode>] | OK | AT+CEMODE=1<br>OK |
| Read | AT+CEMODE? | +CEMODE: <mode><br>OK | +CEMODE: 1<br>OK |
| Test | AT+CEMODE=? | +CEMODE: (list of supported <mode>'s)<br>OK | +CEMODE: (0-3)<br>OK |

### 14.19.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Mode configuration:<br>• 0: PS mode 2 of operation. The UE registers only to EPS services, and the UE's usage setting is "data centric"<br>• 1 (default and factory-programmed value for voice capable devices): CS/PS mode 1 of operation. The UE registers to both EPS and non-EPS services, and the UE's usage setting is "voice centric"<br>• 2 (default and factory-programmed value for voice not-capable devices): CS/PS mode 2 of operation. The UE registers to both EPS and non-EPS services, and the UE's usage setting is "data centric"<br>• 3: PS mode 1 of operation. The UE registers only to EPS services, and the UE's usage setting is "voice centric" |

### 14.19.4 Notes

- A UE set to "Data centric" does not disable the E-UTRAN capability if voice services cannot be obtained. Upon receiving combined EPS/IMSI attach accept or combined TA/LA Update accept with "SMS-only" indication, a data centric UE stays in the current RAT and is not allowed to use CSFB. Upon receiving combined EPS/IMSI attach accept or combined TA/LA Update accept with "CSFB Not Preferred" indication, a data centric UE stays in the current RAT and is allowed to use CSFB.
- A UE set to "Voice centric" shall always try to ensure that Voice service is possible. A CSFB and an IMS/CS-voice capable UE set to "Voice centric" unable to obtain voice service in E-UTRAN (e.g. CSFB and IMS voice are not supported or the configured preferences on how to handle voice services prevent usage of any available voice services), shall disable the E-UTRAN capability, which results in re-selecting GERAN or UTRAN. The E-UTRAN capability is re-enabled by the UE under the conditions described in 3GPP TS 24.301 [69].

**SARA-R5**

- <mode>=1 and 3 are not supported.

**SARA-R5**

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

## 14.20 EPS network registration status +CEREG

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

### 14.20.1 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.

### 14.20.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CEREG=[<n>] | OK | AT+CEREG=1<br>OK |
| Read | AT+CEREG? | +CEREG: <n>,<stat>[,[<tac>],[<ci>],[<AcT>[,[<cause_type>],[<reject_cause>][,[<Assigned_Active_Time>,[<Assigned_Periodic_TAU>]]]]]] | +CEREG: 2,1,"3a9b","0000c33d",7<br>OK |

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

## 14.20.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <n> | Number | Mode configuration:<br>• 0: network registration URC disabled<br>• 1: network registration URC +CEREG: <stat> enabled<br>• 2: network registration and location information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>]] enabled<br>• 3: network registration, location information and EMM cause value information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,<cause_type>,<reject_cause>]] enabled<br>• 4: PSM, network registration and location information information URC +CEREG: <stat>[,[<tac>],[<ci>],[<AcT>][,,[,[<Assigned_Active_Time>[,<Assigned_Periodic_TAU>]]]]] enabled<br>• 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<br>Allowed values:<br>• SARA-R5 - 0 (default value), 1, 2, 3, 4, 5 |
| <stat> | Number | EPS registration status:<br>• 0: not registered<br>• 1: registered, home network<br>• 2: not registered, but the MT is currently trying to attach or searching an operator to register to<br>• 3: registration denied<br>• 4: unknown (e.g. out of E-UTRAN coverage)<br>• 5: registered, roaming<br>• 8: attached for emergency bearer services only (see 3GPP TS 24.008 [12] and 3GPP TS 24.301 [69] 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:<br>• 7: E-UTRAN (see 3GPP TS 44.060 [70] that specifies the System Information messages which give the information about whether the serving cell supports EGPRS)<br>• 8: E-UTRAN EC-GSM-IoT (A/Gb mode)<br>• 9: E-UTRAN Cat NB1<br>Allowed values:<br>• SARA-R5 - 7 |
| <cause_type> | Number | <reject_cause> type:<br>• 0: indicates that <reject_cause> contains an EMM cause value, see 3GPP TS 24.301 [69] Annex A<br>• 1: indicates that <reject_cause> contains a manufacture-specific cause<br>Allowed values:<br>• SARA-R5 - 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 |

| Parameter | Type | Description |
|---|---|---|
| | | .5.163/3GPP TS 24.008 [12]. See also 3GPP TS 23.682 [129], 3GPP TS 23.060 [10]) and 3GPP TS 23.401 [130]. |
| <Assigned_Periodic_TAU> | String | One byte in an 8 bit format. Assigned extended periodic TAU value (T3412_ext) allocated to the UE. The assigned extended periodic TAU value is coded as one byte (octet 3) of the GPRS Timer 3 information element coded as bit format (e.g. "01000 111" equals 70 hours). For the coding and the value range, see the GPRS Timer 2 IE in 3GPP TS 24.008 table 10.5.163a/3GPP TS 24.008 [12]. See also 3GPP TS 23.682 [129] and 3GPP TS 23.401 [130]. |
| <rac_or_mme> | String | RAC (Routing Area Code) or MME Code (Mobile Management Entity) in hexadecimal format |

### 14.20.4 Notes

**SARA-R5**

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

## 14.21 Delete non-active PDP contexts +CGDEL

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

### 14.21.1 Description

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

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

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

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

SARA-R5
The command removes the associated PDP context data that can be set by the AT commands +CGDCONT, +CGDSCONT, +CGTFT and +CGEQOS. For an attempt to delete PDP context(s) which would violate these rules, an error result code is returned.

SARA-R5
In Verizon configuration (see the +UMNOPROF AT command), it is not allowed to delete the contexts with the <cid> parameter in range from 1 to 7.

### 14.21.2 Syntax

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

### 14.21.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <cid> | Number | See <cid> |

# 14.22 Traffic flow template read dynamic parameters +CGTFTRDP

| +CGTFTRDP | | | | | | |
|---|---|---|---|---|---|---|
| **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

Returns the relevant information about traffic flow template for an active secondary or non secondary PDP context specified by <cid> together with the additional network assigned values when established by the network.

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

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

The parameters of both network and MT/TA initiated PDP contexts will be returned.

## 14.22.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CGTFTRDP=[<cid>] | [+CGTFTRDP: <cid>,<packet_filter_identifier>,<evaluation_precedence_index>,<remote_address_and_subnet_mask>,<protocol_number_(ipv4)/next_header_(ipv6)>,<local_port_range>,<remote_port_range>,<ipsec_security_parameter index (spi)>,<type_of_service_(tos)(ipv4)_and_mask/traffic_class_(ipv6)_and_mask>,<flow_label(ipv6)>,<direction>,<NW_packet_filter_Identifier>,<local_address_and_subnet_mask>]<br>[+CGTFTRDP: <cid>,<packet_filter_identifier>,<evaluation_precedence_index>,<remote_address_and_subnet_mask>,<protocol_number_(ipv4)/next_header_(ipv6)>,<local_port_range>,<remote_port_range>,<ipsec_security_parameter index (spi)>,<type_of_service_(tos)(ipv4)_and_mask/traffic_class_(ipv6)_and_mask>,<flow_label(ipv6)>,<direction>,<NW_packet_filter_Identifier>,<local_address_and_subnet_mask><br>[...]]<br>OK | AT+CGTFTRDP=2<br>+CGTFTRDP: 2,1,1,"8.9.10.11.255.255.0.0",0,0.65535,0.65535,0,0,0,0,0,"1.2.12.11.255.255.0.0"<br>OK |
| Test | AT+CGTFTRDP=? | +CGTFTRDP: (list of <cid>s associated with active contexts)<br>OK | +CGTFTRDP: 1,2<br>OK |

## 14.22.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <cid> | Number | See <cid> |
| <packet_filter_identifier> | Number | Packet filter:<br>• Range: 1 - 8 |

| Parameter | Type | Description |
|---|---|---|
| <evaluation_precedence_index> | Number | Evaluation precedence index that is unique within all TFTs associated with the PDP contexts that share the same PDP address:<br>• 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:<br>• "a1.a2.a3.a4.m1.m2.m3.m4" for IPv4<br>• "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.<br>• Range: 0 -255 |
| <local_port_range> | Number | Specifies the destination port range attribute of a valid packet filter:<br>• The range goes from 0 to 65535 |
| <remote_port_range> | Number | Specifies the source port range attribute of a valid packet filter:<br>• The range goes from 0 to 65535 |
| <ipsec_security_parameter index_(spi)> | String | IPSec SPI attribute of a valid packet filter which is a 32-bit field.<br>• Range: 0x00000000 - 0xFFFFFFFF |
| <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.<br>• Range: 0-65535 |
| <flow_label(ipv6)> | String | Specifies the Flow Label attribute of a valid packet filter. It is only valid for IPv6.<br>• Range: 0x00000 - 0xFFFFF |
| <direction> | Number | Specifies the transmission direction in which the packet filter shall be applied:<br>• 0: Pre Release 7 TFT Filter (see 3GPP TS 24.008 [12], table 10 .5.162)<br>• 1: uplink<br>• 2: downlink<br>• 3: bidirectional (used for uplink and downlink) |
| <NW_packet_filter_Identifier> | Number | The value range is from 1 to 16. In LTE the value is assigned by the network when the dedicated EPS bearer is established. |
| <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:<br>• "a1.a2.a3.a4.m1.m2.m3.m4" for IPv4<br>• "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 |

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

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

## 14.23.1 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.

SARA-R5
When <auth_type>=3 is set, AT+CGACT=1,<cid> may trigger at most 3 PDP context activation requests for <cid> to the protocol stack. The first request for <cid> is done with no authentication. If the PDP context activation fails, a second attempt is triggered with PAP authentication. If the second PDP context activation fails, a third attempt is triggered with CHAP authentication. These 3 PDP context activation requests are not to be confused with the effective number of request PDP context activations sent to the network (see the 3GPP TS 24.008 [12]).

SARA-R5
The command returns an error result code if the input <cid> is already active or not yet defined.

## 14.23.2 Syntax

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

## 14.23.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <cid> | Number | See <cid>. |
| <auth_type> | Number | Configure the authentication:<br>• 0: no authentication<br>• 1: PAP<br>• 2: CHAP<br>• 3: automatic selection of authentication type (none/CHAP/PAP)<br>Allowed values:<br>• SARA-R5 - 0, 1, 2, 3 |
| <username> | String | Username. The default value is an empty string:<br>• SARA-R5 - The maximum length is 50. |
| <password> | String | Password. The default value is an empty string:<br>• SARA-R5 - The maximum length is 50. |

## 14.23.4 Notes

- In a PPP dial-up scenario, the authentication parameters set by the +UAUTHREQ command are overwritten whenever the host provides a new setting via the PPP authentication protocol (PAP or CHAP).

**SARA-R5**

- The <username> and <password> parameters must be set to an empty string if the authentication type is not set (<auth_type>=0).
- The command setting is not saved in NVM.

## 14.24 Send custom packets over a context +UTGSINK

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

### 14.24.1 Description

Sends the required number of packets over a context identified by <cid>. The packet content is hardcoded and is a series of '*' characters.

No check is performed on <cid>'s status: the context must be activated before issuing the command.

The sending process is not guaranteed, and might depend on channel conditions and internal protocols status.

### 14.24.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UTGSINK=[[<cid>][,<packet_size>][,<packet_count>]] | OK | AT+UTGSINK=1,1400,10<br>OK<br>AT+UTGSINK=1,1200<br>OK<br>AT+UTGSINK=4<br>OK |
| Test | AT+UTGSINK=? | +UTGSINK: (list of supported <cid>s),(list of supported <packet_size>s),(list of supported <packet_count>s)<br>OK | +UTGSINK: (1-8),(1-1500),(1-50)<br>OK |

### 14.24.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <cid> | Number | Context identifier.<br>The range goes from 1 to 8. The default value is 1. |
| <packet_size> | Number | Packet size in bytes. The range goes from 1 to 1500. The default value is 1 |
| <packet_count> | Number | Number of packets to send. The range goes from 1 to 50. The default value is 1 |

## 14.25 Define EPS quality of service +CGEQOS

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

### 14.25.1 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 [69] and 3GPP TS 23.203 [72]). 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.

☞ SARA-R5
Before activating a secondary PDP context, issue the +CGEQOS set command to set specific EPS quality of service parameters.

### 14.25.2 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<br>OK |
| Read | AT+CGEQOS? | [+CGEQOS: <cid>,<QCI>,[<DL_GBR>,<UL_GBR>],[<DL_MBR>,<UL_MBR>]]<br>[+CGEQOS: <cid>,<QCI>,[<DL_GBR>,<UL_GBR>],[<DL_MBR>,<UL_MBR>]<br>[...]]<br>OK | +CGEQOS: 1,1,2500,7000,2500,7000<br>OK |
| 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)<br>OK | +CGEQOS: (1-8),(0-9),(0-5000),(0-21000),(0-5000),(0-21000)<br>OK |

### 14.25.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <cid> | Number | See <cid>. |
| <QCI> | Number | Specifies a class of EPS QoS (see 3GPP TS 24.301 [69]):<br>• 0: QCI is selected by network<br>• 1-4: value range for guaranteed bit rate traffic flows<br>• 5-9: value range for non-guaranteed bit rate traffic flows<br>• 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 [69]). |
| <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 [69]). |
| <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 [69]). |
| <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 [69]). |

## 14.26 EPS quality of service read dynamic parameters +CGEQOSRDP

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

### 14.26.1 Description

Returns the quality of service parameters <QCI>, <DL_GBR>, <UL_GBR>, <DL_MBR> and <UL_MBR> of the active secondary or non secondary PDP context associated to the provided context identifier <cid>.

The test command returns a list of <cid>s associated with secondary or non secondary active PDP contexts.

The parameters of both network and MT/TA initiated PDP contexts will be returned.

☞ If the parameter <cid> is omitted, the quality of service parameters for all the secondary and non secondary active PDP contexts are returned.

### 14.26.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CGEQOSRDP=[<cid>] | [+CGEQOSRDP: <cid>,<QCI>,[<DL_GBR>,<UL_GBR>],[<DL_MBR>,<UL_MBR>],[<DL_AMBR>,<UL_AMBR>]]<br>[+CGEQOSRDP: <cid>,<QCI>,[<DL_GBR>,<UL_GBR>],[<DL_MBR>,<UL_MBR>],[<DL_AMBR>,<UL_AMBR>]<br>[...]]<br>OK | AT+CGEQOSRDP=1<br>+CGEQOSRDP: 1,7,0,0,0,0,0,0<br>OK |
| Test | AT+CGEQOSRDP=? | +CGEQOSRDP: (list of <cid>s associated with active contexts)<br>OK | +CGEQOSRDP: 1<br>OK |

### 14.26.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <cid> | Number | See <cid>. |
| <QCI> | Number | Specifies a class of EPS QoS (see 3GPP TS 24.301 [69]):<br>• 0: QCI is selected by network<br>• 1-4: value range for guaranteed bit rate traffic flows<br>• 5-9: value range for non-guaranteed bit rate traffic flows<br>• 65-66: value range for guaranteed bit rate traffic flows<br>• 69-70: value range for non-guaranteed bit rate traffic flows<br>• 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 [69]). |
| <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 [69]). |
| <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 [69]). |
| <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 [69]). |
| <DL_AMBR> | Number | Indicates DL APN aggregate maximum bit rate (MBR) (see 3GPP TS 24.301 [69]). The value is expressed in kb/s. |
| <UL_AMBR> | Number | Indicates UL APN aggregate maximum bit rate (MBR) (see 3GPP TS 24.301 [69]). The value is expressed in kb/s. |

## 14.27 Secondary PDP context read dynamic parameters +CGSCONTRDP

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

### 14.27.1 Description

Returns the <p_cid>, <bearer_id> and <IM_CN_Signalling_Flag_Ind> parameters for an active secondary PDP context having the context identifier <cid>. The test command returns the list of <cid>s associated with active secondary PDP contexts.

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

☞ The parameters for UE initiated and network initiated PDP contexts are returned.

☞ In EPS, the Traffic Flow parameters are returned.

### 14.27.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CGSCONTRDP=[<cid>] | [+CGSCONTRDP: <cid>,<p_cid>,<bearer_id>[,<IM_CN_Signalling_Flag_Ind>]]<br>[+CGSCONTRDP: <cid>,<p_cid>,<bearer_id>[,<IM_CN_Signalling_Flag_Ind>]<br>[...]]<br>OK | AT+CGSCONTRDP=2<br>+CGSCONTRDP: 2,1,6,0<br>OK |
| Test | AT+CGSCONTRDP=? | +CGSCONTRDP: (list of active secondary PDP contexts)<br>OK | +CGSCONTRDP: 2<br>OK |

### 14.27.3 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.<br>This parameter is only locally valid on the interface TE-MT. |
| <bearer_id> | Number | Bearer identification, i.e. the EPS bearer in EPS and the NSAPI in UMTS/GPRS. The allowed range goes from 5 to 16. |
| <IM_CN_Signalling_Flag_Ind> | Number | Shows whether the PDP context is for IM CN subsystem-related signalling only or not:<br>• 0: PDP context is not for IM CN subsystem-related signalling only<br>• 1: PDP context is for IM CN subsystem-related signalling only |

## 14.28 UE's usage setting for EPS +CEUS

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

### 14.28.1 Description

Sets the MT to operate according to the specified UE's usage setting for EPS, as defined in 3GPP TS 24.301 [69].

The read command returns the usage setting set by the TE.

The test command is used for requesting information on the supported MT settings.

### 14.28.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CEUS=[<setting>] | OK | AT+CEUS=1<br>OK |
| Read | AT+CEUS? | +CEUS: <setting><br>OK | +CEUS: 1<br>OK |
| Test | AT+CEUS=? | +CEUS: (list of supported <setting>s)<br>OK | +CEUS: (0,1)<br>OK |

### 14.28.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <setting> | Number | Configure the UE usage setting: |

| Parameter | Type | Description |
|---|---|---|
| | | • 0: voice centric<br>• 1 (default value): data centric |

### 14.28.4 Notes

- See 3GPP TS 23.221 [71] for the definition of the "voice centric" and "data centric" usage settings.

**SARA-R5**

- The <setting> parameter cannot be set to 0.

## 14.29 PDP context read dynamic parameters +CGCONTRDP

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

### 14.29.1 Description

Returns the relevant information <bearer_id>, <APN>, <local_addr_and_subnet_mask>, <gw_addr>, <DNS_prim_addr>, <DNS_sec_addr>, <P-CSCF_prim_addr>, <P-CSCF_sec_addr>, <IM_CN_Signalling_Flag_Ind>, <LIPA_indication>, <IPv4_MTU> and <WLAN_offload> for an active non secondary PDP context with the context identifier <cid>.

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

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

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

☞ SARA-R5
If the MT has dual stack capabilities, for each <cid> will be printed two different rows: the first one will contain the IPv4 parameters, in the second one the IPv6 parameters.

☞ SARA-R5
The IPv6 addresses notation depends on the +CGPIAF setting.

### 14.29.2 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>]]]]]]]]]]]<br><br>[+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>]]]]]]]]]]]<br><br>[...]]<br><br>OK | AT+CGCONTRDP=1<br><br>+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<br><br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| Test | AT+CGCONTRDP=? | +CGCONTRDP: (list of active non secondary PDP contexts)<br>OK | +CGCONTRDP: 1<br>OK |

### 14.29.3 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:<br>• "a1.a2.a3.a4.m1.m2.m3.m4" for IPv4<br>• "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:<br>• 0: PDP context is not for IM CN subsystem-related signalling only<br>• 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:<br>• 0: indication not received that the PDP context provides connectivity using a LIPA PDN connection<br>• 1: indication received that the PDP context provides connectivity using a LIPA PDN connection |
| <IPv4_MTU> | Number | Provides the IPv4 MTU size in octets. |
| <WLAN_offload> | Number | Indicates whether the traffic can be offloaded using the specified PDN connection via a WLAN or not. This refers to bits 1 and 2 of the WLAN offload acceptability IE as specified in 3GPP TS 24.008 [12] subclause 10.5.6.20. Allowed values:<br>• 0: offloading the traffic of the PDN connection via a WLAN when in S1 mode or when in Iu mode is not acceptable<br>• 1: offloading the traffic of the PDN connection via a WLAN when in S1 mode is acceptable, but not acceptable in Iu mode<br>• 2: offloading the traffic of the PDN connection via a WLAN when in Iu mode is acceptable, but not acceptable in S1 mode<br>• 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 [69] and 3GPP TS 24.008 [12] subclause 10.5.6.3). Allowed values:<br>• 0: indicates that the MS or the network or both do not support local IP address in TFTs<br>• 1: indicates that the MS and the network support local IP address in TFTs |

## 14.30 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 |

### 14.30.1 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 [10] and 3GPP TS 24.008 [12]). 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 [10].

☞ 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.

### 14.30.2 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"<br><br>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><br><br>[+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>, | +CGTFT: 2,1,1,"10 9.115.183.216.255.255.0.0",0,"0.0","0.0",00000000,"0.0",00000<br><br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | <flow_label (ipv6)>,<direction>,<local_address_and_subnet_mask><br>[...]]<br>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)<br>[+CGTFT: <PDP_type>,(list of supported <packet_filter_identifier>s),(list of supported <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)<br>[...]]<br>OK | +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")<br>OK |

## 14.30.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <cid> | Number | See <cid> |
| <PDP_type> | String | See <PDP_type> |
| <packet_filter_identifier> | Number | Packet filter:<br>• SARA-R5 - 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:<br>• 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: |

| Parameter | Type | Description |
|---|---|---|
| | | • "a1.a2.a3.a4.m1.m2.m3.m4" for IPv4<br>• "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:<br>• 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:<br>• 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:<br>• Range: 0-65535 |
| <ipsec_security_parameter_index_(spi)> | Number | IPSec SPI attribute of a valid packet filter which is a 32-bit field:<br>• 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.<br>• 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.<br>• Range: 00000-FFFFF |
| <direction> | Number | Specifies the transmission direction in which the packet filter shall be applied:<br>• 0: Pre Release 7 TFT Filter (see 3GPP TS 24.008 [12], table 10 .5.162)<br>• 1: uplink<br>• 2: downlink<br>• 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:<br>• "a1.a2.a3.a4.m1.m2.m3.m4" for IPv4<br>• "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 |

# 14.31 Read counters of sent or received PSD 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 |

## 14.31.1 Description

Allows reading the counters for total sent / received bytes for each defined context.

For each active <cid> one result code line is provided by the DCE.

☞ Only if the specific PDP context parameter values for a PDP context are set.

☞ 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.

### 14.31.2 Syntax

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

### 14.31.3 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. |

## 14.32 Set/reset counter of sent or received PSD 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 |

### 14.32.1 Description

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

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

SARA-R5
If <cid>=255 than the total counter for every defined context is set to zero. The offset parameters are ignored in this case.

### 14.32.2 Syntax

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

### 14.32.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <cid> | Number | Local PDP context identifier:<br>• SARA-R5 - the range goes from 0 to 255 |
| <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. |

### 14.32.4 Notes

**SARA-R5**

- The <sim_id> parameter is not supported.

## 14.33 Uplink user data plane configuration +UDCONF=9

| +UDCONF=9 | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | NVM | No | - | +CME Error |

### 14.33.1 Description

Enables or disables the uplink user data plane. When the uplink data traffic is disabled, the module will not be able to transmit data to the cellular network.

Only primary EPS bearer/PDP contexts are suitable for the transmission.

☞ The AT command does not affect the functionality of the +UTGSINK AT command.

### 14.33.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UDCONF=9,<UUDP_enable> | OK | AT+UDCONF=9,1<br>OK |
| Read | AT+UDCONF=9 | +UDCONF: 9,<UUDP_enable><br>OK | AT+UDCONF=9<br>+UDCONF: 9,1<br>OK |

### 14.33.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <UUDP_enable> | Number | Configures the uplink user data plane feature:<br>• 0: uplink user data plane disabled<br>• 1 (factory-programmed value): uplink user data plane enabled |

## 14.34 Feature Group Indicators (FGI) settings +UFGI

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

### 14.34.1 Description

Displays the contents of the FGI bits stored on the module that are reported during the LTE registration to the network as part of the UE-EUTRA-Capability information element. The description of each bit can be found in 3GPP TS 36.331 [88], Annex B.

### 14.34.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Read | AT+UFGI? | +UFGI: <FGI>,<FGI_rel9>,<FGI_rel10> | +UFGI: 4291821242,3229614080,3407872 |
| | | OK | OK |

### 14.34.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <FGI> | Number | 32 bits number that describes bits 1-32 of featureGroupIndicators. The leftmost bit represents index 1 in the field featureGroupIndicators. |
| <FGI_rel9> | Number | 32 bits number that describes bits 33-64 of featureGroupIndRel9Add. The leftmost bit represents index 33 in the field featureGroupIndRel9Add. |
| <FGI_rel10> | Number | 32 bits number that describes bits 101-132 of featureGroupIndRel10Add. The leftmost bit represents index 101 in the field featureGroupIndRel10Add. |

## 14.35 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 |

### 14.35.1 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.

### 14.35.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UDCONF=75,<cid>,<PDP_IP_conf> | OK | AT+UDCONF=75,1,0<br>OK |
| Read | AT+UDCONF=75 | +UDCONF: 75,<cid>,<PDP_IP_conf><br>OK | AT+UDCONF=75<br>+UDCONF: 75,1,0<br>OK |

### 14.35.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <cid> | Number | See <cid>. |
| <PDP_IP_conf> | Number | PDP IP configuration when roaming:<br>• 0: IP<br>• 1: IPv6<br>• 2: IPv4v6<br>See <PDP_type>. |

### 14.35.4 Notes

**SARA-R5**

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

## 14.36 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 |

### 14.36.1 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.

### 14.36.2 Syntax

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

### 14.36.3 Defined values

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

## 14.37 APN back-off timer read dynamic parameters +CABTRDP

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

### 14.37.1 Description

Returns the relevant information in the MT for the APN back-off timer parameter values <residual_backoff_time>, <re_attempt_rat_indicator>, <re_attempt_eplmn_indicator>, <NSLPI> and <procedure> for the interested APN if the back-off timer is running. If the parameter <apn> is omitted, the relevant information for all APNs associated with running session management back-off timers is returned.

### 14.37.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CABTRDP[=<apn>] | +CABTRDP: <apn>[,<residual_backoff_time>[,<re_attempt_rat_indicator>[,<re_attempt_eplmn_indicator>[,<NSLPI>[,<procedure>]]]]]<br>[...]<br>OK | AT+CABTRDP="APN"<br>+CABTRDP: "APN",2,0,1,0,1<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| Test | AT+CABTRDP=? | +CABTRDP: (list of supported <re_attempt_rat_indicator>s),(list of supported <re_attempt_eplmn_indicator>s),(list of supported <NSLPI>s)<br>OK | +CABTRDP: (0-1),(0-1),(0-1)<br>OK |

## 14.37.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <apn> | String | See <APN>. |
| <residual_backoff_time> | Number | Indicates the remaining back-off time associated with the <apn> in seconds. When the parameter <residual_backoff_time> is omitted, the back-off timer is deactivated. |
| <re_attempt_rat_indicator> | Number | Indicates whether the UE is allowed to re-attempt the corresponding session management procedure for the same APN after inter-system change. Allowed values:<br>• 0: re-attempt the session management procedure after inter-system change is allowed<br>• 1: re-attempt the session management procedure after inter-system change is not allowed |
| <re_attempt_eplmn_indicator> | Number | Indicates whether the UE is allowed to re-attempt the corresponding session management procedure for the same APN in an equivalent PLMN. Allowed values:<br>• 0: re-attempt the session management procedure in an equivalent PLMN is allowed<br>• 1: re-attempt the session management procedure in an equivalent PLMN is not allowed |
| <NSLPI> | Number | Indicates the NAS signalling priority requested for this PDN connection. Allowed values:<br>• 0: indicates that this PDN connection was activated with the value for NAS signalling low priority indicator set to "MS is configured for NAS signalling low priority"<br>• 1: indicates that this PDN connection was activated with the value for NAS signalling low priority indicator set to "MS is not configured for NAS signalling low priority" |
| <procedure> | Number | Indicates the procedure(s) for which the back-off timer applies. When <procedure>=0 the information returned is associated with timer T3396. For all other values of <procedure> the information returned is associated with the back-off timer as specified in 3GPP TS 24.008 [12] or 3GPP TS 24.301 [69] for the various session management procedures. Allowed values:<br>• 0: all procedures<br>• 1: PDN connectivity procedure as specified in 3GPP TS 24.301 [69], subclause 6.5.1<br>• 2: bearer resource allocation procedure as specified in 3GPP TS 24.301 [69], subclause 6.5.3<br>• 3: bearer modification procedure as specified in 3GPP TS 24.301 [69], subclause 6.5.4<br>• 4: PDP context activation procedure as specified in 3GPP TS 24.008 [12], subclause 6.1.3.1<br>• 5: secondary PDP context activation procedure as specified in 3GPP TS 24.008 [12], subclause 6.1.3.2<br>• 6: PDP context modification procedure as specified in 3GPP TS 24.008 [12], subclause 6.1.3.3 |

# 15 System features

## 15.1 Firmware installation +UFWINSTALL

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

### 15.1.1 Description

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

☞ SARA-R5
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).
At the end of a successful installation, the main firmware software boots up, NVM and profiles data are set to the factory-programmed values of the new firmware version and the SIM is reset (the PIN will be required if enabled).

☞ 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.

☞ SARA-R5
After having issued the command, the +UFWPREVAL URC displays the progress indication for the validation package. In case of a successful validation the FW installation procedure will continue with the +UUFWINSTALL URC. Otherwise the FW installation procedure will be suspended and the module exits from firmware update mode and returns to normal mode since the FW is still unchanged and usable. A +UUFWINSTALL URC will be issued stating the unsuccessful FW update.
During the update operations, the +UUFWINSTALL URC displays the progress indication and the result operation on the interface chosen via the +UFWINSTALL command. When the FW update is completed, a URC will notify the final result of the operation.
For more details, see the SARA-R5 series Firmware update with uFOTA, FOAT and EasyFlash Application Note [171].

### 15.1.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UFWINSTALL[=<Serial_Port_Number>[,<BaudRate>]] | OK | AT+UFWINSTALL=1,115200<br>OK |
| Test | AT+UFWINSTALL=? | +UFWINSTALL: (list of supported <Serial_Port_Number>s),(list of supported <BaudRate>s)<br>OK | +UFWINSTALL: (0,1),(9600,19200,38400,57600,115200,230400,460800,921600,3000000,3250000)<br>OK |
| URC | | +UFWPREVAL: <progress_validation> | |
| URC | | +UUFWINSTALL: <progress_install> | |

### 15.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <Serial_Port_ Number> | Number | Serial interface where the progress percentage and the information text responses will be sent:<br>• 0: no info will be shown. In this case the <BaudRate> parameter is ignored<br>• 1: UART interface<br>• 2: AUX UART interface<br>If omitted, the command will take as default value for <Serial_Port_Number> the port where the command is issued. |
| <BaudRate> | Number | Available baud rates expressed in b/s:<br>• 9'600<br>• 19'200<br>• 38'400<br>• 57'600<br>• 115'200<br>• 230'400<br>• 460'800<br>• 921'600<br>• 3'000'000<br>• 3'250'000<br>If omitted, the command will take the current value set for the <BaudRate> parameter as the baud rate to be used during the FW installation. |
| <progress_ validation> | Number | Provide the validation progress from 1 to 100. |
| <progress_install> | Number | Provide the installation progress from 1 to 100 and the update result (see FWINSTALL error result codes). |

### 15.1.4 Notes

**SARA-R5**

- 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, +UFTPC or +UHTTPC AT commands). When the new FW has been installed, the user can optionally delete the "updatePackage.bin" file using the file system AT commands (for more details, see the +UDELFILE AT command).

| Command | Response | Description |
|---|---|---|
| AT+UFWINSTALL=1,115200 | OK | The "OK" final result code is printed out just before the FW reset. |
| | +UFWPREVAL: 0 | The progression of firmware package validation is incremental (the subsequent increment of <progress_ validation> can be more than 1). |
| | +UFWPREVAL: 3 | |
| | +UFWPREVAL: 7 | |
| | ... | |
| | +UFWPREVAL: 90 | |
| | +UFWPREVAL: 100 | |
| | +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 | |
| | .... | |
| | +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 |

| Command | Response | Description |
|---|---|---|
| | | completed with success (for more details see the FWINSTALL error result codes). |

**Table 13: +UFWINSTALL example**

## 15.2 Firmware update Over AT (FOAT) +UFWUPD

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

### 15.2.1 Description

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

The update will affect:

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

Issue the command and wait the device for switching in Xmodem protocol. Send the FOAT package which will be downloaded into the module file system. After the download ends, the +UFWPREVAL URCs displays the progress indication for the validation package. In case of a successful validation, the FW installation procedure will start with the +UFWUPD URCs. Otherwise the procedure will be suspended, a proper +UFWUPD URC error result code will be issued. The module exits from the update procedure mode and returns to the normal mode since the firmware is unchanged and usable. During the update operations, the +UFWUPD URCs display the progress indication and the result operation on the interface set via the +UFWUPD command. When the firmware update is completed, a URC will notify the final result of the operation. For more details, see the SARA-R5 series Firmware update with uFOTA, FOAT and EasyFlash Application Note [171].

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

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

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

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

☞ For more details, see the SARA-R5 series firmware update with uFOTA, FOAT and EasyFlash application note [171].

### 15.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UFWUPD[=<Serial_Port_Number>[,<BaudRate>]] | +UFWUPD: ONGOING | AT+UFWUPD=1,115200 |
| | | (Sent at new baud rate, if specified) | +UFWUPD: ONGOING |
| | | CCC<NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK> | CCC<NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK> |
| | | OK | OK |
| Test | AT+UFWUPD=? | +UFWUPD: (list of supported <Serial_Port_Number>s),(list of supported <BaudRate>s) | +UFWUPD: (0,1),(9600,19200,38400,57600,115200,230400,460800,921600,3000000,3250000) |
| | | OK | OK |
| URC | | +UFWPREVAL: <progress_validation> | |

| Type | Syntax | Response | Example |
|---|---|---|---|
| URC | | +UFWUPD: <progress_install> | |

### 15.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <Serial_Port_ Number> | Number | Serial interface where the progress percentage and the information text responses will be sent:<br>• 0: no update info will be shown. The current interface and baud rate will be used for the xmodem fw download. In this case the <BaudRate> parameter is ignored.<br>• 1: UART interface<br>• 2: AUX UART interface |
| <BaudRate> | Number | Available baud rates expressed in b/s:<br>• 9'600<br>• 19'200<br>• 38'400<br>• 57'600<br>• 115'200<br>• 230'400<br>• 460'800<br>• 921'600<br>• 3'000'000<br>• 3'250'000<br>When a USB interface is selected, the parameter has no effect in the FW install configuration.<br>If omitted, the command will take the current value set for the <BaudRate> parameter as the baud rate to be used during the FW installation. |
| <progress_install> | Number | Provide the installation progress from 1 to 100 and the update result (see FWINSTALL error result codes). |
| <progress_ validation> | Number | Provide the validation progress from 1 to 100. |

### 15.2.4 Examples

Table 14 reports an example of a FOAT procedure.

| Command | Response | Description |
|---|---|---|
| AT+UFWUPD=1,460800 | +UFWUPD: ONGOING | The host starts the FOAT process on primary UART interface at speed 460'800 bit/s. From now on, cellular module responses are sent at 460'800 bit/s. |
| | CCC<NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK><NACK> | Up to 3 "C"s and up to 10 <NACK>s. |
| | +UFWPREVAL: 0 | After the download is complete the module reboot and the firmware package validation starts. The progression of firmware package validation is incremental (the subsequent increment of <progress_validation> can be more than 1). |
| | +UFWPREVAL: 3 | |
| | +UFWPREVAL: 7 | |
| | ... | |
| | +UFWPREVAL: 90 | |
| | +UFWPREVAL: 100 | |
| | +UFWUPD: 1 | The progression of installation is incremental (the subsequent increment of <progress_install> can be more than 1). |
| | +UFWUPD: 2 | |
| | +UFWUPD: 3 | |
| | +UFWUPD: 4 | |
| | .... | |
| | +UFWUPD: 9 | |
| | +UFWUPD: 12 | |
| | +UFWUPD: 15 | |
| | .... | |
| | +UFWUPD: 99 | |

| Command | Response | Description |
|---|---|---|
| | +UFWUPD: 100 | The installation is done when the percentage ends with +UFWUPD: 100. |
| | +UFWUPD: 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 FOAT error result codes). |

**Table 14: Firmware update Over AT commands procedure**

# 15.3 Antenna detection +UANTR

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

## 15.3.1 Description

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

## 15.3.2 Syntax

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

## 15.3.3 Defined values

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

## 15.3.4 Notes

- The load resistor values below the minimum limit of 1 kOhm are identified as short circuit (<antenna_load>=0), while values above the maximum limit of 53 kOhm are identified as open circuit (<antenna_load>=-1).
- The reported value could differ from the real resistance value of the diagnostic resistor mounted inside the antenna assembly due to antenna cable length, antenna cable capacity and the measurement method.

**SARA-R5**

- The accuracy of the measure is within 10%.

## 15.4 End user test +UTEST

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

### 15.4.1 Description

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

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

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

### 15.4.2 RF test description

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

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

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

When entering the test mode, it is possible to sequentially trigger the following actions for testing purposes (also depending on the RATs supported by the module):

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

The <mode>, <RX_channel>, <RX_time_interval>, <receiver_path>, <TX_channel>, <power_control_level>, <training_sequence>, <modulation_mode>, <TX_time_interval> parameters setting is not stored in the NVM.

The command only accepts the parameter set supported by the specific module version. When an unsupported parameter is issued, an error result code will be provided ("+CME ERROR: operation not supported" or "+CME ERROR: 4" depending on the +CMEE AT command setting).

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

- The module only accepts +UTEST commands

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)

SARA-R5
A network deregistration is needed, issue the AT+CFUN=0 command to deactivate the protocol stack before entering the non-signalling mode.
When the module exits from the test mode, the network status before entering this mode will be restored.

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

SARA-R5

The command allows the antenna dynamic tuner control by means of the <mode>=4 and the <ant_tuner_enable> parameter. This setting is stored in the NVM, and its configuration is effective also after exiting the test mode. The <ant_tuner_enable> parameter setting persists after a reset to the factory configuration using +UFACTORY AT command. Enter the test mode to enable or disable the antenna dynamic tuner control (see the antenna dynamic tuner configuration examples).
When the antenna dynamic tuner control is enabled or disabled, all running continuous RX and TX activities are stopped and shall be restarted again after the new configuration is applied.
Enabling the antenna dynamic tuner control by means of the AT+UTEST=4,1 command, the I2S_TXD and I2S_WA pins are automatically configured as antenna dynamic tuning, their output is controlled by RF driver and it changes according to the LTE band used by the module; the relation between the I2S_TXD and I2S_WA pins output and the LTE frequency band in use, is reported in Table 17. After enabling the feature all the following RF testing by means of AT+UTEST=2 and AT+UTEST=3 are performed with the antenna tuner control active.

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

- a module reset
- power off the module
- send AT+UTEST=0 (depending on the module series, a reboot could be automatically performed)

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

### 15.4.3 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+UTEST=<mode>[,[<param_val1>][,[<param_val2>][,[<param_val3>][,[<param_val4>][,[<param_val5>]]]]]] | [+UTEST: [<param_val1>,<param_val2>][,<param_val3>][,<param_val4>,<param_val5>][,<min>,<avg>,<max>]]<br>OK | AT+UTEST=0<br>OK |
| **Entering normal mode** | | | |
| Set | AT+UTEST=0 | OK | AT+UTEST=0<br>OK |
| **Entering non-signalling mode** | | | |
| Set | AT+UTEST=1 | OK | AT+UTEST=1<br>OK |
| **RX test mode** | | | |
| Set | AT+UTEST=2[,[<RX_channel>][,[<RX_time_interval>][,[<receiver_path>]]]] | +UTEST: <RX_channel>,<RX_time_interval>,<receiver_path>,<min>,<avg>,<max><br>OK | AT+UTEST=2,124,250<br>+UTEST: 124,250,0,-80,-80,-80<br>OK |
| **TX test mode** | | | |
| Set | AT+UTEST=3[,[<TX_channel>][,[<power_control_level>][,[<training_sequence>][,[<modulation_mode>][,[<TX_time_interval>]]]]]] | +UTEST: <TX_channel>,<power_control_level>,<training_sequence>,<modulation_mode>,<TX_time_interval><br>OK | AT+UTEST=3,32,7,5<br>+UTEST: 32,7,5,1,1000<br>OK |
| **Antenna dynamic tuner configuration mode** | | | |
| Set | AT+UTEST=4,<ant_tuner_enable> | +UTEST: 4,<ant_tuner_enable><br>OK | AT+UTEST=4,1<br>+UTEST: 4,1<br>OK |
| Read | AT+UTEST? | +UTEST: <mode><br>OK | +UTEST: 1<br>OK |
| Test | AT+UTEST=? | +UTEST: (list of supported <mode>s)<br>OK | +UTEST: (0-3)<br>OK |

### 15.4.4 Defined values

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

### 15.4.5 Notes

**SARA-R5**

- Check the corresponding module data sheet for the list of supported bands and Radio Access Technologies (RAT).
- **RX mode setting (<mode>=2)**

| Parameter | Description | Range | Default | Notes |
|---|---|---|---|---|
| <RX_channel> | Channel | 0 ÷ max value of supported band | 32 | RX channel 2G RAT: for 850, 900, 1800 bands the value corresponds to ARFCN while for 1900 band an offset of 32768 is added.<br>o [0-124]: GSM 900 MHz<br>o [128-251]: GSM 850 MHz<br>o [512-885]: DCS 1800 MHz<br>o [975-1023]: EGSM 900 MHz<br>o [33280-33578]: PCS 1900 MHz (corresponding to ARFCN 512-810 range in band 1900)<br><br>RX channel 3G RAT: the value corresponds to UARFCN except for band 19 where an offset of 20000 is added, additional channels available in some 3G bands are not supported.<br>o [1537-1738]: band 4 (1700 MHz)<br>o [2937-3088]: band 8 (900 MHz)<br>o [4357-4458]: band 5 (850 MHz)<br>o [4387-4413]: band 6 (800 MHz)<br>o [20712-20763]: band 19 (800 MHz)<br>o [9662-9938]: band 2 (1900 MHz)<br>o [10562-10838]: band 1 (2100 MHz)<br>o [10050-10125]: TD-SCDMA band 34 (2000 MHz)<br>o [9400-9600]: TD-SCDMA band 39 (1900 MHz)<br><br>RX channel 4G RAT: the value corresponds to EARFCN with an offset of 100000. |

| <RX_channel> range | LTE band | EARFCN range |
|---|---|---|
| [100000-100599] | FDD 1 | [0-599] |
| [100600-101199] | FDD 2 | [600-1199] |
| [101200-101949] | FDD 3 | [1200-1949] |

| Parameter | Description | Range | Default | Notes |
|---|---|---|---|---|

| <RX_channel> range | LTE band | EARFCN range |
|---|---|---|
| [101950-102399] | FDD 4 | [1950-2399] |
| [102400-102649] | FDD 5 | [2400-2649] |
| [102650-102749] | FDD 6 | [2650-2749] |
| [102750-103449] | FDD 7 | [2750-3449] |
| [103450-103799] | FDD 8 | [3450-3799] |
| [103800-104149] | FDD 9 | [3800-4149] |
| [104150-104749] | FDD 10 | [4150-4749] |
| [104750-104949] | FDD 11 | [4750-4949] |
| [105010-105179] | FDD 12 | [5010-5179] |
| [105180-105279] | FDD 13 | [5180-5279] |
| [105280-105379] | FDD 14 | [5280-5379] |
| [105730-105849] | FDD 17 | [5730-5849] |
| [105850-105999] | FDD 18 | [5850-5999] |
| [106000-106149] | FDD 19 | [6000-6149] |
| [106150-106449] | FDD 20 | [6150-6449] |
| [106450-106599] | FDD 21 | [6450-6599] |
| [106600-107399] | FDD 22 | [6600-7399] |
| [107500-107699] | FDD 23 | [7500-7699] |
| [107700-108039] | FDD 24 | [7700-8039] |
| [108040-108689] | FDD 25 | [8040-8689] |
| [108690-109039] | FDD 26 | [8690-9039] |
| [109210-109659] | FDD 28 | [9210-9659] |
| [109660-109769] | FDD 29 | [9660-9769] |
| [109770-109869] | FDD 30 | [9770-9869] |
| [109870-109919] | FDD 31 | [9870-9919] |
| [109920-110359] | FDD 32 | [9920-10359] |
| [136000-136199] | FDD 33 | [36000-36199] |
| [136200-136349] | TDD 34 | [36200-36349] |
| [136350-136949] | TDD 35 | [36350-36949] |
| [136950-137549] | TDD 36 | [36950-37549] |
| [137550-137749] | TDD 37 | [37550-37749] |
| [137750-138249] | TDD 38 | [37750-38249] |
| [138250-138649] | TDD 39 | [38250-38649] |
| [138650-139649] | TDD 40 | [38650-39649] |
| [139650-141589] | TDD 41 | [39650-41589] |
| [141590-143589] | TDD 42 | [41590-43589] |
| [143590-145589] | TDD 43 | [43590-45589] |
| [145590-146589] | TDD 44 | [45590-46589] |
| [165536-166435] | FDD 65 | [65536-66435] |
| [166436-167335] | FDD 66 | [66436-67335] |
| [167336-167535] | FDD 67 | [67336-67535] |
| [167536-167835] | FDD 68 | [67536-67835] |
| [167836-168335] | FDD 69 | [67836-68335] |
| [168336-168585] | FDD 70 | [68336-68585] |
| [168586-168935] | FDD 71 | [68586-68935] |
| [170366-170545] | FDD 85 | [70366-70545] |

**Table 15: <RX_channel> parameter range**

The "+CME ERROR: operation not supported" or "+CME ERROR: 4" error result code will be provided in these cases (depending on the +CMEE AT command setting):

- A value not belonging to the above ranges is set

| Parameter | Description | Range | Default | Notes |
|---|---|---|---|---|
| | | | | o The RX channel parameter value belongs to a non-supported RAT (2G or 3G or 4G RAT) or band<br>☞ The default channel will be equal to 32 if the GSM RAT is supported, in the other cases it will be the same as the central channel of the lower LTE band supported by the module. |
| <RX_time_interval> | Time | 1 ÷ 600000 | 1000 | Time interval for RX test expressed in ms<br>☞ SARA-R5<br>The range goes from 10 ms to 600000 ms. |
| <receiver_path> | Antenna diversity | 0 ÷ 1 | 0 | Receiver path:<br>o 0: main / primary antenna<br>o 1: diversity / secondary antenna<br>The parameter is available only if supported, otherwise an error result code will be provided ("+CME ERROR: operation not supported" or "+CME ERROR: 4" depending on the +CMEE AT command setting) |
| <min> | Minimum antenna RF level estimation | See Notes | | Expressed in dBm |
| <avg> | Average antenna RF level estimation | See Notes | | Expressed in dBm |
| <max> | Maximum antenna RF level estimation | See Notes | | Expressed in dBm |

- RF level estimation range:
  - SARA-R5 - The range is [-90 ÷ -20] in 3G / 4G RAT.
- **TX mode setting (<mode>=3)**

| Parameter | Description | Range | Default | Notes |
|---|---|---|---|---|
| <TX_channel> | Tx channel | 0 ÷ max value of supported band | 32 | TX channel 2G RAT: for 850, 900, 1800 bands the value corresponds to ARFCN while for 1900 band an offset of 32768 is added.<br>o [0-124]: GSM 900 MHz<br>o [128-251]: GSM 850 MHz<br>o [512-885]: DCS 1800 MHz<br>o [975-1023]: EGSM 900 MHz<br>o [33280-33578]: PCS 1900 MHz (corresponding to ARFCN 512-810 range in band 1900)<br>TX channel 3G RAT: the value corresponds to UARFCN except for the band 19 where an offset of 20000 is added, additional channels available in some 3G bands are not supported.<br>o [1312-1513]: band 4 (1700 MHz)<br>o [2712-2863]: band 8 (900 MHz)<br>o [4132-4233]: band 5 (850 MHz)<br>o [4162-4188]: band 6 (800 MHz)<br>o [20312-20363]: band 19 (800 MHz)<br>o [9262-9538]: band 2 (1900 MHz)<br>o [9612-9888]: band 1 (2100 MHz)<br>o [10050-10125]: TD-SCDMA band 34 (2000 MHz)<br>o [9400-9600]: TD-SCDMA band 39 (1900 MHz)<br>TX channel 4G RAT: the value corresponds to EARFCN with an offset of 100000. |

| <TX_channel> range | LTE band | EARFCN range |
|---|---|---|
| [118000-118599] | FDD 1 | [18000-18599] |
| [118600-119199] | FDD 2 | [18600-19199] |
| [119200-119949] | FDD 3 | [19200-19949] |

| Parameter | Description | Range | Default | Notes |
|---|---|---|---|---|

| <TX_channel> range | LTE band | EARFCN range |
|---|---|---|
| [119950-120399] | FDD 4 | [19950-20399] |
| [120400-120649] | FDD 5 | [20400-20649] |
| [120650-120749] | FDD 6 | [20650-20749] |
| [120750-121449] | FDD 7 | [20750-21449] |
| [121450-121799] | FDD 8 | [21450-21799] |
| [121800-122149] | FDD 9 | [21800-22149] |
| [121800-122149] | FDD 10 | [21800-22149] |
| [122750-122949] | FDD 11 | [22750-22949] |
| [123010-123179] | FDD 12 | [23010-23179] |
| [123180-123279] | FDD 13 | [23180-23279] |
| [123730-123849] | FDD 17 | [23730-23849] |
| [123850-123999] | FDD 18 | [23850-23999] |
| [124000-124149] | FDD 19 | [24000-24149] |
| [124150-124449] | FDD 20 | [24150-24449] |
| [124450-124599] | FDD 21 | [24450-24599] |
| [124600-125399] | FDD 22 | [24600-25399] |
| [125500-125699] | FDD 23 | [25500-25699] |
| [125700-126039] | FDD 24 | [25700-26039] |
| [126040-126689] | FDD 25 | [26040-26689] |
| [126690-127039] | FDD 26 | [26690-27039] |
| [127040-127209] | FDD 27 | [27040-27209] |
| [127210-127659] | FDD 28 | [27210-27659] |
| [127660-127759] | FDD 30 | [27660-27759] |
| [127760-127809] | FDD 31 | [27760-27809] |
| [136200-136349] | TDD 34 | [36200-36349] |
| [137750-138249] | TDD 38 | [37750-38249] |
| [138250-138649] | TDD 39 | [38250-38649] |
| [138650-139649] | TDD 40 | [38650-39649] |
| [139650-141589] | TDD 41 | [39650-41589] |
| [231072-231971] | FDD 65 | [131072-131971] |
| [231972-232671] | FDD 66 | [131972-132671] |
| [232672-232971] | FDD 68 | [132672-132971] |
| [232972-233121] | FDD 70 | [132972-133121] |
| [233122-233471] | FDD 71 | [133122-133471] |
| [234002-234181] | FDD 85 | [134002-134181] |

**Table 16: <TX_channel> parameter range**

The "+CME ERROR: operation not supported" or "+CME ERROR: 4" error result code will be provided in these cases (depending on the +CMEE AT command setting):

- A value not belonging to the above ranges is set
- The TX channel parameter value belongs to a non-supported RAT (2G or 3G or 4G RAT) or band

Avoid channels that would put the TX waveform outside the band due to SC-FDMA modulation bandwidth.

The default channel will be equal to 32 if the GSM RAT is supported, in the other cases it will be the same as the central channel of the lower LTE band supported by the module.

| Parameter | Description | Range | Default | Notes |
|---|---|---|---|---|
| <power_ control_level> | Power control level | -56 ÷ 24 | 5 | For 2G RAT: PCL (power control level). The allowed values depend on the related <TX_channel> value: lower numbers means higher power level.<br>o [0-19]: GSM 850 and 900, if <power_control_level> is less than 5 the handling is the same for <power_ control_level>=5<br>o [0-15]: DCS 1800 and PCS 1900<br>In case <modulation_mode> is set to 2 (8-PSK modulation) the range is as below. Other values are valid but behave as the indicated level:<br>o [0-19]: GSM 850 and 900 if <power_control_level> is less than 8 the handling is the same for <power_ control_level>=8<br>o [0-15]: DCS 1800 and PCS 1900; if <power_control_ level> is less than 2 the handling is the same for <power_control_level>=2<br>For 3G RAT: absolute output power [dBm]<br>o [-56 ÷ 24] for all the bands<br>For 4G RAT: absolute output power [dBm]<br>o [-40 ÷ 24] for all the bands<br>Only the values indicated in the above ranges are valid, otherwise an error result code will be provided ("+CME ERROR: operation not supported" or "+CME ERROR: 4" depending on the +CMEE AT command setting).<br>SARA-R5<br>The maximum value of the output power level <power_control_level> is 23 dBm in 4G mode. |
| <training_ sequence> | Training sequence | 0 ÷ 7 | 5 | Training sequence to be used (to be changed only in case of link with network simulator, else use default)<br>In 3G / 4G RAT the values is unused. |
| <modulation_ mode> | Modulation mode | 1 ÷ 2 | 1 | Modulation mode:<br>o 1: GMSK normal modulation including the training sequence<br>o 2: 8-PSK normal modulation including the training sequence<br>In 3G / 4G RAT the parameter is ignored.<br>LTE SC-FDMA OFDM modulation (5 MHz bandwidth), FDD, is automatically set using for <TX_ channel> an EARFCN value.<br>The LTE Cat.M1 SC-FDMA OFDM modulation (1.4 MHz bandwidth), FDD, is automatically set using an EARFCN value for the <TX_channel> parameter. |
| <TX_time_ interval> | Time | 0 ÷ 600000 | 1000 | Time interval for TX test expressed in ms<br>o 0: burst sequence is continuously transmitted. In this case the command will immediately return the information text response. The command line will be immediately available for any +UTEST command. Provide AT+UTEST=1 command to stop the burst sequence transmission, any other +UTEST commands can be set and the current sequence transmission is stopped. |

**SARA-R5**

- **Antenna dynamic tuner (<mode>=4) truth table:**

| I2S_TXD | I2S_WA | LTE frequency band in use |
|---|---|---|
| 0 | 0 | B71 (<700 MHz) |
| 0 | 1 | B12, B13, B28, B85 (700 MHz .. 800 MHz) |

| I2S_TXD | I2S_WA | LTE frequency band in use |
|---|---|---|
| 1 | 0 | B5, B8, B18, B19, B20, B26 (800 MHz .. 900 MHz) |
| 1 | 1 | B1, B2, B3, B4, B25, B66 (>900 MHz) |

**Table 17: Antenna dynamic tuning truth table**

### 15.4.6 RF test description examples

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

| Command | Response | Description |
|---|---|---|
| AT+UTEST=2 | +UTEST: 32,1000,-89,-88,-87<br>OK | The module measures the antenna RX level at RX channel 32 band GSM 900 for 1 s interval.<br>In the example -89,-88,-87 are the antenna RF level estimation: the numbers are just an example. |
| AT+UTEST=2,885,5000 | +UTEST: 885,5000,-66,-65,-65<br>OK | The module measures the antenna RX level at RX channel 885 band DCS 1800 for 5 s interval. |
| AT+UTEST=2,10562,2000 | +UTEST: 10562,2000,-60,-60,-59<br>OK | The module measures the antenna RX level at RX channel 10562 band B1 for 2 s interval on the main antenna path. |
| AT+UTEST=2,10562 | +UTEST: 10562,1000,0,-85,-85,-85<br>OK | The module measures the antenna RX level at RX channel 10562 band B1 for 1 s interval on the main antenna path. |
| AT+UTEST=2,65,3000,0 | +UTEST: 65,3000,0,-63,-62,-62<br>OK | The module measures the antenna RX level at RX channel 65 band GSM 900 for 3 s interval on the main antenna path. |
| AT+UTEST=2,4357,,1 | +UTEST: 4357,1000,1,-51,-51,-51<br>OK | The module measures the antenna RX level at RX channel 4357 band B5 for 1 s interval on the diversity antenna path. |
| AT+UTEST=2,102174,500,0 | +UTEST: 102174,500,0,-71,-70,-70<br>OK | The module measures the antenna RX level at RX channel 2174 band FDD 4 for 0.5 s interval on the primary antenna path. |
| AT+UTEST=2,105230,,1 | +UTEST: 105230,1000,1,-72,-71,-70<br>OK | The module measures the antenna RX level at RX channel 5230 band FDD 13 for 1 s interval on the secondary antenna path. |
| AT+UTEST=2,109690,,0 | +UTEST: 109690,1000,0,-52,-51,-50<br>OK | The module measures the antenna RX level at RX channel 9690 band FDD 29 for 1 s interval on the primary antenna path. |
| AT+UTEST=2,109690,,1 | +UTEST: 109690,1000,1,-52,-51,-50<br>OK | The module measures the antenna RX level at RX channel 9690 band FDD 29 for 1 s interval on the secondary antenna path. |

**Table 18: RX mode test command examples**

| Command | Response | Description |
|---|---|---|
| AT+UTEST=3,32,7,5 | +UTEST: 32,7,5,1,1000<br>OK | The module will transmit for 1 s interval 1 slot burst sequence at TX channel 32 GSM 900 at PCL 5 using training sequence 5 and normal GMSK modulation. |
| AT+UTEST=3,65,8,,2,5000 | +UTEST: 65,8,5,2,5000<br>OK | The module will transmit for 5 s interval 1 slot burst sequence at TX channel 65 GSM 900 at PCL 8 (gamma 6, 27 dBm) using training sequence 5 and normal 8-PSK modulation. |
| AT+UTEST=3,660,,,,0 | +UTEST: 660,5,5,1,0<br>OK | The module will transmit continuously 1 slot burst sequence at TX channel 660 DCS 1800 at PCL 5 using training sequence 5 and normal GMSK modulation. |

| Command | Response | Description |
|---|---|---|
| AT+UTEST=3,9612,22,,,2000 | +UTEST: 9612,22,5,1,2000<br>OK | The module will transmit for 2 s interval at TX channel 9612 band B1 at 22 dBm power level using WCDMA modulation. |
| AT+UTEST=3,120399,15,,,3000 | +UTEST: 120399,15,5,1,3000<br>OK | The module transmits for 3 s interval at TX channel 20399 band FDD 4 at 15 dBm power level using SC-FDMA OFDM modulation 5 MHz bandwidth. |
| AT+UTEST=3,123230,-10,,,0 | +UTEST: 123230,-10,5,1,0<br>OK | The module continuously transmits at TX channel 23230 band FDD 13 at -10 dBm power level using SC-FDMA OFDM modulation 5 MHz bandwidth. |

**Table 19: TX mode test command examples**

### 15.4.7 Antenna dynamic tuner configuration examples

| Command | Response | Description |
|---|---|---|
| **Enabling antenna tuner control** | | |
| AT+UTEST=1 | OK | Enters the test mode. |
| AT+UTEST=4,1 | +UTEST: 4,1<br>OK | Enables antenna dynamic tuner control. All the following RX or TX activities are performed with antenna tuner control active. |
| **Disabling antenna tuner control** | | |
| AT+UTEST=1 | OK | Enters the test mode. |
| AT+UTEST=4,0 | +UTEST: 4,0<br>OK | Disables the antenna dynamic tuner control. |
| AT+UTEST=0 | OK | Enters the normal mode. |

**Table 20: antenna dynamic tuner configuration examples**

### 15.4.8 Digital pins testing description

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

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

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

☞ These commands are intended for production to check the correct digital pins behavior, detect possible soldering or functional problems and can be executed only in non-signalling mode (otherwise the "+CME ERROR: operation not allowed" or "+CME ERROR: 3" error result code - depending on the +CMEE AT command setting - is issued without performing any operations).

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

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

☞ SARA-R5
See the SARA-R5 series data sheet [151] for the pins levels characteristics.

### 15.4.9 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Digital pins testing generic syntax** | | | |
| Set | AT+UTEST=10,<op_code>[,[<bit_padding>]<pin_seq>] | OK | AT+UTEST=10,3,"0000001000000300" |

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

## 15.4.10 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | Test mode setting:<br>• 0: exits the test interface and restores the pins to the original configuration<br>• 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:<br>o 0: the pin will not be tested<br>o 1: the pin will be tested (as digital input or output)<br>• 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.<br>In case 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:<br>o 0: the pin will be set as an output<br>o 1: the pin will be set as an input<br>• 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:<br>o 0: the pin will output a "low" logic level<br>o 1: the pin will output a "high" logic level<br>• 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. |

| Parameter | Type | Description |
|---|---|---|
| | | • 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:<br>o 0: "low" logic digital level measured at the module pin<br>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:<br>• SARA-R5 - See the Notes and the SARA-R5 application development guide [177] for detailed number description |

### 15.4.11 Notes

- Consider these steps to construct the [<bit_padding>]<pin_seq> sequence:
  - o Consider the total number of the module's pins available
    - SARA-R5 - 96 pins
  - o When a non-testable pin is selected, the command does not return an error result code but the value is not considered and not applied.
  - o The status of the n-th pin will be represented by the corresponding n-th bit; see the <op_code> description for the notation of each mode setting
  - o Convert each group of four binary digits into its hexadecimal representation

☞ SARA-R5
See the SARA-R5 application development guide [177] and the corresponding module data sheet for the list of pins available for testing and their levels characteristics and further test command examples.

## 15.5 Smart temperature supervisor +USTS

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

### 15.5.1 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 shut-down procedure is performed only if <mode>=1 (notified by a URC) or <mode>=3 (without notification).

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

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

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

### 15.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USTS=<mode> | OK | AT+USTS=0 |

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

### 15.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Enables / disables the smart temperature mode:<br>• 0 (default value and factory-programmed value): smart temperature feature disabled<br>• 1: smart temperature feature enabled; the indication by means of the +UUSTS URC and shutting down (if needed) are performed<br>• 2: smart temperature indication enabled; the +UUSTS URC will be issued to notify the Smart Temperature Supervisor status<br>• 3: smart temperature feature enabled with no indication; the shutdown (if needed) is performed, but without a URC notification<br>Allowed values:<br>• SARA-R5 - 0 (default value and factory-programmed value), 1, 2 |
| <event> | Number | Provides the event status:<br>• -2: temperature below $t_{-2}$ threshold<br>• -1: temperature below $t_{-1}$ threshold<br>• 0: temperature inside the allowed range - not close to the limits<br>• 1: temperature above $t_{+1}$ threshold<br>• 2: temperature above the $t_{+2}$ threshold<br>• 10: timer expired and no emergency call is in progress, shutdown phase started<br>• 20: emergency call ended, shutdown phase started<br>• 100: error during measurement |

## 15.6 RING line handling +URING

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

### 15.6.1 Description

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

The RING line will be asserted when one of the configured events occurs and it remains asserted for 1 s unless another configured event happens (in this case the 1 s timer will be started again). Same behavior will be applied if the events are the incoming call or the incoming SMS.

### 15.6.2 Syntax

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

### 15.6.3 Defined values

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

### 15.6.4 Notes

**SARA-R5**

- The RING line handling depends on +USIO AT command configuration and the GPIO setting:
  - The +UGPIOC AT command allows setting a GPIO as RING line (<gpio_mode>=18).
  - When UART and AUX UART are both enabled as 5-wire configuration (for more details see +USIO AT command, <active_variant>=2), the GPIO pin set as RING line acts as the RING line for both of them.
  - When only the UART interface is enabled (for more details see +USIO AT command, <active_variant>=0, 1, 3, 4), the GPIO pin set as RING line is handled as the UART RING line (when one of the configured events occurs, they are both asserted / de-asserted).
  - <mode>=2, 3 is supported only with sockets and FTP in Direct Link mode.

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

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

### 15.7.1 Description

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

### 15.7.2 Syntax

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

### 15.7.3 Defined values

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

### 15.7.4 Notes

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

## 15.8 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 |

### 15.8.1 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 tunnelling 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.

### 15.8.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USIO=<requested_variant> | OK | AT+USIO=1<br>OK |
| Read | AT+USIO? | +USIO: <requested_variant>, *<active_variant><br>OK | +USIO: 1, *1<br>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>] [...]]<br>OK | +USIO: Variant=0: AT="UART"; AT="AUX UART"; TRACE="EXT UART"<br>+USIO: Variant=1: AT="UART"; TRACE="AUX UART"; DIGITAL AUDIO="I2S"<br>+USIO: Variant=2: AT="UART"; AT="AUX UART"; DIGITAL AUDIO="I2S"<br>+USIO: Variant=3: AT="UART"; GNSS="AUX UART"; TRACE="EXT UART"<br>+USIO: Variant=4: AT="UART"; GNSS="AUX UART"; DIGITAL AUDIO="I2S"<br>OK |

### 15.8.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <requested_variant> | Number | Requested (stored in NVM for next boot) configuration variant (range 0-255). The factory-programmed value is 1. |
| <active_variant> | Number | Active (currently used) configuration variant (range 0-255). The factory-programmed value is 1. |
| <AT_interface> | String | Serial interface configured for AT commands |
| <GNSS_interface> | String | Serial interface configured for GNSS tunnelling |
| <Trace_interface> | String | Serial interface configured for diagnostic log |

| Parameter | Type | Description |
|---|---|---|
| <Digital_audio_ interface> | String | Serial interface configured for digital audio |

### 15.8.4 Notes

- Table 21 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:<br>It is the full featured UART (9-wire), used as main interface to the host. |
| "AUX UART" | Auxiliary UART:<br>It is the general purpose UART (3-wire or 5-wire), with limited v.24 features. |
| "EXT UART" | External UART:<br>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. |
| "USB" | USB CDC-ACM or Network over USB:<br>USB CDC-ACM is a virtual UART, providing simulated v.24 features over a USB interface.<br>Network over USB is a virtual network interface providing diagnostic logging. |
| "I2S" | $I^2S$ interface:<br>It can be used for the digital audio. See the Audio interface for the required configurations. |
| "SPI" | SPI interface:<br>It is limited to diagnostic log. |
| "SDIO" | SDIO interface:<br>It is limited to diagnostic log. |

**Table 21: Serial interfaces**

**SARA-R5**

- The allowed configurations are listed as follows:

| <active_variant> | AT instance 1 | AT instance 2 | Diagnostic log | GNSS tunneling |
|---|---|---|---|---|
| 0 (factory-programmed value) | UART (7-wire) | Not available | USB-NCM, SPI, SDIO | Not available |
| 1 | UART (9-wire) | Not available | USB-NCM, SPI, SDIO | Not available |
| 2 | UART (5-wire) | AUX UART (5-wire) | USB-NCM, SPI, SDIO | Not available |
| 3 | UART (5-wire) | Not available | AUX UART (5-wire), USB-NCM, SPI, SDIO | Not available |
| 4 | UART (5-wire) | Not available | USB-NCM, SPI, SDIO | AUX UART (5-wire) |

**Table 22: Supported USIO variants**

- The SDIO interface is not supported.

## 15.9 Restore factory configuration +UFACTORY

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

### 15.9.1 Description

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

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

### 15.9.2 Syntax

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

### 15.9.3 Defined values

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

### 15.9.4 Notes

**SARA-R5**

- <fs_op>=1 (FS flash sectors erased) is not supported.
- If <fs_op>=2 (all files stored in FS deleted):
  - Any added ".lua" file in the "lwm2m_internal" folder is deleted. User has to store it again after the command.
  - Security data excluding user imported certificates (by using the +USECMNG AT command import functionality) are retained.
- <nvm_op>=1 (NVM flash sectors erased) is not supported.

## 15.10 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 |

### 15.10.1 Description

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

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

### 15.10.2 Syntax

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

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | OK | OK |

### 15.10.3 Defined values

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

## 15.11 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 |

### 15.11.1 Description

Enables URC reporting status for FOTA downloads and updates.

### 15.11.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UFOTASTAT=<n> | OK | AT+UFOTASTAT=1<br>OK |
| Read | AT+UFOTASTAT? | +UFOTASTAT: <n><br>OK | +UFOTASTAT: 1<br>OK |
| Test | AT+UFOTASTAT=? | +UFOTASTAT: (list of supported<n>s)<br>OK | +UFOTASTAT: (0,1)<br>OK |
| **Generic syntax** | | | |
| URC | | +UFOTASTAT: <event>,<param1>[,<param2>]<br>OK | +UFOTASTAT: 3,1,0<br>OK |
| **Download progress** | | | |
| URC | | +UFOTASTAT: 0,<progress_status>[,<percentage>]<br>OK | +UFOTASTAT: 0,1,10<br>OK |
| **Download start** | | | |
| URC | | +UFOTASTAT: 1,<start_triggered>,0<br>OK | +UFOTASTAT: 1,0,0<br>OK |
| **Download complete** | | | |
| URC | | +UFOTASTAT: 2,<status>,<status_details><br>OK | +UFOTASTAT: 2,2,100<br>OK |
| **FOTA status** | | | |
| URC | | +UFOTASTAT: 3,<update_result>,<update_state><br>OK | +UFOTASTAT: 3,1,0<br>OK |
| **Registration status** | | | |
| URC | | +UFOTASTAT: 4,<registration_result><br>OK | +UFOTASTAT: 4,2<br>OK |

### 15.11.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <n> | Number | Enable FOTA status URCs:<br>• 0: FOTA status URC disabled<br>• 1 (factory-programmed value): FOTA status +UFOTASTAT URC enabled |
| <event> | Number | Event type:<br>• 0: download progress<br>• 1: download start<br>• 2: download complete<br>• 3: FOTA status<br>• 4: registration status<br>Allowed values:<br>• SARA-R5 - 0, 1, 2, 3 |
| <progress_status> | Number | Allowed value:<br>• 1: download in progress |
| <percentage> | Number | Download completion in percentage |
| <start_triggered> | Number | Allowed value:<br>• 0: download start triggered |
| <status> | Number | FOTA completed download status:<br>• 2: success<br>• 3: fail |
| <status_details> | Number | Provides more information about FOTA completed download status:<br>• 100: success if <status>=2<br>• 100: user cancel if <status>=3<br>• 101: memory error<br>• 102: network error<br>• 103: unknown error<br>• 104: bad url |
| <update_result> | Number | Provides more information about FOTA completed download status:<br>• 0: initial<br>• 1: success<br>• 2: memory error<br>• 3: RAM error<br>• 4: connection lost<br>• 5: checksum error<br>• 6: unsupported package<br>• 7: URI error<br>• 8: firmware update fail<br>• 9: unsupported protocol<br>• 100: user abort |
| <update_state> | Number | Provides more information about FOTA completed download status:<br>• 0: idle<br>• 1: downloading<br>• 2: downloaded<br>• 3: updating |
| <registration_result> | Number | Provides more information about registration status:<br>• 0: idle<br>• 1: bootstrap started<br>• 2: bootstrap successful<br>• 3: bootstrap failed<br>• 4: connect successful<br>• 5: connect failed<br>• 6: registration successful<br>• 7: registration failed<br>• 8: registration timeout<br>• 9: client life time timeout<br>• 10: client halted<br>• 11: update successful |

| Parameter | Type | Description |
|---|---|---|
| | | • 12: update failed<br>• 13: update timeout<br>• 14: response failed<br>• 15: notify failed<br>• 16: de-registration successful<br>• 17: de-registration failed |
| <param1> | Number | Contains additional information depending on <event> value. |
| <param2> | Number | Contains additional information depending on <event> and <param1> values. |

### 15.11.4 Notes

**SARA-R5**

- The settings are not stored in NVM.

## 15.12 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 |

### 15.12.1 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 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.

### 15.12.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULGASP=<GPIO_mode>[,[<text>],[<msg_format>],[<tel_number>],[<profile_id>],[<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,,<br>OK |
| Read | AT+ULGASP? | +ULGASP: <GPIO_mode>,<text>,<msg_format>,<tel_number>,<profile_ID>,<IP_protocol>,<IP_addr:PORT>,<method>,<max_pow_red>,<urc_enable><br>OK | +ULGASP: 0,"Power_loss",0,"+39347123456",3,6,"192.168.100.20:8080",2,0,1<br>OK |
| Test | AT+ULGASP=? | +ULGASP: (list of supported <GPIO_mode>'s),,(list of supported <msg_format>'s),,(list of supported <profile_id>'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)<br>OK | +ULGASP: (0-2),,(0-1),,(0-6),(6,17),,(0-3),(0,1),(0,1)<br>OK |
| URC | | +UULGASP: <result>,<bearer> | +UULGASP: 0,1 |

### 15.12.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <GPIO_mode> | Number | Select the interrupt trigger. Allowed values:<br>• 0 (factory-programmed value): trigger disabled; the following arguments will be ignored<br>• 1: falling edge<br>• 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).<br>The factory-programmed value is "Last Gasp". |
| <msg_format> | Number | Format of the <text> parameter. Allowed values:<br>• 0 (factory-programmed value): text<br>• 1: binary |
| <tel_number> | String | Destination number of the SMS, it is mandatory if <method> is 0 or 2.<br>Factory-programmed value: empty string. |
| <profile_id> | Number | PSD profile identifier, in range 0-6. See +UPSD AT command. |
| <IP_protocol> | Number | IP protocol used for socket connection. Allowed values:<br>• 6: TCP<br>• 17 (factory-programmed value): UDP |
| <IP_addr:PORT> | String | IPv4 server address with the socket port, it is mandatory if <method> is different from 0 (SMS sending).<br>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:<br>• 0 (factory-programmed value): send SMS<br>• 1: use IP (TCP or UDP) connection<br>• 2: SMS preferred<br>• 3: IP (TCP or UDP) preferred |
| <max_pow_red> | Number | Maximum power reduction. Allowed values:<br>• 0 (factory-programmed value): no power reduction<br>• 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:<br>• 0 (factory-programmed value): disabled<br>• 1: enabled |
| <result> | Number | Operation result. Allowed values:<br>• 0: success<br>• 1: generic fail |
| <bearer> | Number | Notification used bearer. Allowed values:<br>• 0: SMS<br>• 1: IP (TCP or UDP) connection |

### 15.12.4 Notes

**SARA-R5**

- The <max_pow_red> parameter is not supported.
- The +UGPIOC: 24,19 configuration is loaded from the NVM only at the module boot, thus any new GPIO configuration takes place after a module power cycle.
- The <GPIO_mode> parameter setting 1 (falling edge) is not supported.

# 16 Power management

## 16.1 Power saving control (Power SaVing) +UPSV

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

### 16.1.1 Description

Sets the UART 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 or deep-sleep mode
- If the power saving is enabled (+UPSV: 1), the UART interface is cyclically enabled and the module enters idle or deep-sleep 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 or deep-sleep 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 or deep-sleep mode as long as the UART **DTR** line state is ON
- If the power saving is enabled (+UPSV: 4), the behaviour is the same as +UPSV: 1

### 16.1.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UPSV=<mode>[,<Timeout>] | OK | AT+UPSV=1,3000<br>OK |
| Read | AT+UPSV? | +UPSV: <mode>[,<Timeout>]<br>OK | +UPSV: 1,3000<br>OK |
| Test | AT+UPSV=? | +UPSV: (list of supported <mode>s), (list of supported <Timeout>s)<br>OK | +UPSV: (0-4),(40-65000)<br>OK |

### 16.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Power saving configuration. Allowed values:<br>• 0 (default and factory-programmed value): disabled<br>• 1: enabled<br>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. If the Power Saving Mode (PSM) feature is enabled (+CPSMS: 1), the module can enter the deep-sleep mode<br>• 2: power saving is controlled by UART **RTS** line:<br>o If the **RTS** line state is set to OFF, the power saving is allowed<br>o If the **RTS** line state is set to ON, the module shall exit from power saving, unless it has already entered the deep-sleep mode<br>☞ <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).<br>☞ 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).<br>• 3: power saving is controlled by UART **DTR** line:<br>o If the **DTR** line state is set to OFF, the power saving is allowed |

| Parameter | Type | Description |
|---|---|---|
| | | o If the **DTR** line state is set to ON, the module shall exit from power saving, unless it has already entered the deep-sleep mode<br>☞ <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.<br>☞ 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).<br>• 4: enabled<br>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. If the Power Saving Mode (PSM) feature is enabled (+CPSMS: 1), the module can enter the deep-sleep mode |
| <Timeout> | Number | If <mode>=1 or <mode>=4 and active mode entered, it provides the guard period of no reception of characters on the UART interface before entering power saving again. It is expressed in GSM frames (4.615 ms)<br>• 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)<br>• This parameter is accepted in case of <mode>=1 or <mode>=4 |

### 16.1.4 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.

**SARA-R5**

- <mode>=1, <mode>=2, <mode>=3 and <mode>=4 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 behaviour 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 or deep-sleep mode.
  - o If power saving is enabled (+UPSV: 1 or +UPSV: 4), both UART and AUX UART interfaces are cyclically enabled and the module enters idle or deep-sleep mode automatically whenever possible. The enabling is synchronous, and the interfaces share the same <Timeout> parameter configuration. The description provided for UART interface is fully applicable to AUX UART interface.
  - o If power saving is controlled by the UART **RTS** line (+UPSV: 2), the UART and AUX UART interfaces are enabled and the module does not enter idle or deep-sleep mode as long as the UART **RTS** line state is ON.
    The description provided for the UART interface is fully applicable to the AUX UART interface, but the AUX UART HW flow control can be enabled.

## 16.2 Power Saving Mode Setting +CPSMS

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

### 16.2.1 Description

Controls the setting of the UEs Power Saving Mode (PSM) parameters. The command controls whether the UE wants to apply PSM or not, as well as:

- the requested extended periodic RAU value in GERAN/UTRAN
- the requested GPRS READY timer value in GERAN/UTRAN

- the requested extended periodic TAU value in E-UTRAN
- the requested Active Time value

⚠ SARA-R5
Do not use a PIN enabled SIM card, otherwise the module does not enter PSM.

The read command returns the requested values:

- If the Power Saving Mode is enabled (+CPSMS: 1) and granted by the network, i.e. Active Time has been assigned, after the expiry of the assigned Active Time (T3324), every SW and HW component on the device will power down except for the real time clock (RTC). It will stay powered down until the expiry of the assigned extended periodic TAU value (T3412_ext) or the assigned periodic TAU value (T3412) (if the former has not been assigned) or the power on line is toggled.
- If the Power Saving Mode is disabled (+CPSMS: 0) or not granted by the network, the device will not enter Power Saving Mode (PSM).

Check whether the Active Time and the extended periodic TAU have been assigned to the UE by means of the AT+CEREG=4 command.

☞ SARA-R5
The assigned Active Time, extended periodic TAU value and periodic TAU value can be checked by means of the +UCPSMS AT command.

☞ SARA-R5
If the set command is issued and an optional parameter is omitted, the module applies the last set value.

### 16.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CPSMS=[<mode>[,<Requested_Periodic_RAU>[,<Requested_GPRS_READY_timer>[,<Requested_Periodic_TAU>,[<Requested_Active_Time>]]]]] | OK | AT+CPSMS=1,,,"01000011","01000011"<br>OK |
| Read | AT+CPSMS? | +CPSMS: <mode>,[<Requested_Periodic_RAU>],[<Requested_GPRS_READY_timer>],[<Requested_Periodic_TAU>],[<Requested_Active_Time>]<br>OK | +CPSMS: 1,,,"01000011","01000011"<br>OK |
| Test | AT+CPSMS=? | +CPSMS: (list of supported <mode>s),(list of supported <Requested_Periodic_RAU>s),(list of supported <Requested_GPRS_READY_timer>s),(list of supported <Requested_Periodic_TAU>s),(list of supported <Requested_Active_Time>s)<br>OK | +CPSMS: (0,1,2),,,("00000000"-"11111111"),("00000000"-"11111111")<br>OK |

### 16.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Indication to disable or enable the use of PSM in the UE. Allowed values:<br>• 0 (default value): disable the use of PSM<br>• 1: enable the use of PSM<br>• 2: disable the use of PSM and reset all parameters for PSM to factory-programmed values.<br>The factory-programmed value is:<br>• SARA-R5 - 0 |
| <Requested_Periodic_RAU> | String | One byte in an 8 bit format. Requested extended periodic RAU value (T3312_ext) to be allocated to the UE in GERAN/UTRAN. The requested extended periodic RAU value is coded as one byte (octet 3) of the GPRS Timer 3 information element coded as bit format (e.g. "01000111" equals 70 hours). For the coding and the value range, see the GPRS Timer 3 IE in 3GPP TS 24.008 table 10.5.163a/3GPP TS 24.008 [12]. See also |

| Parameter | Type | Description |
|---|---|---|
| | | 3GPP TS 23.682 [12]. See also 3GPP TS 23.682 [129] and 3GPP TS 23.060 [10]. The factory-programmed value is: |
| <Requested_GPRS_READY_timer> | String | One byte in an 8 bit format. Requested GPRS READY timer value (T3314) to be allocated to the UE in GERAN/UTRAN. The requested GPRS READY timer value is coded as one byte (octet 2) of the GPRS Timer information element coded as bit format (e.g. "01000011" equals 3 decihours or 18 minutes). For the coding and the value range, see the GPRS Timer IE in 3GPP TS 24.008 table 10.5.172/3GPP TS 24.008 [12]. See also 3GPP TS 23.060 [10]. The factory-programmed value is "00001010" (20 s). |
| <Requested_Periodic_TAU> | String | One byte in an 8 bit format. Requested extended periodic TAU value (T3412_ext) to be allocated to the UE in E-UTRAN. The requested extended periodic TAU value is coded as one byte (octet 3) of the GPRS Timer 3 information element coded as bit format (e.g. "01000111" equals 70 hours). For the coding and value range, see the GPRS Timer 3 IE in 3GPP TS 24.008 table 10.5.163a/3GPP TS 24.008 [12]. See also 3GPP TS 23.682 [129] and 3GPP TS 23.401 [130].<br>• SARA-R5 - The factory-programmed value is "10000101" (150 s). |
| <Requested_Active_Time> | String | One byte in an 8 bit format. Requested Active Time value (T3324) to be allocated to the UE in GERAN/UTRAN or in EUTRAN. The requested Active Time value is coded as one byte (octet 3) of the GPRS Timer 2 information element coded as bit format (e.g. "00100100" equals 4 minutes). For the coding and value range, see the GPRS Timer 2 IE in 3GPP TS 24.008 table 10.5.163/3GPP TS 24.008 [12]. See also 3GPP TS 23.682 [129], 3GPP TS 23.060 [10] and 3GPP TS 23.401 [130].<br>• SARA-R5 - The factory-programmed and default value is "00000011" (6 s). |

### 16.2.4 Notes

**SARA-R5**

- The PSM feature shall be enabled (+CPSMS: 1) as well as the power saving (+UPSV: 1 / +UPSV: 2 / +UPSV: 3 / +UPSV: 4) to allow the module entering the deep-sleep mode. For more details, see the SARA-R5 series system integration manual [152].
- The <Requested_Periodic_RAU> and <Requested_GPRS_READY_timer> parameters are not supported.
- If the special command AT+CPSMS= (with all parameters omitted) is issued, the use of PSM is disabled (<mode>=0) and all the PSM parameters are set to the following values:
  - <Requested_Periodic_TAU>="00100100" (4 hours)
  - <Requested_Active_Time>="00100010" (2 minutes)
- <mode>=2 (PSM use disabled and reset all parameters for PSM to factory-programmed values) is not supported.

## 16.3 Power Saving Mode assigned values +UCPSMS

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

### 16.3.1 Description

Reads the UEs Power Saving Mode (PSM) parameters assigned by the network. The command returns the state of PSM on the UE, as well as:

- the requested extended periodic RAU value in GERAN/UTRAN
- the requested GPRS READY timer value in GERAN/UTRAN
- the requested extended periodic TAU value in E-UTRAN
- the requested Active Time value

To be noticed that:

- If the Power Saving Mode is enabled (+UCPSMS: 1), after the expiry of T3324 (assigned Active Time), every SW and HW component on the device will power down except the real time clock (RTC). It will stay powered down until the expiry of the assigned extended periodic TAU value (T3412_ext), if present, or assigned periodic TAU value (T3412) (if the former is not present) or the power on line is toggled.
- Power Saving Mode disabled (+UCPSMS: 0): the device will not enter the Power Saving Mode (PSM).

### 16.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Read | AT+UCPSMS? | +UCPSMS: <mode>,[<Assigned_Periodic_RAU>],[<Assigned_GPRS_READY_timer>],[<Assigned_Periodic_TAU>],[<Assigned_Active_Time>],[<Assigned_Periodic_TAU_Format_Type>]<br><br>OK | +UCPSMS: 1,,,"01000011","01000011",1<br><br>OK |

### 16.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Indication to disable or enable the use of PSM in the UE. Allowed values:<br>• 0: use of PSM disabled<br>• 1: use of PSM enabled |
| <Assigned_Periodic_RAU> | String | Assigned extended periodic RAU (T3312_ext) value allocated to be allocated to the UE in GERAN/UTRAN, one byte in an 8 bit format. For the coding and the value range, see the GPRS timer 3 IE in 3GPP TS 24.008 [12] |
| <Assigned_GPRS_READY_timer> | String | Assigned GPRS READY timer (T3314) value allocated to the UE in GERAN/UTRAN, one byte in an 8 bit format. For the coding and the value range, see the GPRS timer 3 IE in 3GPP TS 24.008 [12] |
| <Assigned_Periodic_TAU> | String | One byte in an 8 bit format. Assigned extended periodic TAU value (T3412_ext), if present, or assigned periodic TAU value (T3412) (if the former is not present) allocated to the UE in E-UTRAN. The assigned periodic TAU value is coded as indicated by the <Assigned_Periodic_TAU_Format_Type> parameter. See also 3GPP TS 23.682 [129], 3GPP TS 23.060 [10] and 3GPP TS 23.401[130]. |
| <Assigned_Active_Time> | String | One byte in an 8 bit format. Assigned Active Time value (T3324) allocated to the UE in GERAN/UTRAN or in EUTRAN. The assigned Active Time value is coded as one byte (octet 3) of the GPRS timer 2 information element coded as bit format (e.g. "00100100" equals 4 minutes). For the coding and the value range, see the GPRS timer 2 IE in 3GPP TS 24.008 table 10.5.163/3GPP TS 24.008 [12]. See also 3GPP TS 23.682 [129], 3GPP TS 23.060 [10] and 3GPP TS 23.401 [130]. |
| <Assigned_Periodic_TAU_Format_Type> | Number | Coding type for <Assigned_Periodic_TAU> string. Allowed values:<br>• 0: the assigned periodic TAU value (T3412) is coded as one byte (octet 3) of the GPRS Timer 2 information element coded as bit format (e.g. "00100100" equals 4 minutes). For the coding and value range, see the GPRS Timer 2 IE in 3GPP TS 24.008 table 10.5.163/3GPP TS 24.008 [12].<br>• 1: the assigned extended periodic TAU value (T3412_ext) is coded as one byte (octet 3) of the GPRS Timer 3 information element coded as bit format (e.g. "01000111" equals 70 hours). For the coding and value range, see the GPRS Timer 3 IE in 3GPP TS 24.008 table 10.5.163a/3GPP TS 24.008 [12]. |

### 16.3.4 Notes

**SARA-R5**

- <Assigned_Periodic_RAU> and <Assigned_GPRS_READY_timer> are not supported.

## 16.4 Power Saving Mode indication +UPSMR

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

### 16.4.1 Description

Enables or disables the URC that indicates the device is about to enter the Power Saving Mode (PSM) or has exited from it.

### 16.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UPSMR=<mode> | OK | AT+UPSMR=1<br>OK |
| Read | AT+UPSMR? | +UPSMR: <mode><br>OK | +UPSMR: 1<br>OK |
| Test | AT+UPSMR=? | +UPSMR: (list of supported <mode>s)<br>OK | +UPSMR: (0-1)<br>OK |
| **Generic syntax** | | | |
| URC | | +UUPSMR: <state>[,<param1>] | +UUPSMR: 1 |
| **Module exiting PSM** | | | |
| URC | | +UUPSMR: 0,<image> | +UUPSMR: 0,1 |
| **Module entering PSM** | | | |
| URC | | +UUPSMR: 1 | +UUPSMR: 1 |
| **Client preventing PSM entry (<state>=2 or <state>=3)** | | | |
| URC | | +UUPSMR: <state>,<client_id> | +UUPSMR: 2,2 |

### 16.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Indication to disable or enable the PSM URC:<br>• 0 (factory-programmed value): the PSM URC is disabled<br>• 1: the PSM URC is enabled |
| <state> | Number | Indication of the state of the module with respect to PSM:<br>• 0: the module is out of PSM. The loaded image is indicated by the <image> parameter (where supported)<br>• 1: the module is entering PSM<br>• 2: PSM client identified by <client_id> is preventing module from entering PSM<br>• 3: PSM client identified by <client_id> is preventing module from entering PSM deep sleep mode |
| <image> | Number | Identifies the image loaded when exiting PSM:<br>• 1: full image is loaded<br>• 2: paging only image is loaded |
| <client_id> | Number | Identifies the PSM client that is preventing the module from entering PSM:<br>• SARA-R5 - Bitmask in hexadecimal format for combining PSM clients; the allowed values can be combined together: i.e. 24 (0x18 in hexadecimal format) represents LwM2M and security.<br>o 3: LwM2M<br>o 4: security<br>o 5: data connection manager<br>o 6: AT<br>o 7: GNSS<br>o 8: other |
| <param1> | Number | Supported content depends on the related <state> (details are given above). |

### 16.4.4 Notes

**SARA-R5**

- The <image> parameter is not supported.

## 16.5 Power Preference Indication for EPS +CEPPI

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

### 16.5.1 Description

Indicates whether the MT prefers a configuration primarily optimised for power saving or not.

When in E-UTRAN RAT, if further conditions defined in 3GPP TS 36.331 [88] are met, this can cause transmission of a UEAssistanceInformation message with powerPrefIndication set to <power_preference> to the network.

This command may be used in both normal and modem compatibility modes.

### 16.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+CEPPI=<power_preference> | OK | AT+CEPPI=1<br>OK |
| Test | AT+CEPPI=? | +CEPPI: (list of supported <power_preference>s)<br>OK | +CEPPI: (0-1)<br>OK |

### 16.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <power_preference> | Number | MT power consumption preference:<br>• 0: normal<br>• 1: low |

# 17 GPIO

## 17.1 Introduction

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

### 17.1.1 GPIO functions

On u-blox cellular modules, GPIO pins can be opportunely configured as general purpose input or output. Moreover GPIO pins of u-blox cellular modules can be configured to provide custom functions via +UGPIOC AT command. The custom functions availability can vary depending on the u-blox cellular modules series and version: see Table 23 for an overview of the custom functions supported by u-blox cellular modules.

| <gpio_mode> | Output | Input | Network status indication | External GNSS supply enable | External GNSS data ready | External GNSS RTC sharing | Jamming detection indication | SIM card detection | Headset detection | GSM Tx burst indication | Module status indication | Module operating mode indication | I2S digital audio interface | SPI serial interface | Master clock generation | UART (DSR, DTR, DCD and RI) interface | Wi-Fi enable | Ring indicator | Last gasp | External GNSS antenna / LNA control | Time pulse GNSS | Time pulse output | Time stamp of external interrupt | Fast and safe power-off | LwM2M pulse | Hardware flow control (RTS, CTS) | Antenna dynamic tuning | External GNSS time pulse input | External GNSS time stamp of external interrupt | DTR mode for power saving control | 32.768 kHz output | Pad disabled |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 32 | 255 |
| SARA-R500S | * | * | * | * | * | | | * | | | * | * | | | | | | * | * | | | * | * | * | | | | * | * | | | * |
| SARA-R510S | * | * | * | * | * | | | * | | | * | * | | | | | | * | * | | | * | * | * | | | | * | * | | | * |
| SARA-R510M8S | * | * | * | | | | | * | | | * | * | | | | | | * | * | | | * | * | * | | | | | | | | * |

**Table 23: 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.

SARA-R5
For more details on the antenna dynamic tuner control feature, see the +UTEST AT command.

### 17.1.2 GPIO mapping

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

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

#### 17.1.2.1 SARA-R5 GPIO mapping

| <gpio_id> | Pin name | Pin number | Factory-programmed function | Remarks |
|---|---|---|---|---|
| 16 | GPIO1 | 16 | Pin disabled | - |
| 23 | GPIO2 | 23 | Pin disabled | Only pin 23 can be configured for "External GNSS supply enable" functionality |
| 24 | GPIO3 | 24 | Pin disabled | Only pin 24 can be configured for "External GNSS data ready" functionality |
| 25 | GPIO4 | 25 | Pin disabled | Only pin 25 can be configured for "External GNSS time stamp of external interrupt" functionality |

| <gpio_id> | Pin name | Pin number | Factory-programmed function | Remarks |
|---|---|---|---|---|
| 33 | EXT_INT | 33 | Pin disabled | Only pin 33 can be configured for "Time stamp of external interrupt" functionality |
| 42 | GPIO5 | 42 | Pin disabled | Only pin 42 can be configured for "SIM card detection" functionality |
| 19 | GPIO6 | 19 | Pin disabled | Only pin 19 can be configured for "Time pulse output" functionality |
| 46 | SDIO_CMD | 46 | Pin disabled | Only pin 46 can be configured for "External GNSS time pulse input" functionality |

**Table 24: SARA-R5 series GPIO mapping**

#### 17.1.2.2 Additional notes

SARA-R5
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 GPS aiding.

SARA-R5
When "SIM card detection" functionality is enabled, the status is reported by +CIND AT command.

SARA-R5
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.

SARA-R5
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.

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

### 17.1.3 Network status indication

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

- No service: indicates no network coverage or not registered state
- Registered home network 2G: indicates registered state on home network in 2G RAT
- Registered home network 3G: indicates registered state on home network in 3G RAT
- Registered home network NB1 / NB2: indicates registered state on home network in NB1 / NB2
- 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 NB1 / NB2: indicates registered state with visitor NB1 / NB2 network (roaming in NB1 / NB2)
- Data transmission: indicates voice or data call active either in 2G, 3G or 4G RAT
- Data transmission roaming: indicates voice or data call active either in 2G, 3G or 4G RAT with visitor network

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

#### 17.1.3.1 No service (no network coverage or not registered)

- Continuous Output / Low




**Figure 1: GPIO pin progress for no service**

#### 17.1.3.2 Registered home network 2G

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

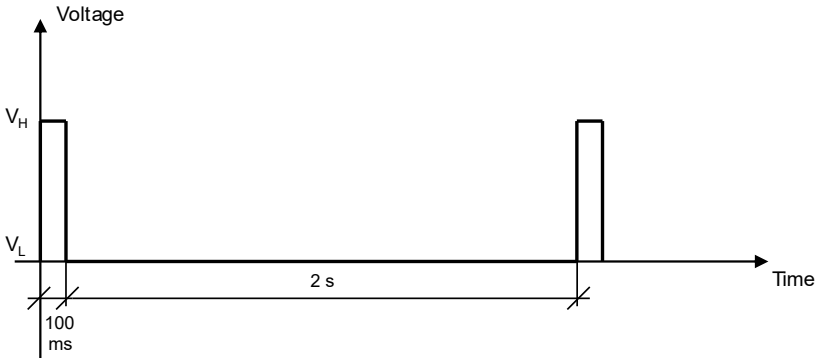



**Figure 2: GPIO pin progress for registered home network 2G**

#### 17.1.3.3 Registered home network 3G

- Cyclic Output / High for 50 ms, Output / Low for 50 ms, Output / High for 50 ms, Output / Low for 2 s

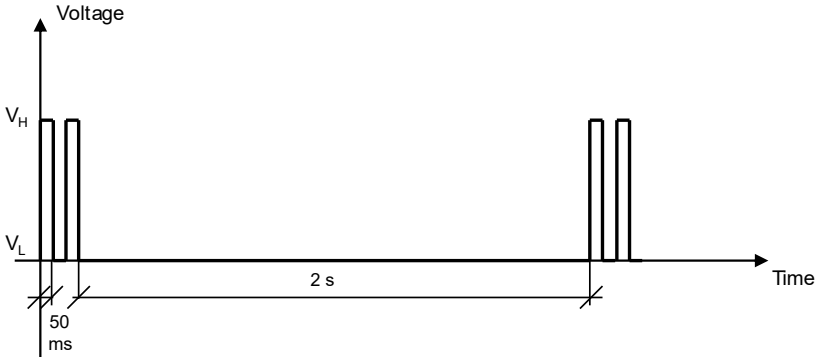



**Figure 3: GPIO pin progress for registered home network 3G**

#### 17.1.3.4 Registered home network NB1 / NB2

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

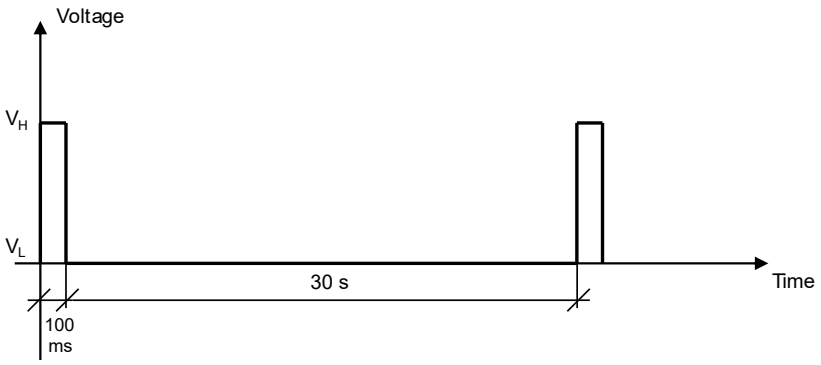



**Figure 4: GPIO pin progress for registered home network NB1 / NB2**

#### 17.1.3.5 Registered roaming 2G

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

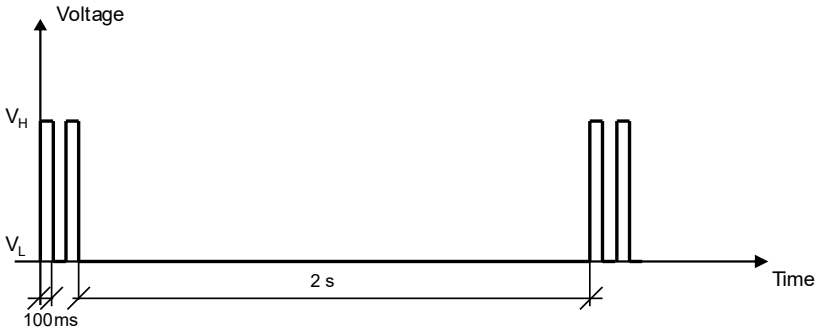



**Figure 5: GPIO pin progress for registered roaming 2G**

#### 17.1.3.6 Registered roaming 3G

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

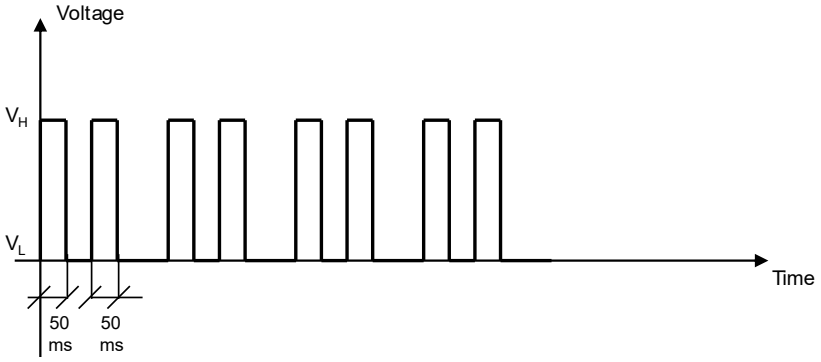



**Figure 6: GPIO pin progress for registered roaming 3G**

#### 17.1.3.7 Registered roaming NB1 / NB2

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

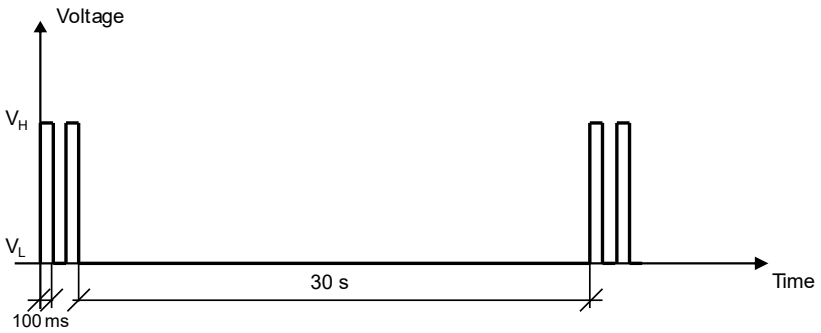



**Figure 7: GPIO pin progress for registered roaming NB1 / NB2**

#### 17.1.3.8 Data transmission

- Continuous Output / High

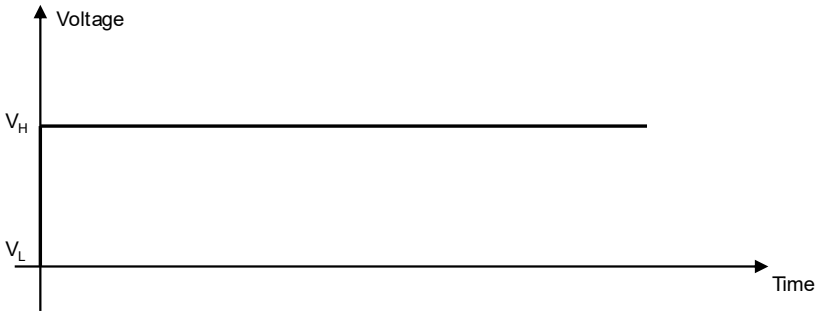



**Figure 8: GPIO pin progress for data transmission**

#### 17.1.3.9 Data transmission roaming

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

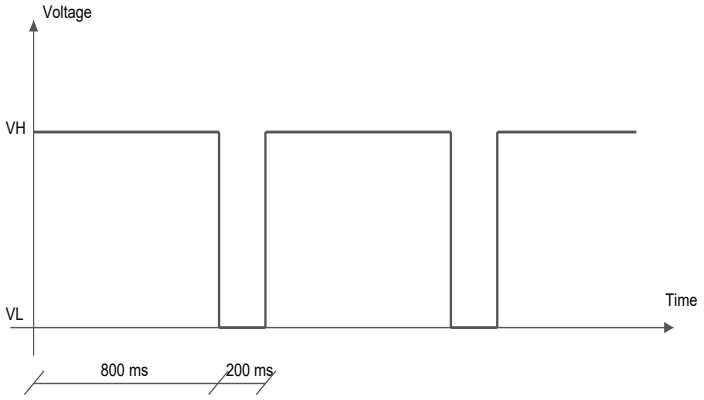



**Figure 9: GPIO pin progress for data transmission roaming**

SARA-R5
When registered on 4G (LTE) network, the GPIO pin progress is the same as for data transmission (Figure 8) because a PDP context/EPS bearer is available.

### 17.1.4 Module status indication

When a GPIO pin is configured to provide module status indication, its progress depends on the current module status (power-off mode, i.e. module switched off, versus idle, active or connected mode, i.e. module switched on):

- Output / High, when the module is switched on (any operating mode during module normal operation: idle, active or connected mode)
- Output / Low, when the module is switched off (power-off mode)

### 17.1.5 Module operating mode indication

When a GPIO pin is configured to provide module operating mode indication, its progress depends on the current module operating mode (the low power idle mode versus active or connected mode):

- Output / High, when the module is in active or connected mode
- Output / Low, when the module is in idle mode (that can be reached if the power saving is enabled by the +UPSV AT command)

## 17.2 GPIO select configuration command +UGPIOC

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

### 17.2.1 Description

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

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

☞ Not all the GPIO functions can be assigned to each GPIO pin. If the configuration is not allowed, an error result code will be returned (error result code 1502 - "+CME ERROR: Select GPIO mode error").
The following custom functions cannot be simultaneously configured on 2 GPIOs:

- Network status indication
- External GNSS supply enable
- External GNSS data ready
- External GNSS RTC sharing
- Jamming detection indication
- SIM card detection
- Headset detection
- GSM Tx burst indication
- Module status indication
- Module operating mode indication
- Ring indicator
- Last gasp
- External GNSS antenna / LNA control
- Time pulse GNSS
- Time pulse output
- Time stamp of external interrupt
- Fast and safe power-off
- External GNSS time pulse input
- External GNSS time stamp of external interrupt
- DTR mode for power saving control
- 32.768 kHz output

☞ For more details regarding the custom functions supported by the u-blox cellular modules and the factory-programmed settings, see GPIO functions and GPIO mapping.

SARA-R5
For more details on the antenna dynamic tuner control feature, see the +UTEST AT command.

SARA-R5
To make available the GPIO set as "External GNSS supply enable" mode it is needed to stop supplying GNSS receiver with the AT+UGPS=0 command.

SARA-R5
The list of the <gpio_id> with the related <gpio_mode> is not provided in the test command.

### 17.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGPIOC=<gpio_id>,<gpio_mode>[,<gpio_out_val>\<gpio_in_pull>] | OK | AT+UGPIOC=20,0,1<br>OK |
| Read | AT+UGPIOC? | +UGPIOC:<br><gpio_id>,<gpio_mode><br>[<gpio_id>,<gpio_mode><br>[....]]<br>OK | +UGPIOC:<br>20,0<br>21,3<br>23,255<br>24,255<br>42,7<br>OK |
| Test | AT+UGPIOC=? | +UGPIOC: (list of supported <gpio_id>),(list of supported <gpio_mode>),(list of supported <gpio_out_val>\<gpio_in_pull>)<br>[<gpio_id1>,<gpio_mode><br>...<br><gpio_idN>,<gpio_mode>]<br>OK | +UGPIOC: (20,21,23,24,42),(0-5,7,9,255),(0-2)<br>OK |

### 17.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <gpio_id> | Number | GPIO pin identifier: pin number<br>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<br>See the GPIO functions for custom functions supported by different u-blox cellular modules series and product version.<br>Allowed values:<br>• 0: output<br>• 1: input<br>• 2: network status indication<br>• 3: external GNSS supply enable<br>• 4: external GNSS data ready<br>• 5: external GNSS RTC sharing<br>• 6: jamming detection indication<br>• 7: SIM card detection<br>• 8: headset detection<br>• 9: GSM Tx burst indication<br>• 10: module status indication<br>• 11: module operating mode indication<br>• 12: $I^2S$ digital audio interface<br>• 13: SPI serial interface<br>• 14: master clock generation |

| Parameter | Type | Description |
|---|---|---|
| | | • 15: UART (DSR, DTR, DCD e RI) interface<br>• 16: Wi-Fi enable<br>• 18: ring indicator<br>• 19: last gasp<br>• 20: external GNSS antenna / LNA control enable<br>• 21: time pulse GNSS<br>• 22: time pulse output<br>• 23: time stamp of external interrupt<br>• 24: fast and safe power-off<br>• 25: LwM2M pulse<br>• 26: hardware flow control (RTS, CTS)<br>• 27: antenna dynamic tuning<br>• 28: external GNSS time pulse input<br>• 29: external GNSS time stamp of external interrupt<br>• 30: DTR mode for power saving control<br>• 32: 32.768 kHz output<br>• 255: pad disabled |
| <gpio_out_val> | Number | GPIO output value (for output function <gpio_mode>=0 only):<br>• 0 (default value): low<br>• 1: high |
| <gpio_in_pull> | Number | GPIO input value (for input function <gpio_mode>=1 only):<br>• 0 (default value): no resistor activated<br>• 1: pull up resistor active<br>• 2: pull down resistor active |

### 17.2.4 Notes

**SARA-R5**

- <gpio_in_pull> is not supported.
- The network status indication function cannot be set on the GPIO5 pin.

## 17.3 GPIO read command +UGPIOR

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

### 17.3.1 Description

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

### 17.3.2 Syntax

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

### 17.3.3 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 version. |
| <gpio_val> | Number | GPIO value. Allowed values are 0 and 1. |

### 17.3.4 Notes

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

## 17.4 GPIO set command +UGPIOW

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

### 17.4.1 Description

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

### 17.4.2 Syntax

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

### 17.4.3 Defined values

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

### 17.4.4 Notes

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

# 18 File System

## 18.1 File tags

### 18.1.1 Description

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

The file tag applicability depends on the module series: see Table 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" |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SARA-R5 | * | * | | | | | | * | | * | * |

**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.<br>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>.<br>☞ 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 [182]) 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.<br>To download the eCall controller configuration or custom eCall prompts in the module, use the +UDWNFILE command.<br>To read the eCall controller configuration from the module, use the +URDFILE command.<br>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):<br>• +CLVL AT command<br>• +CRSL AT command<br>• +UI2S AT command<br>• +UMAFE AT command<br>• +USAFE AT command<br>• +UMSEL AT command |

| Tag | Name | Specification |
|---|---|---|
| | | • +UMGC AT command<br>• +USGC AT command<br>• +USPM AT command<br>• +UTI AT command<br>To download the audio configuration in the module, use the +UDWNFILE command.<br>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 shut-down. Some notes about ECNL:<br>• If eCall is enabled, the ECNL list is not used and call is treated as any normal call.<br>• Conflict manager will not manage these calls, meaning no ongoing calls will be dropped.<br>• Maximum allowed numbers in the ECNL list is 20. Numbers after 20 will be ignored.<br>• Reboot is required to reload the ECNL list after download.<br>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 [12] sub-clause 10.5.4.7).<br>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.<br>Example of a two line ECNL file:<br>`2,+390123456789`<br>`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:<br>• "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.<br>• "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:<br>`ATT%310150%310170%310410%310560%311180%310030%310280`<br>`%310950%313100%312670%313110%313120%313130%313140`<br>`%313790%VZW%310890%311480%311270%310010%310012%310013`<br>`%310590%310890%310910%311110%311270%311271%311272`<br>`%311273%311274%311275%311276%311277%311278%311279`<br>`%311280%311281%311282%311283%311284%311285%311286` |

| Tag | Name | Specification |
|---|---|---|
| | | %311287%311288%311289%311390%311480%311481%311482<br>%311483%311484%311485%311486%311487%311488%311489<br>Allowed MNO1,..., MNOn values for both iccid_list and mno_list files are:<br>• ATT: AT&T<br>• VZW: Verizon<br>The maximum entries number in the MCC/MNC list and ICCID list is 126 and the file overall maximum size is 1024 bytes. |

**Table 26: Tag meanings**

# 18.2 Download file +UDWNFILE

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

## 18.2.1 Description

Stores (writes) a file into the file system:

- The stream of bytes can be entered after the '>' prompt has been provided to the user. The file transfer is terminated exactly when <size> bytes have been entered and either "OK" final result code or an error result code is returned. The feed process cannot be interrupted i.e. the command mode is re-entered once the user has provided the declared the number of bytes.
- If the file already exists, the data will be appended to the file already stored in the file system.
- If the data transfer stops, after 20 s the command is stopped and the "+CME ERROR: FFS TIMEOUT" error result code (if +CMEE: 2) is returned.
- If the module shuts down during the file storing, all bytes of the file will be deleted.
- If an error occurs during the file writing, the transfer is aborted and it is up to the user to delete the file.

SARA-R5

- The available free memory space is checked before starting the file transfer. If the file size exceeds the available space, the "+CME ERROR: FFS MEMORY NOT AVAILABLE" error result code will be provided (if +CMEE: 2).
- If the file already exists, the data will be overwritten.
- If an error occurs during the file writing, all bytes of the file will be deleted.

SARA-R5
If the HW flow control is disabled (AT&K0), a data loss could be experienced. So the HW flow control usage is strongly recommended.

## 18.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UDWNFILE=<filename>,<size>[,<tag>] | OK | AT+UDWNFILE="filename",36,"USER"<br>><br>The 36 downloaded bytes of the file!<br>OK |
| | > <text> | | |
| **Download audio configuration** | | | |
| Set | AT+UDWNFILE=<filename>,<size>,"AUDIO_EXT" | OK | AT+UDWNFILE="audioconfig",4873,"AUDIO_EXT"<br>OK |

## 18.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <filename> | String | File name. For file system file name and data size limits see File system limits. |

| Parameter | Type | Description |
|---|---|---|
| <size> | Number | File size expressed in bytes. For file system file name and data size limits see File system limits. |
| <tag> | String | Optional parameter that specifies the application file type. FILE TAGS table lists the allowed <tag> strings. For more details on specific limitations, see Notes. |
| <text> | String | Stream of bytes. |

### 18.2.4 Notes

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

**SARA-R5**

- Set the <tag> parameter to "GNSS" in order to store the firmware file for the internal GNSS receiver. In this case the <filename> parameter is ignored.
- The <tag> parameter is mandatory for firmware package transfer. The tag must be given as "FOAT" for FW download. For more details, see FILE TAGS.

## 18.3 List files information +ULSTFILE

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

### 18.3.1 Description

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

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

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

### 18.3.2 Syntax

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

### 18.3.3 Defined values

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

## 18.4 Read file +URDFILE

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

### 18.4.1 Description

Retrieves a file from the file system.

### 18.4.2 Syntax

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

### 18.4.3 Defined values

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

### 18.4.4 Notes

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

## 18.5 Partial read file +URDBLOCK

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

### 18.5.1 Description

Retrieves a file from the file system.

Differently from +URDFILE command, this command allows the user to read only a portion of the file, indicating the offset and amount of bytes.

### 18.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+URDBLOCK=<filename>,<offset>,<size>[,<tag>] | +URDBLOCK: <filename>,<size>,<data><br>OK | AT+URDBLOCK="filename",0,20<br>+URDBLOCK: "filename",20,"these bytes are the "<br>OK |

### 18.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <filename> | String | File name. For file system file name and data size limits see File system limits. |
| <offset> | Number | Offset in bytes from the beginning of the file. |
| <size> | Number | Number of bytes to be read starting from the <offset>. |
| <data> | String | Content of the file read. |
| <tag> | String | The optional parameter <tag> specifies a different application file type. FILE TAGS table lists the allowed <tag> strings. |

### 18.5.4 Notes

- The returned file data is displayed as an ASCII string of <length> characters in the range [0x00,0xFF]. At the end of the string, <CR><LF> are provided for user convenience and visualization purposes.
- In case a size larger than the whole file size is required the command returns the file size only, indicating the amount of bytes read.
- In case an offset larger than the whole file size is required, the "+CME ERROR: FFS file range" error result code is triggered.

**SARA-R5**

- The <tag> parameter is not supported.

## 18.6 Delete file +UDELFILE

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

### 18.6.1 Description

Deletes a stored file from the file system.

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

### 18.6.2 Syntax

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

### 18.6.3 Defined values

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

## 18.7 File system limits

### 18.7.1 Allowed characters in filenames

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

☞ SARA-R5
Filenames starting with a dot (.) are not valid.

### 18.7.2 Limits

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

Maximum filename length:

- SARA-R5 - 248 characters

Maximum file size:

- SARA-R5 - File size limited by the available file system space retrieved by +ULSTFILE=1 command

Maximum number of files:

- SARA-R5 - The theoretical maximum number of files that can be stored is 1100.

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

# 19 DNS

DNS service requires the user to define and activate a connection profile, either PSD or CSD.

SARA-R5
See +UPSD, +UPSDA and +UPSND AT commands for establishing a PSD connection.

When these command report an error which is not a +CME ERROR, the error class and code is provided through +USOER AT command.

## 19.1 Resolve name / IP number through DNS +UDNSRN

| +UDNSRN | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | No | No | < 130 s | TCP/UDP/IP Error |

### 19.1.1 Description

Translates a domain name to an IP address or an IP address to a domain name by using an available DNS. There are two available DNSs, primary and secondary. The network usually provides them after a GPRS activation or a CSD establishment. They are automatically used in the resolution process if available. The resolver will use first the primary DNS, otherwise if there is no answer, the second DNS will be involved.

SARA-R5
The user can replace each network provided DNS by setting its own DNS for a PSD context by means of the +UPSD AT command. If a DNS value different from "0.0.0.0" is provided, the user DNS will replace the correspondent network-provided one. Usage of the network provided DNSs is recommended.

The DNS resolution timeout depends on the number of DNS servers available to the DNS resolution system. The response time for the DNS resolution is estimated in case 8 servers are used to perform this task.

Pay attention to the DNS setting for the different profiles since the user DNS can be put into action if the corresponding profile is activated (if the user sets a DNS for a profile, and a different profile is activated, the user DNS has no action and the network DNS is used if available).

### 19.1.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UDNSRN=<resolution_type>, <domain_ip_string>[,<async>] | +UDNSRN: <resolved_ip_address><br>OK<br>or<br>+UDNSRN: <resolved_domain_name><br>OK | AT+UDNSRN=0,"www.google.com"<br>+UDNSRN: "216.239.59.147"<br>OK |
| | | | AT+UDNSRN=0,"www.google.com",1<br>OK<br>+UUDNSRN: "216.239.59.147" |
| | | | AT+UDNSRN=0,"www.google.com",0<br>+UDNSRN: "216.239.59.147"<br>OK |
| URC | | +UUDNSRN: <result_code>[,<resolved_ip_address>] | +UUDNSRN: 0,"216.239.59.147" |
| | | +UUDNSRN: <result_code>[,<resolved_domain_name>] | +UUDNSRN: 0,"somedomain.com" |
| | | +UUDNSRN: -1 | +UUDNSRN: -1 |

### 19.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <resolution_type> | Number | Type of resolution operation:<br>• 0: domain name to IP address<br>• 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:<br>• 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<br>• 1: a final result code (OK or an error result code) is returned immediately unlocking the AT interface and making it available for the execution of other AT commands. Once the result of DNS resolution becomes available, it is notified to the AT interface through the +UUDNSRN URC |
| <resolved_ip_address> | String | Resolved IP address corresponding to the specified domain name |
| <resolved_domain_name> | String | Resolved domain name corresponding to the provided IP address |
| <result_code> | Number | Result code of DNS resolution:<br>• 0: no error<br>• -1: DNS resolution failed. In this case the <resolved_ip_address> or the <resolved_domain_name> fields are not present |

### 19.1.4 Notes

**SARA-R5**

- The <async> parameter and the +UUDNSRN URC are not available.

## 19.2 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 |

### 19.2.1 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).

### 19.2.2 Description

Sets up the dynamic DNS client functionality. This command is part of the internal TCP/IP stack so it only works for internal PDP contexts (managed by +UPSD and +UPSDA command; see the Multiple PDP contexts).

The command configuration is stored into the NVM: if enabled, it automatically works after a reboot.

The following dynamic DNS providers are supported:

- TZO.com
- DynDNS.org

- DynDNS.it
- No-IP.org
- DNSDynamic.org

During the service subscription phase the dynamic DNS provider gives a domain name, a username and a password that the AT application will use later.

If the DYNDNS client is enabled when an internal PDP connection is already active, the DYNDNS client starts working on the next PDP context activation.

☞ This functionality is only available for the PDP context enabled with +UPSDA command.

☞ Before changing the dynamic DNS client configuration it is required to stop (deactivate) it. Any attempt to reconfigure an already running DNS client raises an error.

☞ The dynamic DNS update is not allowed during the first 60 s after module power on. If a PDP connection is established before this time, a URC notifies that the update has been delayed. In this case the update is performed once the 60 s are elapsed.

☞ The dynamic DNS protocol does not allow more than one update every 60 s, anyhow the module's DYNDNS client will respect specific timing rules depending on the selected provider policies.

☞ Due to the various caches involved in the DNS resolution process, the time since the DNS update is done until it is available for a user, can significantly change among different internet providers.

### 19.2.3 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UDYNDNS=<on_off>[,<service_id>,<domain_name>,<username>,<password>] | OK | **Enable the dynamic DNS client using the TZO DNS service and the domain name "remote001.tzo.net".**<br>AT+UDYNDNS=1,0,"remote001.tzo.net","dummy_username","dummy_password"<br>OK |
| | | | **Disable the dynamic DNS client:**<br>AT+UDYNDNS=0<br>OK |
| Read | AT+UDYNDNS? | +UDYNDNS: <on_off>,<service_id>,<domain_name>,<username>,<password><br>OK | +UDYNDNS: 1,0,"remote001.tzo.net","dummy_username","dummy_password"<br>OK |
| Test | AT+UDYNDNS=? | +UDYNDNS: (list of supported <on_off>),(list of supported <service_id>),<domain_name>,<username>,<password>)<br>OK | +UDYNDNS: (0-1),(0-4),"domain_name","username","password"<br>OK |
| URC | | +UUDYNDNS: <status>,<code> | +UUDYNDNS: 1,0 |

### 19.2.4 Defined values

| Parameter | Type | Description |
|---|---|---|
| <on_off> | Number | Enable / disable the dynamic DNS client:<br>• 0 (factory-programmed value): disable the client<br>• 1: enable the client |
| <service_id> | Number | Indicates which dynamic DNS service provider to use:<br>• 0 (factory-programmed value): TZO.com<br>• 1: DynDNS.org<br>• 2: DynDNS.it<br>• 3: No-IP.org<br>• 4: DynamicDNS.org<br>Mandatory parameter with <on_off>=1, not allowed with <on_off>=0. |

| Parameter | Type | Description |
|---|---|---|
| <domain_name> | String | Indicates which domain name should be associated with the module IP address. The dynamic DNS service provider provides this value.<br>Maximum length: 64 bytes.<br>Mandatory parameter with <on_off>=1, not allowed with <on_off>=0.<br>The factory-programmed value is an empty string. |
| <username> | String | The username used for the client authentication.<br>Maximum length: 64 characters.<br>Mandatory parameter with <on_off>=1, not allowed with <on_off>=0.<br>The factory-programmed value is an empty string. |
| <password> | String | The password used for the client authentication.<br>Maximum length: 32 characters.<br>Mandatory parameter with <on_off>=1, not allowed with <on_off>=0.<br>The factory-programmed value is an empty string. |
| <status> | Number | This is the internal status of the dynamic DNS client. Each time the internal status changes or there is an error the URC +UUDYNDNS is issued:<br>• 0: client inactive/stopped<br>• 1: client enabled/active<br>• 2: DNS update successfully executed<br>• 3: DNS update failed<br>• 4: DNS update delayed<br>• 5: No DNS update is required<br>• 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). |

### 19.2.5 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.

### 19.2.6 DynDNS client behavior in case of error

When the error result code is in range 1-10 and 100-108 the client waits for 60 s before allowing any update operation.

In all the other cases (error in range from 40 to 57) the following behaviors are applied:

- SARA-R5 - 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 |

- SARA-R5 - 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 |

# 20 Internet protocol transport layer

## 20.1 Introduction

SARA-R5
Before using TCP/IP services, a connection profile must be defined and activated. The sockets can be managed independently and simultaneously over the same bearer (either PSD or CSD). AT commands for both reading and writing data on sockets are provided and the URC notifies the external application of incoming data and transmission result, no need for polling.

SARA-R5
See +UPSD, +UPSDA and +UPSND AT commands for establishing a PSD connection.

SARA-R5
When these commands report an error result code which is not a +CME ERROR, the error code can be queried using the +USOER or +USOCTL (specifying the socket ID and with <param_id>=1) AT commands.

The maximum number of sockets that can be managed depends on the module series:

- SARA-R5 - 7

The UDP protocol has not any flow control mechanism and packets might be lost in the following scenarios:

- No network signal is available
- Unreliable radio interface (e.g. mobility in GPRS, where cell reselections can lead to data loss, that can be contrasted with the usage of LLC ack reliability QoS parameter

SARA-R5
Some network operators close dynamic NATs after few minutes if there is no activity on the connection (no data transfer in the period). To solve this problem enable the TCP keep alive options with 1 minute delay (see the +USOSO AT command).

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

- If it is possible, adopt an application layer UDP acknowledge system

## 20.2 IPv4/IPv6 addressing

### 20.2.1 Introduction

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

### 20.2.2 IPv4

**Format:**

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

**Examples:**

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

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

**Table 27: IPv4 address format examples**

# 20.3 Create Socket +USOCR

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

## 20.3.1 Description

Creates a socket and associates it with the specified protocol (TCP or UDP), returns a number identifying the socket. Such command corresponds to the BSD socket routine:

- SARA-R5 - Up to 7 sockets can be created.

It is possible to specify the local port to bind within the socket in order to send data from a specific port. The bind functionality is supported for both TCP and UDP sockets.

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

## 20.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USOCR=<protocol>[,<local_port>[,<IP_type>]] | +USOCR: <socket><br>OK | AT+USOCR=17<br>+USOCR: 2<br>OK |
| Test | AT+USOCR=? | +USOCR: (list of supported <protocol>s),(list of supported <local_port>s),(list of supported <IP_type>s)<br>OK | +USOCR: (6,17),(1-65535),(0,1)<br>OK |

## 20.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <protocol> | Number | • 6: TCP<br>• 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.<br>• SARA-R5 - The range goes from 0 to 6. |
| <IP_type> | Number | Selects the specific IP type (for the required <socket>) between IPv4 and IPv6 when <PDP_type> is set to "IPV4V6" while the PDP context is created by means of +CGDCONT AT command. Allowed values:<br>• 0 (default value): IPv4<br>• 1: IPv6 |

## 20.3.4 Notes

**SARA-R5**

- The <IP_type> parameter is not supported.

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

| +USOSEC | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | No | No | < 120 s | +CME Error |

### 20.4.1 Description

Enables or disables the use of SSL/TLS/DTLS connection (where supported) on a TCP/UDP socket. The configuration of the SSL/TLS/DTLS properties is provided with an SSL/TLS/DTLS profile managed by USECMNG.

The <usecmng_profile_id> parameter is listed in the information text response to the read command only if the SSL/TLS/DTLS is enabled on the interested socket.

SARA-R5
The command is applicable only with TCP sockets.

The enable or disable operation can be performed only after the socket has been created with +USOCR AT command.

The SSL/TLS/DTLS is supported only with +USOCO command (socket connect command). The SSL/TLS/DTLS is not supported with +USOLI command (socket set listen command is not supported and the +USOSEC settings will be ignored).

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

### 20.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USOSEC=<socket>,<ssl_tls_dtls_status>[,<usecmng_profile_id>] | OK | AT+USOSEC=0,1,1<br>OK |
| Read | AT+USOSEC=<socket> | +USOSEC: <socket>,<ssl_tls_dtls_status>[,<usecmng_profile_id>]<br>OK | AT+USOSEC=0<br>+USOSEC: 0,1,1<br>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)<br>OK | +USOSEC: (0-6),(0,1),(0-4)<br>OK |

### 20.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier defined by the AT+USOCR command.<br>• SARA-R5 - The range goes from 0 to 6. |
| <ssl_tls_dtls_status> | Number | • 0 (default value): disable the SSL/TLS/DTLS on the socket.<br>• 1: enable the socket security; a USECMNG profile can be specified with the <usecmng_profile_id> parameter. |
| <usecmng_profile_id> | Number | Defines the USECMNG profile which specifies the SSL/TLS/DTLS properties to be used for the SSL/TLS/DTLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see USECMNG section). |

## 20.5 Set socket option +USOSO

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

### 20.5.1 Description

Sets the specified standard option (type of service, local address re-use, linger time, time-to-live, etc.) for the specified socket, like the BSD setsockopt routine.

☞ Issue a set command to set each parameter.

### 20.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USOSO=<socket>,<level>,<opt_name>,<opt_val>[,<opt_val2>] | OK | AT+USOSO=2,6,1,1<br>OK |
| Test | AT+USOSO=? | +USOSO: (list of supported <socket>s),(list of supported <level>s)<br>OK | +USOSO: (0-6),(0,6,65535)<br>OK |

### 20.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier.<br>• SARA-R5 - The range goes from 0 to 6. |
| <level> | Number | Allowed values:<br>• 0: IP protocol<br><opt_name> for IP protocol level may be:<br>o 1: type of service (TOS)<br><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 [24]<br>o 2: time-to-live (TTL)<br><opt_val>: unsigned 8 bit value representing the TTL. The range is 0-255 (the default value is 255)<br>• 6: TCP protocol<br><opt_name> for TCP protocol level may be:<br>o 1: no delay option; do not delay send to coalesce packets;<br><opt_val>: numeric parameter, it enables/disables the "no delay" option:<br>- 0 (default value): disabled<br>- 1: enabled<br>o 2: keepidle option: send keepidle probes when it is idle for <opt_val> milliseconds<br><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)<br>• 65535: socket<br><opt_name> for socket level options may be:<br>o 4: local address re-use.<br><opt_val>: numeric parameter, it configures the "local address re-use" option.<br>- 0 (default value): disabled<br>- 1: enabled<br>o 8: keep connections alive.<br><opt_val>: numeric parameter, it configures "keep connections alive" option.<br>- 0 (default value): disabled<br>- 1: enabled<br>o 32: sending of broadcast messages.<br><opt_val>: numeric parameter, it configures "sending of broadcast messages".<br>- 0 (default value): disabled |

| Parameter | Type | Description |
|---|---|---|
| | | - 1: enabled<br>o 128: linger on close if data present.<br><opt_val>: numeric parameter, it configures the "linger" option.<br>- 0 (default value): disabled<br>- 1: enabled<br><opt_val2>: signed 16 bit numeric parameter, it sets the linger time, the range goes from 0 to 32767 in milliseconds. The default value is 0.<br>o 512: local address and port re-use.<br><opt_val>: numeric parameter, it configures the "local address and port re-use".<br>- 0 (default value): disabled<br>- 1: enabled |
| <opt_name> | Number | Type and supported content depend on the related <level> parameter value (details are given above). |
| <opt_val> | Number | Type and supported content depend on the related <level> parameter value (details are given above). |
| <opt_val2> | Number | Type and supported content depend on the related <level> parameter value (details are given above). |

### 20.5.4 Notes

**SARA-R5**

- If <level>=6 (TCP protocol) and <opt_name>=2 (keepidle option), the keepidle option range is 1000-2147483647.

## 20.6 Get Socket Option +USOGO

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

### 20.6.1 Description

Retrieves the specified standard option (type of service, local address re-use, linger time, time-to-live, etc) for the specified socket, like the BSD getsockopt routine.

### 20.6.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USOGO=<socket>,<level>,<opt_name> | +USOGO: <opt_val>[,<opt_val2>]<br>OK | AT+USOGO=0,0,2<br>+USOGO: 255<br>OK |
| Test | AT+USOGO=? | +USOGO: (list of supported <socket>s),(list of supported <level>s)<br>OK | +USOGO: (0-6),(0,6,65535)<br>OK |

### 20.6.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier.<br>• SARA-R5 - The range goes from 0 to 6. |
| <level> | Number | • 0: IP Protocol<br><opt_name> for IP protocol level may be:<br>o 1: type of service<br><opt_val>: 8 bit mask that represents the flags of IP TOS. For more information see the RFC 791 [24]. The range is 0-255. The default value is 0<br>o 2: time-to-live |

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

## 20.7 Close Socket +USOCL

| +USOCL | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | partial | No | No | No | < 120 s | +CME Error |

### 20.7.1 Description

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

By default the command blocks the AT command interface until the the completion of the socket close operation. By enabling the <async_close> flag, the final result code is sent immediately. The following +UUSOCL URC will indicate the closure of the specified socket.

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

### 20.7.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USOCL=<socket>[,<async_close>] | OK | AT+USOCL=2<br>OK |
| Test | AT+USOCL=? | +USOCL: (list of supported <socket>s)<br>OK | +USOCL: (0-6),(0-1)<br>OK |
| URC | | +UUSOCL: <socket> | +UUSOCL: 2 |

### 20.7.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier.<br>• SARA-R5 - The range goes from 0 to 6. |
| <async_close> | Number | Asynchronous close flag. The flag has effect for TCP connections only. Allowed values:<br>• 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.<br>• 1: the final result code is returned immediately unlocking the AT interface and making it available for the execution of other AT commands. Once the result of TCP close becomes available, it is notified to the AT interface through the +UUSOCL URC. |

### 20.7.4 Notes

**SARA-R5**

- The <async_close> parameter is not supported.

## 20.8 Get Socket Error +USOER

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

### 20.8.1 Description

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

### 20.8.2 Syntax

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

### 20.8.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket_error> | Number | Code of the last error occurred in a socket operation. The allowed values are listed in Appendix A.7<br>• 0: no error |

## 20.9 Connect Socket +USOCO

| +USOCO | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | partial | No | No | No | < 130 s | +CME Error |

### 20.9.1 Description

Establishes a peer-to-peer connection of the socket to the specified remote host on the given remote port, like the BSD connect routine. If the socket is a TCP socket, the command will actually perform the TCP negotiation (3-way handshake) to open a connection. If the socket is a UDP socket, this function will just declare the remote host address and port for later use with other socket operations (e.g. +USOWR, +USORD). This is important to note because if <socket> refers to a UDP socket, errors will not be reported prior to an attempt to write or read data on the socket.

The estimated response time depends also by the DNS resolution. For further details about the estimated response time related to the DNS resolution, see the +UDNSRN AT command.

### 20.9.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USOCO=<socket>,<remote_addr>,<remote_port>[,<async_connect>] | OK | AT+USOCO=3,"151.63.16.9",1200<br>OK |
| | | | AT+USOCO=2,"151.63.16.9",8200,1<br>OK<br>+UUSOCO: 2,0 |
| | | | AT+USOCO=2,"151.63.16.9",8230,0<br>OK |
| Test | AT+USOCO=? | +USOCO: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <async_connect>s)<br>OK | +USOCO: (0-6),"remote_host",(1-65535),(0-1)<br>OK |
| URC | | +UUSOCO: <socket>,<socket_error> | +UUSOCO: 2,0 |

### 20.9.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier to be used for any future operation on that socket.<br>• SARA-R5 - 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:<br>• 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<br>• 1: the final result code is returned immediately unlocking the AT interface and making it available for the execution of other AT commands. Once the result of TCP connection becomes available, it is notified to the AT interface through the +UUSOCO URC. |
| <socket_error> | Number | Code of the last error occurred in a socket operation. The allowed values are listed in Appendix A.7:<br>• 0: no error, connection successful |

### 20.9.4 Notes

- In case of the socket connection with the asynchronous flag:

- the socket will be closed if a further +USOCO AT command is issued before having received the +UUSOCO URC of the first AT command.
- it is not possible to connect a second socket before the reception of the +UUSOCO URC related to the pending socket connection.

**SARA-R5**

- The <async_connect> parameter and the +UUSOCO URC are not available.

## 20.10 Write socket data +USOWR

| +USOWR | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | partial | No | No | No | < 120 s | +CME Error |

### 20.10.1 Description

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

There are three kinds of syntax:

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

Some notes about the **TCP socket**:

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

Some notes about the **UDP socket**:

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

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

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

### 20.10.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Base syntax** | | | |
| Set | AT+USOWR=<socket>,<length>,<data> | +USOWR: <socket>,<length><br>OK | AT+USOWR=3,12,"Hello world!"<br>+USOWR: 3,12<br>OK |
| **Binary syntax** | | | |
| Set | AT+USOWR=<socket>,<length> | @<data><br>+USOWR: <socket>,<length><br>OK | AT+USOWR=3,16<br>@16 bytes of data<br>+USOWR: 3,16 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | OK |
| Test | AT+USOWR=? | +USOWR: (list of supported <socket>s),(list of supported <length>s),"HEX data"<br>+USOWR: (list of supported <socket>s),(list of supported <length>s),"data"<br>+USOWR: (list of supported <socket>s),(list of supported <length>s)<br>OK | +USOWR: (0-6),(0-512),"HEX data"<br>+USOWR: (0-6),(0-1024),"data"<br>+USOWR: (0-6),(0-1024)<br>OK |

### 20.10.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier.<br>• SARA-R5 - The range goes from 0 to 6. |
| <length> | Number | Number of data bytes to write:<br>• Base syntax normal mode: range 1-1024<br>• Base syntax HEX mode: range 1-512<br>• Binary extended syntax: range 1-1024 |
| <data> | String | Data bytes to be written. Not all of the ASCII charset can be used. |

### 20.10.4 Notes

- For base syntax:
  - The value of <length> and the actual length of <data> must match
- For base syntax HEX mode:
  - Only the ASCII characters 0-9, A-F and a-f are allowed.
  - The length of the <data> parameter must be two times the <length> parameter.
- For binary syntax:
  - After the command is sent, the user waits for the @ prompt. When it appears the stream of bytes can be provided. After the specified amount of bytes has been sent, the system provides the final result code. The feed process cannot be interrupted i.e. the return in the command mode can be effective only when the number of bytes provided is the declared one.
  - After the @ prompt reception, wait for a minimum of 50 ms before sending data.
  - The binary extended syntax is the only way for the system to accept control characters as data; for the AT command specifications 3GPP TS 27.005 [15], characters like <CR>, <CTRL-Z>, quotation marks, etc. have a specific meaning and they cannot be used like data in the command itself. The command is so extended with a specific acceptance state identified by the @ prompt.
  - This feature can be successfully used when there is need to send a byte stream which belongs to a protocol that has any kind of characters in the ASCII range [0x00,0xFF].
  - In binary mode the module does not display the echo of data bytes.
  - Binary syntax is not affected by HEX mode option.
- For <data> parameter not all of the ASCII charset can be used.

## 20.11 SendTo command (UDP only) +USOST

| +USOST | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | No | No | < 130 s | +CME Error |

### 20.11.1 Description

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

There are three kinds of syntax:

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

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

☞ If no network signal is available, outcoming UDP packet may be lost.

☞ The information text response to the test command provides the information about the bynary extended syntax only where supported.

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

### 20.11.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Base syntax** | | | |
| Set | AT+USOST=<socket>,<remote_addr>,<remote_port>,<length>,<data>,[<seq_no>] | +USOST: <socket>,<length><br>OK | AT+USOST=3,"151.9.34.66",449,16,"16 bytes of data"<br>+USOST: 3,16<br>OK |
| **Binary syntax** | | | |
| Set | AT+USOST=<socket>,<remote_addr>,<remote_port>,<length><br>After the"@" prompt <length> bytes of data are entered | @<data><br>+USOST: <socket>,<length><br>OK | AT+USOST=3,"151.9.34.66",449,16<br>@16 bytes of data<br>+USOST: 3,16<br>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"<br>+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"<br>[+USOST: (list of supported <socket>s),"remote_host",(list of supported <remote_port>s),(list of supported <length>s)]<br>OK | +USOST: (1-8),"remote_host",(1-65535),(1-512),(1-255),"HEX data"<br>+USOST: (1-8),"remote_host",(1-65535),(1-1024),(1-255),"data"<br>OK |
| URC | | +UUSOST: <socket>,<seq_no>,<UDP_result> | +USOST: 3,1,1 |

### 20.11.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier.<br>• SARA-R5 - 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:<br>• Base syntax normal mode: range 1-1024<br>• Base syntax HEX mode: range 1-512<br>• 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:<br>• 0: fail<br>• 1: success |

### 20.11.4 Notes

- For base syntax:
  - The value of <length> and the actual length of <data> must match
  - For base syntax HEX mode, only ASCII characters 0-9, A-F and a-f are allowed. The length of the <data> parameter must be two times the <length> parameter
- For binary syntax:
  - After the command is sent, the user waits for the @ prompt. When it appears the stream of bytes can be provided. After the specified amount of bytes has been sent, the system returns with final result code. The feed process cannot be interrupted i.e. the return in the command mode can be effective only when the number of bytes provided is the declared one
  - That binary extended syntax is the only way for the system to accept control characters as data; for the AT command specifications [15], 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

**SARA-R5**

- The <seq_no> parameter and the +UUSOST URC are not supported.
- The command will provide an error result code if the socket has been previously connected using the +USOCO AT command.

## 20.12 Read Socket Data +USORD

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

### 20.12.1 Description

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

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

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

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

☞ If the UART interface of the application processor has a RX FIFO of only 1 character, it is highly recommended to set the <length> parameter lower than 64.

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

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

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

## 20.12.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USORD=<socket>,<length> | +USORD: <socket>,<length>,<data in the ASCII [0x00,0xFF] range><br>OK | AT+USORD=3,16<br>+USORD: 3,16,"16 bytes of data"<br>OK |
| Test | AT+USORD=? | +USORD: (list of supported <socket>s),(list of supported <length>s)<br>OK | +USORD: (0-6),(0-1024)<br>OK |
| URC | | +UUSORD: <socket>,<length> | +UUSORD: 3,16 |

## 20.12.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier.<br>• SARA-R5 - The range goes from 0 to 6. |
| <length> | Number | Number of data bytes<br>• to read stored in buffer, in range 0-1024 in the set command<br>• read from buffer, in range 0-1024<br>• stored in buffer for the URC |
| <data> | String | Data bytes to be read |

## 20.12.4 Notes

- The returned data may be any ASCII character in the range [0x00,0xFF] i.e. control characters. The starting quotation marks shall not be taken into account like data; the first byte of data starts after the first quotation marks. Then the other characters are provided for a <length> amount. An application should rely on the <length> info to count the received number of characters (after the starting quotation marks) especially if any protocol control characters are expected.
- If an application deals with letter and number characters only i.e. all of the expected characters are outside the [0x00, 0x1F] range and are not quotation marks, the AT+USORD response quotation marks can be assumed to identify the start and the end of the received data packet. Always check <length> to identify the valid data stream.
- If the number of data bytes requested to be read from the buffer is bigger than the number of bytes stored in the buffer only the available amount of data bytes will be read.
- When <length>= 0, the command returns the total amount of data present in the network buffer.
  **Example:** 23 unread bytes in the socket.

```
AT+USORD=3,0
+USORD: 3,23
OK
```

- If the HEX mode is enabled, the length of <data> will be 2 times <length>.

## 20.13 Receive From command (UDP only) +USORF

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

### 20.13.1 Description

Reads the specified amount of data from the specified UDP socket, like the BSD recvfrom routine. The URC **+UUSORF: <socket>,<length>** (or also +UUSORD: <socket>,<length>) notifies that new data is available for reading, either when new data arrives or after a partial read by the user for the socket. This command can also return the total amount of unread data.

This command can be applied to UDP sockets only, and it can be used to read data after both +UUSORD and +UUSORF unsolicited indication.

If the HEX mode is enabled (see +UDCONF=1) the received data will be displayed using an hexadecimal string.

### 20.13.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USORF=<socket>,<length> | +USORF: <socket>,<remote_ip_addr>,<remote_port>,<length>,<data in the ASCII [0x00,0xFF] range><br>OK | AT+USORF=3,16<br>+USORF: 3,"151.9.34.66",2222,16,"16 bytes of data"<br>OK |
| Test | AT+USORF=? | +USORF: (list of supported <socket>s),(list of supported <length>s)<br>OK | +USORF: (0-6),(0-1024)<br>OK |
| URC | | +UUSORF: <socket>,<length> | +UUSORF: 3,16 |

### 20.13.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier.<br>• SARA-R5 - 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:<br>• to read stored in buffer, in range 0-1024 in the set command.<br>• read from buffer, in range 0-1024.<br>• stored in buffers for the URC. |
| <data> | String | Data bytes to be read |

### 20.13.4 Notes

- Each packet received from the network is stored in a separate buffer and the command is capable to read only a packet (or e portion of it) at time. This means that if <length> is greater than the packet size, the command will return a maximum amount of data equal to the packet size, also if there are other packets in the buffer. The remaining data (i.e. the remaining UDP packets) can be read with further reads.
- The returned data may have any kind of ASCII character in the range [0x00,0xFF] i.e. control characters too. The starting quotation marks shall not be taken into account like data; the first byte of data starts after the first quotation marks. Then the other characters are provided for a <length> amount. At the end of the length byte stream, another quotation marks followed by <CR><LF> are provided for user

convenience and visualization purposes. An application should rely on the <length> info to count the received number of characters (after the starting quotation marks) especially if any protocol control characters are expected.

- If an application deals with letter and number characters only i.e. all of the expected characters are outside the [0x00, 0x1F] range and are not quotation marks, the AT+USORD response quotation marks can be assumed to identify the start and the end of the received data packet, anyway the <length> field usage to identify the valid data stream is recommended.
- When <length>= 0, the command returns the total amount of data present in the network buffer.
  **Example:** 23 unread bytes in the socket.

```
AT+USORF=3,0
+USORF: 3,23
OK
```

- If the HEX mode is enabled, the length of <data> will be 2 times <length>.

**SARA-R5**

- The command will provide an error result code if the socket has been previously connected using the +USOCO AT command.

# 20.14 Set Listening Socket +USOLI

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

## 20.14.1 Description

Sets the specified socket in listening mode on the specified port of service, waiting for incoming connections (TCP) or data (UDP):

- For **TCP sockets**, incoming connections will be automatically accepted and notified via the URC **+UUSOLI: <socket>,<ip_address>,<port>,<listening_socket>,<local_ip_address>,<listening_port>,** carrying the connected socket identifier, the remote IP address and port.
- For **UDP sockets**, incoming data will be notified via URC **+UUSORF: <listening_socket>,<length>.** To know from which remote IP address and port the data is coming from, use the AT+USORF command.

## 20.14.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USOLI=<socket>,<port> | OK | **TCP sockets**<br>AT+USOLI=2,1200<br>OK<br>+UUSOLI: 3,"151.63.16.7",1403,2,"82.89.67.164",1200<br>**UDP sockets**<br>AT+USOLI=0,1182<br>OK<br>+UUSORF: 0,1024 |
| Test | AT+USOLI=? | +USOLI: (list of supported <socket>s),(list of supported <port>s)<br>OK | +USOLI: (0-6),(1-65535)<br>OK |
| URC (TCP) | | +UUSOLI: <socket>,<ip_address>,<port>,<listening_socket>,<local_ip_address>,<listening_port> | +UUSOLI: 3,"151.63.16.7",1403,0,"82.89.67.164",200 |
| URC (UDP) | | +UUSORF: <listening_socket>,<length> | +UUSORF: 1,967 |

### 20.14.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier.<br>• SARA-R5 - The range goes from 0 to 6. |
| <port> | Number | Port of service, range 1-65535. Port numbers below 1024 are not recommended since they are usually reserved |
| <ip_address> | String | Remote host IP address (only in URC +UUSOLI). For IP address format reference see the IP addressing. |
| <listening_socket> | Number | Socket identifier specified within the AT+USOLI command, indicates on which listening socket the connection has been accepted (only in +UUSOLI URC) |
| <local_ip_address> | String | TE IP address (only in +UUSOLI URC). For IP address format reference see the IP addressing. |
| <listening_port> | Number | Listening port that has accepted the connection. This port is specified within the AT +USOLI command (only in +UUSOLI URC) |
| <length> | Number | Data length received on the UDP listening socket (only in +UUSORF unsolicited indication). In order to know the sender IP address and port, use the AT+USORF command. |

### 20.14.4 Notes

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

## 20.15 HEX mode configuration +UDCONF=1

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

### 20.15.1 Description

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

### 20.15.2 Syntax

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

### 20.15.3 Defined values

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

## 20.16 Set socket in Direct Link mode +USODL

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

### 20.16.1 Description

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

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

SARA-R5
The +UDCONF=5, +UDCONF=6, +UDCONF=7, +UDCONF=8 commands allow the configuration of UDP and TCP direct link triggers.

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

### 20.16.2 Syntax

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

### 20.16.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier.<br>• SARA-R5 - The range goes from 0 to 6. |

### 20.16.4 Enhanced Direct Link

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

- Timer Trigger
- Data Length Trigger
- Character Trigger

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

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

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

By default no triggers are enabled for TCP sockets.

SARA-R5
See the +UDCONF=5, +UDCONF=6, +UDCONF=7, +UDCONF=8 commands description for the transmission triggers configuration.

#### 20.16.4.1 Timer Trigger (TT)

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

The timer range is between 100 and 120000 ms.

SARA-R5

The special value 0 (zero) means that the timer is disabled. By default the timer trigger is disabled for TCP sockets and enabled with a value of 500 ms for UDP sockets.

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

#### 20.16.4.2 Data Length Trigger (DLT)

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

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

☞ SARA-R5
If the data length is set to 0 (zero) the trigger is disabled (every data chunk received from the serial port is immediately sent to the network). By default the data length trigger is disabled for TCP sockets and set to 1024 for UDP sockets.

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

#### 20.16.4.3 Character Trigger (CT)

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

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

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

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

#### 20.16.4.4 Combined Triggers

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

#### 20.16.4.5 About serial data chunks

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

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

#### 20.16.4.6 Data from the network

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

#### 20.16.4.7 Congestion timer

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

- SARA-R5 - The timer range is between 1000 and 720000 ms, the special value 0 (zero) means that the timer is disabled. By default the congestion timer is set to 60000 (60 s) for both TCP and UDP sockets. The +UDCONF=8 command can configure the congestion timer.

## 20.17 Timer Trigger configuration for Direct Link +UDCONF=5

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

### 20.17.1 Description

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

### 20.17.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UDCONF=5,<socket_id>,<br><timer_trigger> | OK | AT+UDCONF=5,0,500 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | OK |
| Read | AT+UDCONF=5,<socket_id> | +UDCONF: 5,<socket_id>,<timer_trigger><br>OK | AT+UDCONF=5,0<br>+UDCONF: 5,0,500<br>OK |

### 20.17.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket_id> | Number | Socket identifier; used when changing the UDP Direct Link settings:<br>• SARA-R5 - 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;<br>• SARA-R5 - the factory-programmed value is 500 ms for UDP, 0 ms for TCP. |

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

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

### 20.18.1 Description

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

### 20.18.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UDCONF=6,<socket_id>,<data_length_trigger> | OK | AT+UDCONF=6,0,1024<br>OK |
| Read | AT+UDCONF=6,<socket_id> | +UDCONF: 6,<socket_id>,<data_length_trigger><br>OK | AT+UDCONF=6,0<br>+UDCONF: 6,0,1024<br>OK |

### 20.18.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket_id> | Number | Socket identifier; used when changing the UDP Direct Link settings:<br>• SARA-R5 - 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. |

## 20.19 Character trigger configuration for Direct Link +UDCONF=7

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

### 20.19.1 Description

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

### 20.19.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UDCONF=7,<socket_id>,<character_trigger> | OK | AT+UDCONF=7,0,13<br>OK |
| Read | AT+UDCONF=7,<socket_id> | +UDCONF: 7,<socket_id>,<character_trigger><br>OK | AT+UDCONF=7,0<br>+UDCONF: 7,0,13<br>OK |

### 20.19.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket_id> | Number | Socket identifier; used when changing the Direct Link settings:<br>• SARA-R5 - The range goes from 0 to 6. |
| <character_trigger> | Number | Enhanced Direct Link character trigger, the value represents the ASCII code (in base 10) of the character to be used as character trigger. The allowed range is -1, 0-255, the factory-programmed value is -1; -1 means trigger disabled. |

## 20.20 Congestion timer configuration for Direct Link +UDCONF=8

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

### 20.20.1 Description

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

### 20.20.2 Syntax

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

### 20.20.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket_id> | Number | Socket identifier; used when changing the Direct Link settings.<br>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 |

## 20.21 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 |

### 20.21.1 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 behaviour 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.

### 20.21.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UDCONF=10,<dl_dsr_line_behaviour> | OK | AT+UDCONF=10,1<br>OK |
| Read | AT+UDCONF=10 | +UDCONF: 10,<dl_dsr_line_behaviour><br>OK | AT+UDCONF=10<br>+UDCONF: 10,1<br>OK |

### 20.21.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <dl_dsr_line_behaviour> | Number | Behaviour of the DSR transition when the module exits from Direct Link. Allowed values:<br>• 0 (default value): DSR line transition (HIGH to LOW) is performed after the output of the "<CR><LF>DISCONNECT<CR><LF>" string<br>• 1: DSR line transition (HIGH to LOW) is performed before (~20 ms) the output of the "<CR><LF>DISCONNECT<CR><LF>" string |

## 20.22 Socket control +USOCTL

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

### 20.22.1 Description

Allows interaction with the low level socket layer.

### 20.22.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USOCTL=<socket>,<param_id> | +USOCTL: <socket>,<param_id>,<param_val>[,<param_val2>]<br>OK | AT+USOCTL=0,2<br>+USOCTL: 0,2,38<br>OK |
| Test | AT+USOCTL=? | +USOCTL: (list of supported <socket>s),(list of supported <param_id>s)<br>OK | +USOCTL: (0-6),(0-4,10-11)<br>OK |

### 20.22.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <socket> | Number | Socket identifier.<br>• SARA-R5 - The range goes from 0 to 6. |
| <param_id> | Number | Control request identifier. Possible values are:<br>• 0: query for socket type<br>• 1: query for last socket error<br>• 2: get the total amount of bytes sent from the socket<br>• 3: get the total amount of bytes received by the socket |

| Parameter | Type | Description |
|---|---|---|
| | | • 4: query for remote peer IP address and port<br>• 10: query for TCP socket status (only TCP sockets)<br>• 11: query for TCP outgoing unacknowledged data (only TCP sockets)<br>• 5-9, 12-99: RFU |
| <param_val> | Number / String | This value may assume different means depending on the <param_id> parameter.<br>If <param_id>=0, <param_val> can assume these values:<br>• 6 TCP socket<br>• 17: UDP socket<br>If <param_id>=1, <param_val> can assume these values:<br>• N: last socket error<br>If <param_id>=2, <param_val> can assume these values:<br>• N: the total amount (in bytes) of sent (acknowledged + unacknowledged) data<br>If <param_id>=3, <param_val> can assume these values:<br>• N: the total amount (in bytes) of received (read) data<br>If <param_id>=4, <param_val> can assume these values:<br>• A string representing the remote peer IP address expressed in dotted decimal form<br>If <param_id>=10, <param_val> can assume these values:<br>• 0: the socket is in INACTIVE status (it corresponds to CLOSED status defined in RFC793 "TCP Protocol Specification" [91])<br>• 1: the socket is in LISTEN status<br>• 2: the socket is in SYN_SENT status<br>• 3: the socket is in SYN_RCVD status<br>• 4: the socket is in ESTABILISHED status<br>• 5: the socket is in FIN_WAIT_1 status<br>• 6: the socket is in FIN_WAIT_2 status<br>• 7: the sokcet is in CLOSE_WAIT status<br>• 8: the socket is in CLOSING status<br>• 9: the socket is in LAST_ACK status<br>• 10: the socket is in TIME_WAIT status<br>If <param_id>=11, <param_val> can assume these values:<br>• 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. |

# 20.23 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 |

## 20.23.1 Description

Enable, disables or forces the IP change notification (CN) functionality. This command only works for internal PDP context activation.

SARA-R5
See +UPSD, +UPSDA and +UPSND AT commands for establishing a PSD connection.

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 IP CN feature only works for PDP connections configured and enabled by +UPSD and +UPSDA command.

☞ The username and password are not compulsory, but it is encouraged to use them for security reasons.

## 20.23.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UIPCHGN=<action>[,<server>,<port>,<path>,<send_imei>,<send_imsi>,<username>,<password>,<cust_info>] | OK | To enable the IP CN feature:<br>AT+UIPCHGN=1,"somedomain.com",80,"modemipnotify.php",1,1,"test_user","test_password","Product: Tracker v.1.0"<br>OK<br>To force another IP CN to the remote server (CN must be previously enabled): |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | AT+UIPCHGN=2<br>OK<br>To disable the IP CN feature:<br>AT+UIPCHGN=0<br>OK |
| Read | AT+UIPCHGN? | +UIPCHGN: <status>[,<server>,<port>,<path>,<send_imei>,<send_imsi>,<username>,<password>,<cust_info>]<br>OK | +UIPCHGN: 1,"somedomain.com",80,"/modemipnotify.php",1,1,"test_user","test_password","Product: Tracker v.1.0"<br>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>)<br>OK | +UIPCHGN: (0 2),"server",(1 65535),"path",(0 1),(0 1),"username","password","cust_info"<br>OK |
| URC | | +UUIPCHGN: <code>[,<reply_str>] | +UUIPCHGN: 200,"IP_UPDATED" |

### 20.23.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <action> | Number | Disable / Enable / Force the Update of IP CN feature<br>• 0 (factory-programmed value): disable the feature<br>• 1: enable the feature<br>• 2: force IP notification update<br>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.<br>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.<br>Maximum length: 64 characters<br>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.<br>Valid range: from 1 to 65535<br>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.<br>Maximum length: 64 characters<br>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.<br>Max length: 64 characters<br>Mandatory parameter with < action> =1, ignored with < action> =0 or < action> =2<br>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<br>• 0: do not send IMEI<br>• 1: send IMEI<br>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 |

| Parameter | Type | Description |
|---|---|---|
| | | Valid range: 0-1<br>• 0: do not send IMSI<br>• 1: send IMSI<br>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.<br>Maximum length: 32 characters<br>Mandatory parameter with <action>=1, ignored with <action>=0 or <action>=2<br>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.<br>Maximum length: 128 characters<br>Mandatory parameter with <action>=1, ignored with <action>=0 or <action>=2<br>If no custom information is required, this parameter must be inserted as empty string ("") |
| <status> | Number | This value indicates the status of the IP CN feature<br>• 0: disabled<br>• 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.<br><code> values greater than 100 must be interpreted as HTTP server response code.<br>If error is not present the code returned by the +UUIPCHGN should be 200.<br>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.<br>The maximum length of this string is 64 bytes; if the server sends a longer string, it will be truncated.<br>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. |

# 20.24 Configure Dormant Close Socket Behavior +USOCLCFG

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

## 20.24.1 Description

Enables or disables the TCP socket Graceful Dormant Close feature. When enabled, if the RRC connection is released and a TCP socket is closed with the +USOCL, the module will re-establish the RRC connection to close the socket both locally and remotely. When this feature is disabled, the module will close the socket locally without re-establishing the RRC connection. In this case the socket will remain open on the remote side until it is closed.

## 20.24.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USOCLCFG=<GDC_enable> | OK | AT+USOCLCFG=0<br>OK |
| Read | AT+USOCLCFG? | +USOCLCFG: <GDC_enable><br>OK | +USOCLCFG: 0<br>OK |
| Test | AT+USOCLCFG=? | +USOCLCFG: (list of supported <GDC_enable>s) | +USOCLCFG: (0,1)<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | OK | |

### 20.24.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <GDC_enable> | Number | Status of TCP socket Graceful Dormant Close. Allowed values:<br>• 0: disabled<br>• 1 (factory-programmed value): enabled |

# 21 Device and data security

## 21.1 Introduction

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

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

Some definitions are needed to understand the foundations of security:

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

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

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

The pillars of the u-blox security are:

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

The IoT device is secured through different steps:

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

## 21.2 Device security

### 21.2.1 Introduction

These AT commands maintain device integrity over the entire lifecycle.

- **+USECCHIP** queries the immutable chip ID.
- **+USECDEVINFO** allows customer programming the device profile UID into each device along with their own device serial number.
- **+USECROTUID** queries the Root of Trust (RoT) public Unique IDentifier (UID).

SARA-R5
**+USECMODE** configures the secure data suite features on the module if it has not been sealed with the +USECDEVINFO AT command.

**+USECFW** allows customer to check if the RoT FW needs to be updated and to perform the update operation.

## 21.2.2 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 |

### 21.2.2.1 Description

Queries the chip ID of the module and returns it.

### 21.2.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Action | AT+USECCHIP | +USECCHIP: <chip_id><br>OK | +USECCHIP: "12345678"<br>OK |

### 21.2.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <chip_id> | String | Chip ID of the module. |

## 21.2.3 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 |

### 21.2.3.1 Description

Returns the Root of Trust (RoT) public Unique IDentifier (UID).

### 21.2.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Action | AT+USECROTUID | +USECROTUID: <rot_public_UID><br>OK | +USECROTUID: "00020000 89285555"<br>OK |

### 21.2.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <rot_public_UID> | String | Root of Trust Public UID |

## 21.2.4 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 |

### 21.2.4.1 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.

### 21.2.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USECDEVINFO=<device_info>,<br><device_serial_num> | OK | AT+USECDEVINFO="ZHIN70 dVgUWCdfNeXHkQRg","SN#4756" |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | OK |
| Read | AT+USECDEVINFO? | +USECDEVINFO: <module_ registration>,<device_registration>, <device_activation><br><br>OK | +USECDEVINFO: 1,0,1<br><br>OK |

#### 21.2.4.3 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:<br>• 0: not registered<br>• 1: registered |
| <device_ registration> | String | Indicates the status of device registration to security services. Allowed values:<br>• 0: not registered<br>• 1: registered |
| <device_activation> | String | Device's RoT activation status. Allowed values:<br>• 0: disabled<br>• 1: enabled |

### 21.2.5 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 |

#### 21.2.5.1 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 (AT+CFUN=16) in order to apply the new configuration.

#### 21.2.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USECMODE=<enable_security> | OK | AT+USECMODE=1<br><br>OK |
| Read | AT+USECMODE? | +USECMODE: <enable_security><br><br>OK | +USECMODE: 0<br><br>OK |

#### 21.2.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <enable_security> | Number | Disables or enables the security suite features on the module. Allowed values:<br>• 0: turn the security suite features off<br>• 1 (factory-programmed value): turn the security suite features on |

## 21.2.6 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 | - |

### 21.2.6.1 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.

SARA-R5
To prevent flooding the server with "security heartbeats", if the command is issued within 24 hours of the last sent "security heartbeat", the request will be rejected and an error result code will be returned.

### 21.2.6.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Action | AT+USECCONN | OK | OK |

## 21.2.7 Root of trust FW operations +USECFW

| +USECFW | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | No | No | < 30 s | +CME Error |

### 21.2.7.1 Description

The command checks the status of the root of trust (RoT) firmware or triggers a firmware update.

### 21.2.7.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USECFW=<op_code> | +USECFW: <result><br>OK | AT+USECFW=1<br>+USECFW: 0<br>OK |

### 21.2.7.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | Checks the RoT FW status or triggers an update. Allowed values:<br>• 0: check the FW status<br>• 1: trigger the FW update |
| <result> | Number | Operation result, it is <op_code> dependent:<br>• <op_code>=0<br>o 0: RoT FW update file invalid or installation not required: RoT FW file just deleted<br>o 1: installation required<br>o 3: generic error (e.g. RoT FW update file missing)<br>• <op_code>=1<br>o 0: firmware package has been successfully installed<br>o 1: RoT does not support the update<br>o 2: new firmware is invalid<br>o 3: generic error reported by the RoT |

# 21.3 Data security

## 21.3.1 Introduction

### 21.3.1.1 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.

SARA-R5
The secure re-negotiation is currently not supported, and if mandated by the server the SSL/TLS/DTLS connection will fail with a generic SSL/TLS/DTLS handshake alert.

### 21.3.1.2 SARA-R5 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.

### 21.3.1.3 SARA-R5 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.

### 21.3.1.4 SARA-R5 End-to-end data encryption and decryption

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.

## 21.3.2 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 |

### 21.3.2.1 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 [193].

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

- SARA-R5 - 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.

☞ SARA-R5
The SSL/(D)TLS connection can be successfully performed only if keys with at least 2048-bit size and/or certificates generated with at least 2048-bit key size are used.

☞ Data for certificate or private key import can be provided with a stream of byte similar to +UDWNFILE or from a file stored on the FS.

☞ When using the stream of byte import functionality:

- If the data transfer is stopped before its completion, a guard timer of 20 s will ensure the termination of the data transmission. In this case the prompt will switch back in AT command mode and an error result code will be returned.
- If the module shuts down during the data transfer, all the bytes are discarded.
- If any error occurs during the data transfer, all bytes are discarded.

☞ SARA-R5
Enable the RTS/CTS DTE flow control (see &K command description) before to import a stream of bytes.

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

☞ SARA-R5
The imported certificates and private keys are:

- NOT PERSISTED (deleted) after the module FW is upgraded using +UFWINSTALL or +UFWUPD AT commands.
- PERSISTED after a factory reset using +UFACTORY AT command.
- NOT PERSISTED 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).

#### 21.3.2.2 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>] | ><br>Start transfer of data ...<br>+USECMNG: 0,<type>,<internal_name>,<md5_string><br>OK | AT+USECMNG=0,0,"AddTrustCA",1327<br>>-----BEGIN CERTIFICATE-----<br>(...other certificate data bytes...)<br>+USECMNG: 0,0,"AddTrustCA","77107370ec4db40a0 8a6e36a64a1435b"<br>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><br>OK | AT+USECMNG=1,0,"AddTrustCA","addtrust.cert"<br>+USECMNG: 1,0,"AddTrustCA","7710 7370ec4db40a08a6e36a64a1435b"<br>OK |
| **Remove an imported certificate or private key:** | | | |
| Action | AT+USECMNG=2,<type>,<internal_name> | OK | AT+USECMNG=2,0,"AddTrustCA"<br>OK |
| **List imported certificates or private keys:** | | | |
| Read | AT+USECMNG=3[,<type>] | <cert_type>,<internal_name>[,<common_name>,<expiration_date>]<br>...<br>OK | AT+USECMNG=3<br>"CA","AddTrustCA","AddTrust External CA Root","2020/05/30"<br>"CA","GlobalSignCA","GlobalSign","2029/03/18"<br>"CC","JohnDoeCC","GlobalSign","20 10/01/01"<br>"PK","JohnDoePK"<br>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><br>OK | AT+USECMNG=4,0,"AddTrustCA"<br>+USECMNG: 4,0,"AddTrustCA","77107370ec4db40a0 8a6e36a64a1435b"<br>OK |
| Test | AT+USECMNG=? | +USECMNG: (list of supported <op_code>s),(list of supported <type>s)<br>OK | +USECMNG: (0-4),(0-2)<br>OK |

#### 21.3.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | Type of operation:<br>• 0: import a certificate or a private key (data provided by the stream of byte)<br>• 1: import a certificate or a private key (data provided from a file on FS)<br>• 2: remove an imported certificate or private key<br>• 3: list imported certificates or private keys<br>• 4: retrieve the MD5 of an imported certificate or private key |
| <type> | Number | Type of the security data:<br>• 0: trusted root CA (certificate authority) certificate<br>• 1: client certificate<br>• 2: client private key<br>• 3: server certificate<br>• 4: signature verification certificate<br>• 5: signature verification public key<br>Allowed values:<br>• SARA-R5 - 0, 1, 2, 3 |
| <cert_type> | String | Type of the security data in verbose format:<br>• "CA": trusted root CA (certificate authority) certificate<br>• "CC": client certificate<br>• "PK": client private key<br>• "SC": server certificate<br>• "VC": signature verification certificate<br>• "PU": signature verification public key<br>Allowed values:<br>• SARA-R5 - "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.<br>• SARA-R5 - The maximum length is 200 characters. |
| <data_size> | Number | Size in bytes of a certificate or private key being imported.<br>• SARA-R5 - The maximum allowed size is 8192 bytes. |
| <password> | String | Decryption password; applicable only for PKCS8 encrypted client private keys. The maximum length is 128 characters. |
| <filename> | String | Name of the FS file containing the certificate or private key data to be imported.<br>• SARA-R5 - 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. |

### 21.3.3 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 |

#### 21.3.3.1 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
- **Minimum SSL/TLS version to be used:**
  - Any
  - TLS 1.0
  - TLS 1.1
  - TLS 1.2
- **Minimum DTLS version to be used:**
  - DTLS 1.2
- **Cipher suite to be configured using the following methods:**
  - **Legacy cipher suite** to be used. See Syntax description and Table 28 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 28 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 28 for the supported cipher suites.

☞ For the applicability of cipher suite depending on the module series, see Cipher suites applicability.

☞ Cipher suite configuration methods are exclusive and the last configured method is used.

☞ The cipher suite configuration read command response is related to the selected cipher suite type, see Syntax description for more details.

- **Certificate to be used for server and mutual authentication:**
  - The trusted root certificate. The CA certificate should be imported with the +USECMNG AT command.
  - The client certificate that should be imported with the +USECMNG AT command.
  - The client private key that should be imported with the +USECMNG AT command.
  - The server certificate that should be imported with the +USECMNG AT command.
- **Expected server hostname, when using certificate validation level 2 or 3.**
- **Password for the client private key, if it is password protected.**
- **Pre-shared key used for connection. Defines a pre-shared key and key-name (PSK), when a TLS_PSK_* cipher suite is used.**
- **SNI (Server Name Indication).** SNI is a feature of SSL/TLS which uses an additional SSL/TLS extension header to specify the server name to which the client is connecting to. The extension was introduced to support the certificate handling used with virtual hosting provided by the various SSL/TLS enabled servers mostly in cloud based infrastructures. With the SNI a server has the opportunity to present a different server certificate (or/and whole SSL/TLS configuration) based on the host indicated by the SNI extension. When SNI is not used the modules might receive a non host specific SSL/TLS configuration (version/cipher suites/certificate) when used with virtual hosts.
- **(D)TLS session resumption.** The session resumption feature allows to reuse the secure session data in order to reestablish a SSL/(D)TLS secure session. Since the secure session data are available, the SSL/(D)TLS handshake is not performed during the session resumption. Once the session resumption feature is enabled, the session resumption type (provided by the server) and the secure session data (negotiated during the SSL/(D)TLS handshake) are displayed via +USECPRF URC message. The session resumption feature configuration and secure session data are not stored in the NVM, hence the session resumption may be performed until power cycle.

☞ To set all the parameters in security profile, a set command for each <op_code> needs to be issued (e.g. certificate validation level, minimum SSL/TLS/DTLS version, ...).

☞ To reset (set to factory-programmed value) all the parameters of a specific security profile, issue the AT +USECPRF=<profile_id> command.

#### 21.3.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USECPRF=<profile_id>[,<op_code>[,<param_val1>[,<param_val2>[,<param_val3>]]]] | OK | AT+USECPRF=0,0,0<br>OK |
| Read | AT+USECPRF=<profile_id>,<op_code> | +USECPRF: <profile_id>,<op_code>,<param_val1><br>OK | AT+USECPRF=0,0<br>+USECPRF: 0,0,0<br>OK |
| URC | | +UUSECPRF: <profile_id>,<op_code>[,<param_val1>[,<param_val2>[,<param_val3>]]]<br>OK | +USECPRF: 0,13,1,0<br>OK |
| **Legacy cipher suite selection** | | | |
| Set | AT+USECPRF=<profile_id>,2,<legacy_cs> | OK | AT+USECPRF=0,2,2<br>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"<br>OK |
| Read | AT+USECPRF=<profile_id>,2 | +USECPRF: <profile_id>,2,99,<iana_b1>,<iana_b2><br>OK | AT+USECPRF=0,2<br>+USECPRF: 0,2,99,"C0","2B"<br>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<br>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<br>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<br>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 ";"><br>OK | AT+USECPRF=0,2<br>+USECPRF: 0,2,100,"C02A;C02C"<br>OK |
| **Pre-shared key configuration** | | | |
| Set | AT+USECPRF=<profile_id>,8,<preshared_key>[,<string_type>] | OK | AT+USECPRF=0,8,"0sFpZ0AZqE0N6Ti9s0qt40ZP5Eqx"<br>OK |
| **Pre-shared key identity configuration** | | | |
| Set | AT+USECPRF=<profile_id>,9,<preshared_key_id>[,<string_type>] | OK | AT+USECPRF=0,9,"0ceEZ0AZqP0K60i9o04xz0ZP8zyu0Eqx"<br>OK |
| **Server certificate pinning** | | | |
| Set | AT+USECPRF=<profile_id>,12,<server_certificate>,<pinning_level> | OK | AT+USECPRF=0,12,"my_srv_cert",0<br>OK |
| **(D)TLS session resumption generic syntax** | | | |
| Set | AT+USECPRF=<profile_id>,13,<tag>,<param_val1>[,<param_val2>] | OK | AT+USECPRF=0,13,0,1<br>OK |
| Read | AT+USECPRF=<profile_id>,13,<tag> | +USECPRF: <profile_id>,13,<tag>,<param_val1>[,<param_val2>]<br>OK | AT+USECPRF=0,13,0<br>+USECPRF: 0,13,0,1<br>OK |
| URC | | +UUSECPRF: <profile_id>,13,<tag>,<param_val1>[,<param_val2>] | +USECPRF: 0,13,1,0<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | OK | |
| **(D)TLS session resumption status** | | | |
| Set | AT+USECPRF=<profile_id>,13,0,<sess_status> | OK | AT+USECPRF=0,13,0,1<br>OK |
| Read | AT+USECPRF=<profile_id>,13,0 | +USECPRF: <profile_id>,13,0,<sess_status><br>OK | AT+USECPRF=0,13,0<br>+USECPRF: 0,13,0,1<br>OK |
| **(D)TLS session resumption session type** | | | |
| Set | AT+USECPRF=<profile_id>,13,1,<sess_type> | OK | AT+USECPRF=0,13,1,0<br>OK |
| Read | AT+USECPRF=<profile_id>,13,1 | +USECPRF: <profile_id>,13,1,<sess_type><br>OK | AT+USECPRF=0,13,1<br>+USECPRF: 0,13,1,0<br>OK |
| URC | | +UUSECPRF: <profile_id>,13,1,<sess_type> | +UUSECPRF: 0,13,1,0 |
| **(D)TLS session resumption session data having session ID as session resumption type** | | | |
| Set | AT+USECPRF=<profile_id>,13,2,<session_id_base64>,<master_secret_base64> | OK | AT+USECPRF=0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo"<br>OK |
| Read | AT+USECPRF=<profile_id>,13,2 | +USECPRF: <profile_id>,13,2,<session_id_base64>,<master_secret_base64><br>OK | AT+USECPRF=0,13,2<br>+USECPRF: 0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo"<br>OK |
| URC | | +UUSECPRF: <profile_id>,13,2,<session_id_base64>,<master_secret_base64> | +UUSECPRF: 0,13,2,"VWY5UENs0Hh3VWR1MjB2WTVMYVZ5TTdE0WpMeWZWeHo=","SHVSODByUit0My9OMEtIT2ZsVVFRcUsyTkdvaz0nWVFhRzdQZUpndG9IMzN4ZTBo" |
| **(D)TLS session resumption session data having encrypted session ID with local encryption as session resumption type** | | | |
| Set | AT+USECPRF=<profile_id>,13,12,<encrypted_session_data>,<enc_session_data_size> | OK | AT+USECPRF=0,13,12,"AAECAwQFBgcICQoLDA0ODxAREhMUFRYXGBkaGxwdHh/Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0in6aGVISJGBWCAAKJo6Qw5Q+ugXaRZFquG0O69WeHnPRBkcwY2SN4bwnDbyR+709i0pt2nIaYMSCL77MAA=",156<br>OK |
| Read | AT+USECPRF=<profile_id>,13,12 | +USECPRF: <profile_id>,13,12,<encrypted_session_data>,(0-203)<br>OK | AT+USECPRF=0,13,12<br>+USECPRF: 0,13,12,"AAECAwQFBgcICQoLDA0ODxAREhMUFRYXGBkaGxwdHh/Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0in6aGVISJGBWCAAKJo6Qw5Q+ugXaRZFquG0O69WeHnPRBkcwY2SN4bwnDbyR+709i0pt2nIaYMSCL77MAA=",156<br>OK |
| URC | | +UUSECPRF: <profile_id>,13,12,<encrypted_session_data>,(0-203) | +UUSECPRF: 0,13,12,"AAECAwQFBgcICQoLDA0ODxAREhMUFRYXGBkaGxwdHh/Ljgstf1cLaEO2D8IMbxHcQIGfhVxC0 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | in6aGVISJGBWCAAKJo6Qw5Q<br>+ugXaRZFquG0<br>O69WeHnPRBkcwY2SN4bwnDbyR<br>+709i0pt2nlaYMSCL77MAA=",156 |
| Test | AT+USECPRF=? | +USECPRF: (list of supported <profile_id>s),(list of supported <op_code>s)<br>OK | +USECPRF: (0-4),(0-13)<br>OK |

#### 21.3.3.3 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):<br>o 0: level 0 - No validation; the server certificate will not be checked or verified. The server in this case is not authenticated.<br>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.<br>o 2: level 2 - Root certificate validation with URL integrity check. Level 1 validation with an additional URL integrity check.<br>o 3: level 3 - Root certificate validation with check of certificate validity date. Level 2 validation with an additional check of certificate validity date.<br>• 1: SSL/TLS version to use; allowed values for <param_val1>(number):<br>o 0 (factory-programmed value): any; server can use any version for the connection.<br>o 1: TLSv1.0; connection allowed only to TLS/SSL servers which support TLSv1.0<br>o 2: TLSv1.1; connection allowed only to TLS/SSL servers which support TLSv1.1<br>o 3: TLSv1.2; connection allowed only to TLS/SSL servers which support TLSv1.2<br>• 2: cipher suite; allowed values for <legacy_cs> (number) legacy cipher suites are listed in Table 28. 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 28. 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 28.<br>☞ 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.<br>☞ For <legacy_cs>=100, when all added cipher suites are removed the cipher suite is automatically set to 0 (factory-programmed value).<br>☞ For the applicability of default cipher suite lists depending on the module series, see Cipher suites applicability.<br>• 3: trusted root certificate internal name;<br>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.<br>• 4: expected server hostname;<br>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.<br>• 5: client certificate internal name;<br>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.<br>• 6: client private key internal name;<br>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.<br>• 7: client private key password; |

| Parameter | Type | Description |
|---|---|---|
| | | 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.<br>• 8: pre-shared key;<br>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.<br>o <string_type> (number) defines the type and the maximum length of the <preshared_key> string. Allowed values for <string_type>:<br>- 0 (default value): <preshared_key> is an ASCII string and its maximum length is 64 characters<br>- 1: <preshared_key> is an hexadecimal string and its maximum length is 128 characters<br>• 9: pre-shared key identity;<br>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.<br>o <string_type> (number) defines the type of the <preshared_key_id> string. Allowed values for <string_type>:<br>- 0 (default value): <preshared_key_id> is an ASCII string and its maximum length is 128 characters<br>- 1: <preshared_key_id> is an hexadecimal string and its maximum length is 256 characters<br>• 10: SNI (Server Name Indication);<br>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.<br>• 11: PSK key and PSK key identity generated by RoT (Root of trust); allowed values for <param_val1> (number):<br>o 0 (factory-programmed value): OFF - The PSK and PSK key ID are NOT generated by RoT<br>o 1: ON - The PSK and PSK key ID are generated by RoT in the process of SSL/TLS connection negotiation<br>• 12: server certificate pinning;<br>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.<br>o <pinning_level> (number) defines the certificate pinning information level. Allowed values for <pinning_level><br>- 0: pinning based on information comparison of received and configured certificate public key<br>- 1: pinning based on binary comparison of received and configured certificate public key<br>- 2: pinning based on binary comparison of received and configured certificate<br>• 13: (D)TLS session resumption<br>Allowed values:<br>• SARA-R5 - 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>:<br>• 0: add cipher suite defined by <iana_b1> and <iana_b2> to the list<br>• 1: remove cipher suite defined by <iana_b1> and <iana_b2> from the list |
| <tag> | Number | Configures the (D)TLS session resumption. Allowed values:<br>• 0: session resumption status<br>• 1: session resumption type<br>• 2: session resumption data when the session resumption type is session ID<br>• 12: session resumption data for when the session resumption type is encrypted session ID with local encryption |
| <sess_status> | Number | (D)TLS session resumption status. Allowed values:<br>• 0 (factory-programmed value): disabled<br>• 1: enabled |
| <sess_type> | Number | (D)TLS session resumption type. Allowed values: |

| Parameter | Type | Description |
|---|---|---|
| | | • 0: session ID<br>• 10: encrypted session ID with local encryption |
| <session_id_base64> | String | base64 encoded session ID value. The maximum length is 48 characters. |
| <master_secret_base64> | String | base64 encoded session master key. The maximum length is 64 characters. |
| <encrypted_session_data> | String | base64 encoded session ID value encrypted with local encryption. The maximum length is 203 characters |
| <enc_session_data_size> | Number | length of base64 encoded session ID value encrypted with local encryption. |
| <param_val1> | String | Type and supported content depend on related <op_code> (details are given above) |
| <param_val2> | String | Type and supported content depend on related <op_code> (details are given above) |
| <param_val3> | String | Type and supported content depend on related <op_code> (details are given above) |

#### 21.3.3.4 Notes

**SARA-R5**

- 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.
- The factory-programmed value for <op_code>=0 (certificate validation level) is 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).
- The factory-programmed value for <op_code>=1 (SSL/TLS version to use) is 3 (TLSv1.2; connection allowed only to TLS/SSL servers which support TLSv1.2).

#### 21.3.3.5 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" |
| 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" |

| Cipher suite IANA code | Cipher suite name | Legacy cipher suite configuration | IANA enumeration cipher suite configuration | |
|---|---|---|---|---|
| | | <legacy_cs> | <iana_b1> | <iana_b2> |
| 0x008A | TLS_PSK_WITH_RC4_128_SHA | | "00" | "8A" |
| 0x008B | TLS_PSK_WITH_3DES_EDE_CBC_SHA | 8 | "00" | "8B" |
| 0x008C | TLS_PSK_WITH_AES_128_CBC_SHA | 6 | "00" | "8C" |
| 0x008D | TLS_PSK_WITH_AES_256_CBC_SHA | 7 | "00" | "8D" |
| 0x008E | TLS_DHE_PSK_WITH_RC4_128_SHA | | "00" | "8E" |
| 0x008F | TLS_DHE_PSK_WITH_3DES_EDE_CBC_SHA | | "00" | "8F" |
| 0x0090 | TLS_DHE_PSK_WITH_AES_128_CBC_SHA | | "00" | "90" |
| 0x0091 | TLS_DHE_PSK_WITH_AES_256_CBC_SHA | | "00" | "91" |
| 0x0092 | TLS_RSA_PSK_WITH_RC4_128_SHA | | "00" | "92" |
| 0x0093 | TLS_RSA_PSK_WITH_3DES_EDE_CBC_SHA | 11 | "00" | "93" |
| 0x0094 | TLS_RSA_PSK_WITH_AES_128_CBC_SHA | 9 | "00" | "94" |
| 0x0095 | TLS_RSA_PSK_WITH_AES_256_CBC_SHA | 10 | "00" | "95" |
| 0x009C | TLS_RSA_WITH_AES_128_GCM_SHA256 | | "00" | "9C" |
| 0x009D | TLS_RSA_WITH_AES_256_GCM_SHA384 | | "00" | "9D" |
| 0x009E | TLS_DHE_RSA_WITH_AES_128_GCM_SHA256 | | "00" | "9E" |
| 0x009F | TLS_DHE_RSA_WITH_AES_256_GCM_SHA384 | | "00" | "9F" |
| 0x00A8 | TLS_PSK_WITH_AES_128_GCM_SHA256 | 16 | "00" | "A8" |
| 0x00A9 | TLS_PSK_WITH_AES_256_GCM_SHA384 | 17 | "00" | "A9" |
| 0x00AA | TLS_DHE_PSK_WITH_AES_128_GCM_SHA256 | | "00" | "AA" |
| 0x00AB | TLS_DHE_PSK_WITH_AES_256_GCM_SHA384 | | "00" | "AB" |
| 0x00AC | TLS_RSA_PSK_WITH_AES_128_GCM_SHA256 | 18 | "00" | "AC" |
| 0x00AD | TLS_RSA_PSK_WITH_AES_256_GCM_SHA384 | 19 | "00" | "AD" |
| 0x00AE | TLS_PSK_WITH_AES_128_CBC_SHA256 | 12 | "00" | "AE" |
| 0x00AF | TLS_PSK_WITH_AES_256_CBC_SHA384 | 13 | "00" | "AF" |
| 0x00B2 | TLS_DHE_PSK_WITH_AES_128_CBC_SHA256 | | "00" | "B2" |
| 0x00B3 | TLS_DHE_PSK_WITH_AES_256_CBC_SHA384 | | "00" | "B3" |
| 0x00B6 | TLS_RSA_PSK_WITH_AES_128_CBC_SHA256 | 14 | "00" | "B6" |
| 0x00B7 | TLS_RSA_PSK_WITH_AES_256_CBC_SHA384 | 15 | "00" | "B7" |
| 0x00BA | TLS_RSA_WITH_CAMELLIA_128_CBC_SHA256 | | "00" | "BA" |
| 0x00BE | TLS_DHE_RSA_WITH_CAMELLIA_128_CBC_SHA256 | | "00" | "BE" |
| 0x00C0 | TLS_RSA_WITH_CAMELLIA_256_CBC_SHA256 | | "00" | "C0" |
| 0x00C4 | TLS_DHE_RSA_WITH_CAMELLIA_256_CBC_SHA256 | | "00" | "C4" |
| 0xC002 | TLS_ECDH_ECDSA_WITH_RC4_128_SHA | | "C0" | "02" |
| 0xC003 | TLS_ECDH_ECDSA_WITH_3DES_EDE_CBC_SHA | | "C0" | "03" |
| 0xC004 | TLS_ECDH_ECDSA_WITH_AES_128_CBC_SHA | | "C0" | "04" |
| 0xC005 | TLS_ECDH_ECDSA_WITH_AES_256_CBC_SHA | | "C0" | "05" |
| 0xC007 | TLS_ECDHE_ECDSA_WITH_RC4_128_SHA | | "C0" | "07" |
| 0xC008 | TLS_ECDHE_ECDSA_WITH_3DES_EDE_CBC_SHA | 20 | "C0" | "08" |
| 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" |

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

| Cipher suite IANA code | Cipher suite name | Legacy cipher suite configuration | IANA enumeration cipher suite configuration | |
|---|---|---|---|---|
| | | <legacy_cs> | <iana_b1> | <iana_b2> |
| 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" |
| 0xC034 | TLS_ECDHE_PSK_WITH_3DES_EDE_CBC_SHA | | "C0" | "34" |
| 0xC035 | TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA | | "C0" | "35" |
| 0xC036 | TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA | | "C0" | "36" |
| 0xC037 | TLS_ECDHE_PSK_WITH_AES_128_CBC_SHA256 | | "C0" | "37" |
| 0xC038 | TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA384 | | "C0" | "38" |
| 0xC0A0 | TLS_RSA_WITH_AES_128_CCM_8 | | "C0" | "A0" |
| 0xC0A1 | TLS_RSA_WITH_AES_256_CCM_8 | | "C0" | "A1" |
| 0xC0A2 | TLS_DHE_RSA_WITH_AES_128_CCM_8 | | "C0" | "A2" |
| 0xC0A3 | TLS_DHE_RSA_WITH_AES_256_CCM_8 | | "C0" | "A3" |
| 0xC0A4 | TLS_PSK_WITH_AES_128_CCM | | "C0" | "A4" |
| 0xC0A5 | TLS_PSK_WITH_AES_256_CCM | | "C0" | "A5" |
| 0xC0A6 | TLS_DHE_PSK_WITH_AES_128_CCM | | "C0" | "A6" |
| 0xC0A7 | TLS_DHE_PSK_WITH_AES_256_CCM | | "C0" | "A7" |
| 0xC0A8 | TLS_PSK_WITH_AES_128_CCM_8 | | "C0" | "A8" |
| 0xC0A9 | TLS_PSK_WITH_AES_256_CCM_8 | | "C0" | "A9" |
| 0xC0AA | TLS_PSK_DHE_WITH_AES_128_CCM_8 | | "C0" | "AA" |
| 0xC0AB | TLS_PSK_DHE_WITH_AES_256_CCM_8 | | "C0" | "AB" |
| 0xC0AC | TLS_ECDHE_ECDSA_WITH_AES_128_CCM | | "C0" | "AC" |
| 0xC0AD | TLS_ECDHE_ECDSA_WITH_AES_256_CCM | | "C0" | "AD" |
| 0xC0AE | TLS_ECDHE_ECDSA_WITH_AES_128_CCM_8 | | "C0" | "AE" |
| 0xC0AF | TLS_ECDHE_ECDSA_WITH_AES_256_CCM_8 | | "C0" | "AF" |
| 0xCCA8 | TLS_ECDHE_RSA_WITH_CHACHA20_POL1305_SHA256 | | "CC" | "A8" |
| 0xCCA9 | TLS_ECDHE_ECDSA_WITH_CHACHA20_POL1305_ SHA256 | | "CC" | "A9" |
| 0xCCAA | TLS_DHE_RSA_WITH_CHACHA20_POL1305_SHA256 | | "CC" | "AA" |
| 0xCCAB | TLS_PSK_WITH_CHACHA20_POL1305_SHA256 | | "CC" | "AB" |
| 0xCCAC | TLS_ECDHE_PSK_WITH_CHACHA20_POL1305_SHA256 | | "CC" | "AC" |
| 0xCCAD | TLS_DHE_PSK_WITH_CHACHA20_POL1305_SHA256 | | "CC" | "AD" |
| 0xCCAE | TLS_RSA_PSK_WITH_CHACHA20_POL1305_SHA256 | | "CC" | "AE" |

**Table 28: Supported cipher suite**

### 21.3.4 AT+USECMNG command example

SARA-R5

Here below is reported an example with a PEM encoded trusted root certificate.

| Command | Response | Description |
|---|---|---|
| **Step 1: Import a trusted root certificate using the stream of byte similar to +UDWNFILE** | | |
| AT+USECMNG=0,0,"ThawteCA", 1516 | > | Start the data transfer using the stream of byte. |
| PEM encoded trusted root certificate data. | +USECMNG: 1,0,"ThawteCA","8ccadc0 b22cef5be72ac411a11a8d812" | Input PEM formatted trusted root certificate data bytes. Output MD5 |

| Command | Response | Description |
|---|---|---|
| | OK | hash string of the stored trusted root certificate DER. |
| **Step 2: List all available certificates and private keys** | | |
| AT+USECMNG=3 | CA, "ThawteCA","thawte Primary Root CA", "2036/07/17"<br>OK | List all available certificates and private keys. |
| **Step 3: Set the security profile 2 validation level to trusted root** | | |
| AT+USECPRF=2,0,1 | OK | Security profile 2 has the validation level set to trusted root. |
| **Step 4: Set the security profile 2 trusted root certificate to the CA certificate imported as "ThawteCA"** | | |
| AT+USECPRF=2,3,"ThawteCA" | OK | Security profile 2 will use the CA certificate imported as "ThawteCA" for server certificate validation. |
| **Step 5: Use the configured USECMNG profile 2 with the UHTTP application** | | |
| AT+UHTTP=0,1,"www.ssl_tls_test_server.com" | OK | Configure the UHTTP server name. |
| AT+UHTTP=0,6,1,2 | OK | Enable the SSL/TLS for the UHTTP profile #0 and specify the SSL/TLS security profile 2. |
| AT+UHTTPC=0,1,"/","https.resp" | OK | Execute the HTTP GET command. |
| | +UUHTTPCR: 0,1,1 | HTTP GET URC response. |

In the above example the following PEM encoded trusted certificate is used:

```
-----BEGIN CERTIFICATE-----
MIIEIDCCAwigAwIBAgIQNE7VVyDV7exJ9C/ON9srbTANBgkqhkiG9w0BAQUFADCB
qTELMAkGA1UEBhMCVVMxFTATBgNVBAoTDHRoYXd0ZSwgSW5jLjEoMCYGA1UECxMf
Q2VydGlmaWNhdGlvbiBTZXJ2aWNlcyBEaXZpc2lvbjE4MDYGA1UECxMvKGMpIDIw
MDYgdGhhd3RlLCBJbmMuIC0gRm9yIGF1dGhvcml6ZWQgdXNlIG9ubHkxHzAdBgNV
BAMTFnRoYXd0ZSBQcmltYXJ5IFJvb3QgQ0EwHhcNMDYxMTE3MDAwMDAwWhcNMzYw
NzE2MjM1OTU5WjCBqTELMAkGA1UEBhMCVVMxFTATBgNVBAoTDHRoYXd0ZSwgSW5j
LjEoMCYGA1UECxMfQ2VydGlmaWNhdGlvbiBTZXJ2aWNlcyBEaXZpc2lvbjE4MDYG
A1UECxMvKGMpIDIwMDYgdGhhd3RlLCBJbmMuIC0gRm9yIGF1dGhvcml6ZWQgdXNl
IG9ubHkxHzAdBgNVBAMTFnRoYXd0ZSBQcmltYXJ5IFJvb3QgQ0EwggEiMA0GCSqG
SIb3DQEBAQUAA4IBDwAwggEKAoIBAQCsoPD7gFnUnMekz52hWXMJEEUMDSxuaPFs
W0hoSVk3/AszGcJ3f8wQLZU0HObrTQmnHNK4yZc2AreJ1CRfBsDMRJSUjQJib+ta
3RGNKJpchJAQeg29dGYvajig4tVURO sdB58Hum/u6f1OCyn1PoSgAfGcq/gcfomk
6KHYcWUNo1F77rzSImANuVud37r8UVsLr5iy6S7pBOhih94ryNdOwUxkHt3Ph1i6
Sk/KaAcdHJ1KxtUvkcx8cXIcxcBn6zL9yZJclNqFwJu/U30rCfSMnZEfl2pSy94J
NqR32HuHUETVPm4pafs5SSYeCaWAe0At6+gnhcn+Yf1+5nyXHdWdAgMBAAGjQjBA
MA8GA1UdEwEB/wQFMAMBAf8wDgYDVR0PAQH/BAQDAgEGMB0GA1UdDgQWBBR7W0XP
r87Lev0xkhpqtvNG61dIUDANBgkqhkiG9w0BAQUFAAOCAQEAeRHAS7ORtvzw6WfU
DW5FvlXok9LOAz/t2iWwHVfLHjp2oEzsUHboZHIMpKnxuIvW1oeEuzLlQRHAd9mz
YJ3rG9XRbkREqaYB7FViHXe4XI5ISXycO1cRrK1zN44veFyQaEfZYGDm/Ac9IiAX
xPcW6cTYcvnIc3zfFi8VqT79aie2oetaupgf1eNNZAqdE8hhuvU5HIe6uL17In/2
/qxAeeWsEG89jxt5dovEN7MhGITlNgDrYyCZuen+MwS7QcjBAvlEYyCegc5C09Y/
LHbTY5xZ3Y+m4Q6gLkH3LpVHz7z9M/P2C2F+fpErgUfCJzDupxBdN49cOSvkBPB7
jVaMaA==
-----END CERTIFICATE-----
```

### 21.3.5 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).

## 21.3.6 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 |

### 21.3.6.1 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.

### 21.3.6.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+USECDATAENC=<payload_length>[,<filename>]<br>><br><unencrypted_data> | <<br>[+USECDATAENC: <enc_data_length>,<encrypted_data]<br>OK | AT+USECDATAENC=512<br>><br>512 bytes of data to be encrypted<br><<br>+USECDATAENC: 512,"512 bytes of encrypted data"<br>OK |
| **AT interface syntax** | | | |
| Set | AT+USECDATAENC=<payload_length><br>><br><unencrypted_data> | <<br>+USECDATAENC: <enc_data_length>,<encrypted_data><br>OK | AT+USECDATAENC=512<br>><br>512 bytes of data to be encrypted<br><<br>+USECDATAENC: 512,"512 bytes of encrypted data"<br>OK |
| **File system syntax** | | | |
| Set | AT+USECDATAENC=<payload_length>,<filename><br>><br><unencrypted_data> | <<br>OK | AT+USECDATAENC=512,"encfile"<br>><br>512 bytes of data to be encrypted<br><<br>OK |
| Test | AT+USECDATAENC=? | +USECDATAENC: (list of supported <payload_length>s)<br>OK | +USECDATAENC: (1-8192)<br>OK |

### 21.3.6.3 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. |

| Parameter | Type | Description |
|---|---|---|
| <unencrypted_data> | String | Stream of bytes. |
| <enc_data_length> | Number | Number of encrypted bytes returned. |
| <encrypted_data> | String | ASCII string representing the encrypted data of <enc_data_length> characters in the range [0x00,0xFF]. |

## 21.3.7 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 |

### 21.3.7.1 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.

### 21.3.7.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USECDATADEC=<payload_length>[,<filename>]<br>><br><encrypted_data> | <<br>[+USECDATADEC: <dec_data_length>,<decrypted_data>]<br>OK | AT+USECDATADEC=512<br>><br>512 bytes of data to be decrypted<br><<br>+USECDATADEC: 512,"512 bytes of decrypted data"<br>OK |
| **AT interface syntax** | | | |
| Set | AT+USECDATADEC=<payload_length><br>><br><encrypted_data> | <<br>+USECDATADEC: <dec_data_length>,<decrypted_data><br>OK | AT+USECDATADEC=512<br>><br>512 bytes of data to be decrypted<br><<br>+USECDATADEC: 512,"512 bytes of decrypted data"<br>OK |
| **File system syntax** | | | |
| Set | AT+USECDATADEC=<payload_length>,<filename><br>><br><encrypted_data> | <<br>OK | AT+USECDATADEC=512,"decfile"<br>><br>512 bytes of data to be decrypted<br><<br>OK |
| Test | AT+USECDATADEC=? | +USECDATADEC: (list of supported <payload_length>s)<br>OK | +USECDATADEC: (1-8224)<br>OK |

#### 21.3.7.3 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 | ASCII string representing the decrypted data of <dec_data_length> characters in the range [0x00,0xFF]. |

## 21.3.8 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 |

#### 21.3.8.1 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.

#### 21.3.8.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+USECFILEENC=<filename>[,<out_file>] | [+USECFILEENC: <enc_data_length>,<encrypted_data>]<br>OK | AT+USECFILEENC="file_to_encrypt"<br>+USECFILEENC: 512,"512 bytes of encrypted data"<br>OK |
| **AT interface syntax** | | | |
| Set | AT+USECFILEENC=<filename> | +USECFILEENC: <enc_data_length>,<encrypted_data><br>OK | AT+USECFILEENC="file_to_encrypt"<br>+USECFILEEC: 512,"512 bytes of encrypted data"<br>OK |
| **File system syntax** | | | |
| Set | AT+USECFILEENC=<filename>,<out_file> | OK | AT+USECFILEENC="file_to_encrypt","file_to_store_data"<br>OK |

#### 21.3.8.3 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 | ASCII string representing the encrypted data of <enc_data_length> characters in the range [0x00,0xFF]. |

## 21.3.9 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 |

### 21.3.9.1 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.

### 21.3.9.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+USECFILEDEC=<filename>[,<out_file>] | [+USECFILEDEC: <dec_data_length>,<decrypted_data>]<br>OK | AT+USECFILEDEC="file_to_decrypt"<br>+USECFILEDEC: 512,"512 bytes of decrypted data"<br>OK |
| **AT interface syntax** | | | |
| Set | AT+USECFILEDEC=<filename> | +USECFILEDEC: <dec_data_length>,<decrypted_data><br>OK | AT+USECFILEDEC="file_to_decrypt"<br>+USECFILEDEC: 512,"512 bytes of decrypted data"<br>OK |
| **File system syntax** | | | |
| Set | AT+USECFILEDEC=<filename>,<out_file> | OK | AT+USECFILEDEC="file_to_decrypt","file_to_store_data"<br>OK |

### 21.3.9.3 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 | ASCII string representing the decrypted data of <dec_data_length> characters in the range [0x00,0xFF]. |

## 21.3.10 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 |

### 21.3.10.1 Description

Generate a PSK identity and key.

#### 21.3.10.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USECPSK=<psk_size> | +USECPSK: <psk_id>,<psk><br>OK | AT+USECPSK=16<br>+USECPSK: "010203040A0B0C0D0E0F10111213","01020304050607080 9000A0B0C0D0E0F"<br>OK |
| Test | AT+USECPSK=? | +USECPSK: (list of supported <psk_size>s)<br>OK | +USECPSK: (16,32)<br>OK |

#### 21.3.10.3 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. |

### 21.3.11 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 |

#### 21.3.11.1 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.

#### 21.3.11.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+USECE2EDATAENC=<payload_length>[,<filename>]<br>><br><unencrypted_data> | <<br>[+USECE2EDATAENC: <enc_data_length>,<encrypted_data>]<br>OK | AT+USECE2EDATAENC=512<br>><br>512 bytes of data to be encrypted<br><<br>+USECE2EDATAENC: 512,"512 bytes of encrypted data"<br>OK |
| **AT interface syntax** | | | |
| Set | AT+USECE2EDATAENC=<payload_length><br>><br><unencrypted_data> | <<br>+USECE2EDATAENC: <enc_data_length>,<encrypted_data><br>OK | AT+USECE2EDATAENC=512<br>><br>512 bytes of data to be encrypted<br><<br>+USECE2EDATAENC: 512,"512 bytes of encrypted data"<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| **File system syntax** | | | |
| Set | AT+USECE2EDATAENC=<payload_length>,<filename><br>><br><unencrypted_data> | <br>OK | AT+USECE2EDATAENC=512, "encfile"<br>><br>512 bytes of data to be encrypted<br><br>OK |
| Test | AT+USECE2EDATAENC=? | +USECE2EDATAENC: (list of supported <payload_length>s)<br>OK | +USECE2EDATAENC: (1-8192)<br>OK |

#### 21.3.11.3 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 | ASCII string representing the encrypted data of <enc_data_length> characters in the range [0x00,0xFF]. |

## 21.3.12 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 |

#### 21.3.12.1 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.

#### 21.3.12.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+USECE2EFILEENC=<filename>[,<out_file>] | [+USECE2EFILEENC: <enc_data_length>,<encrypted_data>]<br>OK | AT+USECE2EFILEENC="file_to_encrypt"<br>+USECE2EFILEENC: 512,"512 bytes of encrypted data"<br>OK |
| **AT interface syntax** | | | |
| Set | AT+USECE2EFILEENC=<filename> | +USECE2EFILEENC: <enc_data_length>,<encrypted_data><br>OK | AT+USECE2EFILEENC="file_to_encrypt"<br>+USECE2EFILEEC: 512,"512 bytes of encrypted data"<br>OK |
| **File system syntax** | | | |
| Set | AT+USECE2EFILEENC=<filename>,<out_file> | OK | AT+USECE2EFILEENC="file_to_encrypt","file_to_store_data"<br>OK |

#### 21.3.12.3 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 | ASCII string representing the encrypted data of <enc_data_length> characters in the range [0x00,0xFF]. |

## 21.3.13 Chip to chip channel encryption+USECC2C

| +USECC2C | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | No | No | < 30 s | +CME Error |

#### 21.3.13.1 Description

Allows the device to create one or more secure channels (encrypted and authenticated) between the TE and the MT. A pre-shared key is used to establish the secure channel between the MT (master) and TE (slave).

#### 21.3.13.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+USECC2C=<op_code>,<param1>[,<param2>] | [+USECC2C: <op_code>,<C2C_result>,<C2C_encryption_key>]<br>OK | AT+USECC2C=0,"A0324CFF236F458048656C6C6F6F497D"<br>+USECC2CC: 0,0,"00010203040506070809101112131415"<br>OK |
| **C2C key paring** | | | |
| Set | AT+USECC2C=0,<TE_secret> | +USECC2C: 0,<C2C_result>,<C2C_encryption_key><br>OK | AT+USECC2C=0,"A0324CFF236F458048656C6C6F6F497D"<br>+USECC2CC: 0,0,"00010203040506070809101112131415"<br>OK |
| **C2C open session** | | | |
| Set | AT+USECC2C=1,<TE_secret> | OK | AT+USEC2CC=1,"A0324CFF236F458048656C6C6F6F497D"<br>OK |
| **C2C close session** | | | |
| Set | AT+USECC2C=2 | OK | AT+USEC2CC=2<br>OK |
| **C2C new key paring** | | | |
| Set | AT+USECC2C=3 | +USECC2C: 3,<C2C_result>,<C2C_encryption_key><br>OK | AT+USECC2C=3<br>+USECC2CC: 3,0,"01020304050607080910111213141516"<br>OK |
| Test | AT+USECC2C=? | +USECC2C: (list of supported <op_code>s)<br>OK | +USECC2C: (0-3)<br>OK |

#### 21.3.13.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | C2C command request. Allowed values: |

| Parameter | Type | Description |
|---|---|---|
| | | • 0: pair and provide an C2C encryption key<br>o Provides the C2C encryption key.<br>o A specific C2C encryption key is provided only once.<br>o Can be executed for 8 different <TE_secret>s.<br>• 1: open a C2C channel using a specific <TE_secret><br>• 2: close the current C2C channel; it can be executed only during an opened C2C session.<br>• 3: rekeying operation<br>o Provides a new C2C encryption key for the currently opened C2C session identified by the <TE_secret> parameter<br>o The new key is reported only once.<br>o It can be executed only during an opened C2C session.<br>o Once the command is successfully terminated the currently opened C2C session is automatically closed.<br>o After execution when opening a new session using the same <TE_secret>, the new key should be used. |
| <C2C_result> | Number | Result of an C2C command request:<br>• 0: ok |
| <C2C_encryption_key> | String | Key used for the encryption/decryption of the transimtted data. Hexadecimal data 16 octets. |
| <TE_secret> | String | Identifier of the C2C channel data. Hexadecimal data 16 octets. |

## 21.3.14 X.509 device certificate +USECDEVCERT

| +USECDEVCERT | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | No | No | < 30 s | +CME Error |

### 21.3.14.1 Description

Manages the X.509 device certificate information needed to support a mutually authenticated SSL/TLS/DTLS session using the u-blox IoT Dock. The retrieved X.509 device certificate allows simple integration of devices into the third party IoT device management platforms using the Zero Touch Provisioning (ZTP).

For security reasons, the command is available only using C2C (chip-to-chip) secure session (see: +USECC2C).

### 21.3.14.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+USECDEVCERT=<op_code> | +USECDEVCERT: <op_code>, <data><br><br>OK | AT+USECDEVCERT=0<br><br>+USECDEVCERT: 0, "MIIB9TCCAWACAQAwg0 gxGTAXBgNVBAoMEFF1b1ZhZGlzI0 0 pbWI0ZWQxHDAaBgNVBAsME0 RvY3V0 ZW50 IERIcGFydG1lbnQxOTA3BgNV0 AMMMFdoeSBhcmUgeW91IGRIY20 kal5nIG1lPyAgVGhpcyBpcyBvbmx50 GlgdGVzdCEhITERMA8GA1UEBww0 IS GFaWxdb24xETAPBgNVBAgMCF0 lbW0 yJ2tIMQswCQYDVQQGEwJCTTEP0 MA0 C0 qGSIb3DQEJARYAMIGfMA0 GCSqG0 I0 3DQEBAQUAA4GNADCBiQKBgQC0 J WR9nG/ fUvcfKiGlEL4aRLjGt537mZ280 U9/3eiJeJznNSOuNLnF +hmabAu7H0 LT4K7EdqfF |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | +XUZW/2jRKRYcvOUDG0 9A7OjW7UfKk1In3+6QDCi7X34RE10 1jqoaJjrm/T18TOKcgkkhRzEapQn0 Dm0Ea/HVzX/ PiSOGuertwIDAQABM0 sGCSqGSIb3DQEBBQOBgQBzMJd0 AV 4PAwel8LzGx5uMOshezF/ KfP67wJ90 UW +N7zXY6AwPgoLj4Kjw +WtU684J0 8Dtr9FXozakE +8p06BpxegR4BR3F0 Hf6p+0 jQxUEAkAyb/mVgm66TyghD0 C6/ YkiKoZptXQ98TwDIK/39WEB/V0 0 7As+KoYazQG8drorw==" \r\n OK |
| Read | AT+USECDEVCERT? | +USECDEVCERT: <device_private_key_status>,<device_certificate_status>,<ca_certificates_status> OK | +USECDEVCERT: 0,0,0 OK |
| Test | AT+USECDEVCERT=? | +USECDEVCERT: (list of supported <op_code>s) OK | +USECDEVCERT: (0-2) OK |

#### 21.3.14.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | Requested information. Allowed values:<br>• 0: get the device X.509 private key<br>• 1: get the device X.509 certificate<br>• 2: get the X.509 CA certificates |
| <data> | String | Requested data in PEM format |
| <device_private_key_status> | Number | Reports the device X.509 private key provisioning status. Reported values:<br>• 0: the device X.509 private key is provisioned<br>• 1: the device X.509 private key is NOT provisioned<br>• 2: error in the device X.509 private key provisioning<br>• 3: the device X.509 private key is provisioned but NOT exportable |
| <device_certificate_status> | Number | Reports the device X.509 certificate provisioning status. Reported values:<br>• 0: the device X.509 certificate is provisioned<br>• 1: the device X.509 certificate is NOT provisioned<br>• 2: error in the device X.509 certificate provisioning |
| <ca_certificates_status> | Number | Reports the X.509 CA certificates provisioning status. Reported values:<br>• 0: the X.509 CA certificates are provisioned<br>• 1: the X.509 CA certificates are NOT provisioned<br>• 2: error in the X.509 CA certificates provisioning |

## 21.3.15 Cipher suite applicability

### 21.3.15.1 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.

**SARA-R5**

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 (D)
- (0x003D) TLS_RSA_WITH_AES_256_CBC_SHA256 (D)
- (0x0040) TLS_DHE_DSS_WITH_AES_128_CBC_SHA256
- (0x0067) TLS_DHE_RSA_WITH_AES_128_CBC_SHA256 (D)
- (0x006B) TLS_DHE_RSA_WITH_AES_256_CBC_SHA256 (D)
- (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 (D)
- (0x008D) TLS_PSK_WITH_AES_256_CBC_SHA (D)
- (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 (D)
- (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
- (0x009D) TLS_RSA_WITH_AES_256_GCM_SHA384
- (0x009E) TLS_DHE_RSA_WITH_AES_128_GCM_SHA256
- (0x009F) TLS_DHE_RSA_WITH_AES_256_GCM_SHA384
- (0x00A8) TLS_PSK_WITH_AES_128_GCM_SHA256
- (0x00A9) TLS_PSK_WITH_AES_256_GCM_SHA384
- (0x00AA) TLS_DHE_PSK_WITH_AES_128_GCM_SHA256
- (0x00AB) TLS_DHE_PSK_WITH_AES_256_GCM_SHA384
- (0x00AC) TLS_RSA_PSK_WITH_AES_128_GCM_SHA256
- (0x00AD) TLS_RSA_PSK_WITH_AES_256_GCM_SHA384
- (0x00AE) TLS_PSK_WITH_AES_128_CBC_SHA256 (D)
- (0x00AF) TLS_PSK_WITH_AES_256_CBC_SHA384
- (0x00B2) TLS_DHE_PSK_WITH_AES_128_CBC_SHA256
- (0x00B3) TLS_DHE_PSK_WITH_AES_256_CBC_SHA384
- (0x00B6) TLS_RSA_PSK_WITH_AES_128_CBC_SHA256
- (0x00B7) TLS_RSA_PSK_WITH_AES_256_CBC_SHA384
- (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 (D)
- (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 (D)
- (0xC028) TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384 (D)
- (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 (D)
- (0xC02C) TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384 (D)
- (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 (D)
- (0xC030) TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384 (D)
- (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
- (0xC038) TLS_ECDHE_PSK_WITH_AES_256_CBC_SHA384
- (0xC0A4) TLS_PSK_WITH_AES_128_CCM
- (0xC0A5) TLS_PSK_WITH_AES_256_CCM
- (0xC0A6) TLS_DHE_PSK_WITH_AES_128_CCM
- (0xC0A7) TLS_DHE_PSK_WITH_AES_256_CCM
- (0xC0A8) TLS_PSK_WITH_AES_128_CCM_8 (D)
- (0xC0A9) TLS_PSK_WITH_AES_256_CCM_8
- (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
- (0xC0AD) TLS_ECDHE_ECDSA_WITH_AES_256_CCM
- (0xC0AE) TLS_ECDHE_ECDSA_WITH_AES_128_CCM_8
- (0xC0AF) TLS_ECDHE_ECDSA_WITH_AES_256_CCM_8
- (0xCCA8) TLS_ECDHE_RSA_WITH_CHACHA20_POL1305_SHA256
- (0xCCA9) TLS_ECDHE_ECDSA_WITH_CHACHA20_POL1305_SHA256
- (0xCCAA) TLS_DHE_RSA_WITH_CHACHA20_POL1305_SHA256
- (0xCCAB) TLS_PSK_WITH_CHACHA20_POL1305_SHA256
- (0xCCAC) TLS_ECDHE_PSK_WITH_CHACHA20_POL1305_SHA256
- (0xCCAD) TLS_DHE_PSK_WITH_CHACHA20_POL1305_SHA256
- (0xCCAE) TLS_RSA_PSK_WITH_CHACHA20_POL1305_SHA256

# 22 FTP

Proprietary u-blox AT commands. FTP AT commands set can be used for sending and receiving files over the available bearer, transparently retrieving and storing them in the file system. Standard file and directory management operations on the remote FTP server are as well possible. PSD or CSD connection must be activated before using FTP client services.

SARA-R5
See +UPSD, +UPSDA and +UPSND AT commands for establishing a PSD connection.

Basically, two AT commands are necessary for an FTP client service: one AT command (+UFTP) to configure the FTP profile, a second AT command to execute a specific FTP command (+UFTPC). The final result of an FTP command will be notified through the +UUFTPCR URC whereas data will be provided through +UUFTPCD URC.

When these commands report an error which is not a +CME ERROR, the error code can be queried using the +UFTPER AT command.

## 22.1 FTP service configuration +UFTP

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

### 22.1.1 Description

Sets up a parameter for FTP service, or resets a parameter to its factory-programmed value. The set/reset command needs to be executed for each single <op_code>. The read command returns the current setting of all the FTP parameters, one per line (i.e. the FTP profile). The FTP parameter values set with this command are all volatile (not stored in non-volatile memory).

If the set command is issued without <param1> parameter, the corresponding <op_code> parameter is reset to the default value.

### 22.1.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+UFTP=<op_code>[,<param1>[,<param2>]] | OK | AT+UFTP=7,21<br>OK |
| **FTP server IP address** | | | |
| Set | AT+UFTP=0[,<IP_address>] | OK | AT+UFTP=0,"192.168.1.0"<br>OK |
| **FTP server name** | | | |
| Set | AT+UFTP=1[,<server_name>] | OK | AT+UFTP=1,"ftp.server.com"<br>OK |
| **Username** | | | |
| Set | AT+UFTP=2[,<username>] | OK | AT+UFTP=2,"user_test"<br>OK |
| **Password** | | | |
| Set | AT+UFTP=3[,<password>] | OK | AT+UFTP=3,"PWD"<br>OK |
| **Account** | | | |
| Set | AT+UFTP=4[,<account>] | OK | AT+UFTP=4,"test"<br>OK |
| **Inactivity timeout** | | | |
| Set | AT+UFTP=5[,<timeout>] | OK | AT+UFTP=5,21<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| **FTP mode** | | | |
| Set | AT+UFTP=6[,<FTP_mode>] | OK | AT+UFTP=6,1<br>OK |
| **FTP server port** | | | |
| Set | AT+UFTP=7[,<FTP_server_port>] | OK | AT+UFTP=7,30<br>OK |
| **FTP control connection security** | | | |
| Set | AT+UFTP=8[,<FTP_secure>[,<USECMNG_profile>]] | OK | AT+UFTP=8,1,2<br>OK |
| **Timer trigger configuration for Direct Link** | | | |
| Set | AT+UFTP=9,<timer_trigger> | OK | AT+UFTP=9,500<br>OK |
| **Data length trigger configuration for Direct Link** | | | |
| Set | AT+UFTP=10,<data_length_trigger> | OK | AT+UFTP=10,1024<br>OK |
| **Character trigger configuration for Direct Link** | | | |
| Set | AT+UFTP=11,<character_trigger> | OK | AT+UFTP=11,13<br>OK |
| **FTP data connection security** | | | |
| Set | AT+UFTP=12[,<FTP_secure>[,<USECMNG_profile>]] | OK | AT+UFTP=12,1,2<br>OK |
| Read | AT+UFTP? | +UFTP: 0,<IP_address><br>+UFTP: 1,<server_name><br>+UFTP: 2,<username><br>+UFTP: 4,<account><br>+UFTP: 5,<timeout><br>+UFTP: 6,<FTP_mode><br>+UFTP: 7,<FTP_server_port><br>+UFTP: 8,<FTP_secure>[,<USECMNG_profile>]<br>+UFTP: 9,<timer_trigger><br>+UFTP: 10,<data_length_trigger><br>+UFTP: 11,<character_trigger><br>+UFTP: 12,<FTP_secure>[,<USECMNG_profile>]<br>OK | +UFTP: 0,"216.239.59.147"<br>+UFTP: 1,""<br>+UFTP: 2,"username"<br>+UFTP: 4,"account"<br>+UFTP: 5,0<br>+UFTP: 6,0<br>+UFTP: 7,21<br>+UFTP: 8,0<br>+UFTP: 9,500<br>+UFTP: 10,1024<br>+UFTP: 11,13<br>+UFTP: 12,0<br>OK |
| Test | AT+UFTP=? | +UFTP: (list of supported <param_tag>s)<br>OK | +UFTP: (0-11)<br>OK |

### 22.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | String | FTP parameter:<br>• 0: FTP server IP address<br>• 1: FTP server name<br>• 2: FTP username<br>• 3: FTP password<br>• 4: FTP additional user account<br>• 5: FTP inactivity timeout period<br>• 6: FTP mode |

| Parameter | Type | Description |
|---|---|---|
| | | • 7: remote FTP server listening port<br>• 8: control connection security<br>• 9: timer trigger<br>• 10: data length trigger<br>• 11: character trigger<br>• 12: data connection security<br>Allowed values:<br>• SARA-R5 - 0, 1, 2, 3, 4, 5, 6, 7, 8, 12 |
| <IP_address> | String | FTP server IP address. The default value is an empty string. For IP address format reference see the IP addressing. |
| <server_name> | String | FTP server name (e.g. "ftp.server.com"). The maximum length is 128 characters. The default value is an empty string. |
| <username> | String | User name (the maximum length is 30 characters) for the FTP login procedure. The default value is an empty string. |
| <password> | String | Password (the maximum length is 30 characters) for the FTP login procedure. The default value is an empty string. |
| <account> | String | Additional user account (if required) for the FTP login procedure. The maximum length is 30 characters. The default value is an empty string. |
| <timeout> | Number | Inactivity timeout period in seconds. The range goes from 0 to 86400 s; 0 means no timeout (the FTP session will not be terminated in the absence of incoming traffic). The default value is 30 s. |
| <FTP_mode> | Number | FTP mode:<br>• 0 (default value): active<br>• 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:<br>• 0 (default value): no SSL encryption<br>• 1: enable SSL encryption of FTP (control connection or data connection). Only the explicit FTPS mode is supported. |
| <USECMNG_profile> | Number | USECMNG profile (number). Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see USECMNG section). |
| <timer_trigger> | Number | Enhanced direct link sending timer trigger (in milliseconds); valid range is 0 (factory-programmed value), 100-120000; 0 means trigger disabled. |
| <data_length_trigger> | Number | Enhanced direct link data length trigger in bytes, valid range is 0 (factory-programmed value), 3-2048; 0 means trigger disabled. |
| <character_trigger> | Number | Enhanced direct link character trigger, the value represents the ASCII code (in base 10 ) of the character to be used as character trigger. The allowed range is -1, 0-255, the factory-programmed value is -1; -1 means trigger disabled. |
| <param1> | Number / String | Type and supported content depend on related <op_code> (details are given above). If <param1> is not specified the value of the corresponding parameter <op_code> is reset to default value. |
| <param2> | Number / String | Type and supported content depend on related <op_code> (details are given above). If <param2> is not specified the value of the corresponding parameter <op_code> is reset to default value. |

### 22.1.4 Notes

- The information text response to the read command does not display the password.
- The FTP server IP address and the FTP server name are mutually exclusive. If value for <op_code>=0 is specified by user, then value for <op_code>=1 is reset or vice versa.
- Some network operators do not allow incoming connections. Due to these limitations introduced by network operators it is possible to encounter problems using FTP active mode. If the FTP active mode fails to exchange files, try the passive mode to solve the problem.
- Some network operators do not allow FTPS. In this case the +UFTPC=1 command (FTP login) will return a failure response via +UUFTPCR URC after an SSL timeout of 30 s.

**SARA-R5**

- <timer_trigger>, <data_length_trigger> and <character_trigger> parameters are not supported.

## 22.2 FTP command +UFTPC

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

### 22.2.1 Description

Triggers the FTP actions corresponding to the <op_code> parameter. The final result code indicates if sending the command request to the FTP process was successful or not. The +UUFTPCR (FTP command result) URC returns to the user the final result of the FTP command previously sent with +UFTPC. As well, the +UUFTPCD FTP unsolicited data URC provides the data requested by the user (e.g. file or directory lists) and received from the FTP server.

SARA-R5
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.

SARA-R5
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.

### 22.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **General syntax** | | | |
| Set | AT+UFTPC=<op_code>[,<param1>[,<param2>[,<param3>]]] | OK | AT+UFTPC=4,"data.zip","data.zip"<br>OK |
| **FTP logout** | | | |
| Set | AT+UFTPC=0 | OK | AT+UFTPC=0<br>OK |
| **FTP login** | | | |
| Set | AT+UFTPC=1 | OK | AT+UFTPC=1<br>OK |
| **Delete the file from the FTP server** | | | |
| Set | AT+UFTPC=2,<file_name> | OK | AT+UFTPC=2,"mytest"<br>OK |
| **Rename a file of FTP server** | | | |
| Set | AT+UFTPC=3,<file_name>,<new_file_name> | OK | AT+UFTPC=3,"old_name","final_name"<br>OK |
| **Retrieve the file from the FTP server** | | | |
| Set | AT+UFTPC=4,<remote_file_name>,<local_file_name>[,<retrieving_mode>] | OK | AT+UFTPC=4,"data.zip","data.zip"<br>OK |
| **Store the file on the FTP server** | | | |
| Set | AT+UFTPC=5,<local_file_name>,<remote_file_name>[,<number_of_byte>] | OK | AT+UFTPC=5,"data.zip","data.zip",30<br>OK |
| **Retrieve a file from the FTP server using direct link mode** | | | |
| Set | AT+UFTPC=6,<remote_file_name>[,<number_of_byte>] | OK | AT+UFTPC=6,"data.zip",30<br>OK |
| **Send a file to the FTP server using the direct link mode** | | | |
| Set | AT+UFTPC=7,<remote_file_name>[,<number_of_byte>] | OK | AT+UFTPC=7,"data.zip",30<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Change the working directory to the specified one** | | | |
| Set | AT+UFTPC=8,<directory_name> | OK | AT+UFTPC=8,"data_folder"<br>OK |
| **Create a directory on the FTP host** | | | |
| Set | AT+UFTPC=10,<directory_name> | OK | AT+UFTPC=10,"new_data_folder"<br>OK |
| **Remove the directory from the remote FTP server** | | | |
| Set | AT+UFTPC=11,<directory_name> | OK | AT+UFTPC=11,"data_folder"<br>OK |
| **Information of a file or a directory** | | | |
| Set | AT+UFTPC=13[,<file_directory_name>] | OK | AT+UFTPC=13,"data_folder"<br>OK |
| **List the file names in a specified directory** | | | |
| Set | AT+UFTPC=14[,<file_directory_name>] | OK | AT+UFTPC=14,"data.zip"<br>OK |
| **Retrieve the FOTA update file** | | | |
| Set | AT+UFTPC=100,<remote_file_name>[,<fw_download_status>] | OK | AT+UFTPC=100,"data.zip"<br>OK |
| URC | | +UUFTPCR: 100,<stored_byte> / <total_byte> | +UUFTPCR: 100,202752 / 1103692 |
| Test | AT+UFTPC=? | +UFTPC: (list of supported <op_code>s)<br>OK | +UFTPC: (0-5,8,10,11,13,14,100)<br>OK |
| URC | | +UUFTPCD: <op_code>,<ftp_data_len>,<ftp_data> | +UUFTPCD: 13,16,"16 bytes of data" |
| URC | | +UUFTPCR: <op_code>,<ftp_result>[,<md5_sum>] | +UUFTPCR: 1,1 |

### 22.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | FTP command request. Allowed values:<br>• 0: FTP logout; terminates the FTP session by performing a logout.<br>• 1: FTP login; connects to the FTP server using the parameters of the current FTP profile (set via AT+UFTP command).<br>• 2: deletes the file from the FTP server.<br>• 3: renames the file. This AT command just sends requests to the FTP process.<br>• 4: retrieves the file from the FTP server.<br>• 5: stores the file on the FTP server.<br>• 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).<br>• 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.<br>• 8: changes the working directory to the specified one.<br>• 9: RFU.<br>• 10: creates a directory on the FTP host.<br>• 11: removes the directory from the remote FTP server. |

| Parameter | Type | Description |
|---|---|---|
| | | • 12: RFU.<br>• 13: information of a file or a directory. The URC +UUFTPCD returns the information of the specified file or directory from the FTP server.<br>• 14: lists the file names in a specified directory. The URC +UUFTPCD returns the list of the file names received from FTP server. If the directory name is omitted, the list of the files names of current working directory is requested.<br>• 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. |
| <file_name> | String | File name to be deleted/renamed from the FTP host. For the limit of the length of the string, see Command line. |
| <new_file_name> | String | New file name. For the limit of the length of the string, see Command line. |
| <remote_file_name> | String | Remote file name to be retrieved from the FTP host or stored in it. The maximum parameter length is 256 characters. |
| <local_file_name> | String | Local file name (module file system) text string to be stored/sent on the file system. For the limit of the length of the string, see the File system limits. |
| <retrieving_mode> | Number | Allowed values:<br>• 0 (default value): the file is retrieved from beginning.<br>• 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.<br>• During a file retrieval the server writes the file from the offset indicated with this parameter.<br>• 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.<br>• <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:<br>• if omitted trigger the firmware package download from an FTP server<br>• 0: cancel the firmware package download from an FTP server<br>• 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:<br>• 0: fail<br>• 1: success |
| <md5_sum> | String | MD5 checksum of the FOTA update file downloaded via +UFTPC=100 AT command. This parameter is issued only for +UFTPC=100 AT command. |
| <stored_byte> | Number | Amount of stored bytes |
| <total_byte> | Number | Amount of total bytes of the FOTA update file to be stored |
| <param1> | String | Content depend on related <op_code> (details are given above) |
| <param2> | String | Content depend on related <op_code> (details are given above) |
| <param3> | String | Content depend on related <op_code> (details are given above) |

### 22.2.4 Notes

- If <op_code>=6 the user must switch off the direct link mode (sending +++ to the serial interface) when the data stream is finished. This operation may take up to 10 s because the command also handles the final steps of the FTP protocol.

**SARA-R5**

- The <fw_download_status> parameter is not supported.
- The+UUFTPCR: 100,<stored_byte> / <total_byte> URC is not supported.

## 22.3 FTP error +UFTPER

| +UFTPER | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | No | No | - | +CME Error Appendix A.8.1 |

### 22.3.1 Description

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

### 22.3.2 Syntax

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

### 22.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <error_class> | Number | Value of error class. Values are listed in Appendix A.8. |
| <error_code> | Number | Value of class-specific error code (reply code if <error_class> is 0). The values are listed in Appendix A.8.1. |

# 23 HTTP

The section describes the u-blox proprietary AT commands that can be used for sending requests to a remote HTTP server, receiving the server response and transparently storing it in the file system. The supported methods are: HEAD, GET, DELETE, PUT, POST file and POST data. A PSD or CSD connection must be activated before using HTTP AT commands.

SARA-R5
See +UPSD, +UPSDA and +UPSND AT commands for establishing a PSD connection.

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

## 23.1 HTTP control +UHTTP

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

### 23.1.1 Description

Configures, reads or resets (to the factory-programmed values) the HTTP application profile parameters. Up to 4 different HTTP profiles can be defined. To set all the parameters in an HTTP profile a set command for each <op_code> needs to be issued.

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

The read command has two possible usages. The functionality of the command differs with the number of command parameters issued:

- Only the first command parameter (<profile_id>) issued: the module resets all the profile parameters (to the factory-programmed values) for the profile specified with <profile_id>
- Only the first and second command parameters used (<profile_id>, <op_code>): the module returns the current value of the profile parameter specified with <op_code> and related to the profile specified with <profile_id>

### 23.1.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+UHTTP=<profile_id>,<op_code>,<param_val>[,<param_val1>] | OK | AT+UHTTP=2,0,"125.24.51.133"<br>OK |
| Read | AT+UHTTP=<profile_id>,<op_code> | +UHTTP: <profile_id>,<op_code>,<param_val>[,<param_val1>]<br>OK | AT+UHTTP=2,0<br>+UHTTP: 2,0,"125.24.51.133"<br>OK |
| **HTTP server IP address** | | | |
| Set | AT+UHTTP=<profile_id>,0,<HTTP_server_IP_address> | OK | AT+UHTTP=2,0,"125.24.51.133"<br>OK |
| Read | AT+UHTTP=<profile_id>,0 | +UHTTP: <profile_id>,0,<HTTP_server_IP_address><br>OK | AT+UHTTP=2,0<br>+UHTTP: 2,0,"125.24.51.133"<br>OK |
| **HTTP server name** | | | |
| Set | AT+UHTTP=<profile_id>,1,<HTTP_server_name> | OK | AT+UHTTP=2,1,"www.u-blox.com"<br>OK |
| Read | AT+UHTTP=<profile_id>,1 | +UHTTP: <profile_id>,1,<HTTP_server_name><br>OK | AT+UHTTP=2,1<br>+UHTTP: 2,1,"www.u-blox.com"<br>OK |
| **Username** | | | |

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UHTTP=<profile_id>,2,<username> | OK | AT+UHTTP=2,2,"my_user"<br>OK |
| Read | AT+UHTTP=<profile_id>,2 | +UHTTP: <profile_id>,2,<username><br>OK | AT+UHTTP=2,2<br>+UHTTP: 2,2,"my_user"<br>OK |
| **Password** | | | |
| Set | AT+UHTTP=<profile_id>,3,<password> | OK | AT+UHTTP=2,3,"pwd"<br>OK |
| Read | AT+UHTTP=<profile_id>,3 | +UHTTP: <profile_id>,3,<password><br>OK | AT+UHTTP=2,3<br>+UHTTP: 2,3,"pwd"<br>OK |
| **Authentication type** | | | |
| Set | AT+UHTTP=<profile_id>,4,<HTTP_authentication> | OK | AT+UHTTP=2,4,1<br>OK |
| Read | AT+UHTTP=<profile_id>,4 | +UHTTP: <profile_id>,4,<HTTP_authentication><br>OK | AT+UHTTP=2,4<br>+UHTTP: 2,4,1<br>OK |
| **HTTP server port** | | | |
| Set | AT+UHTTP=<profile_id>,5,<HTTP_port> | OK | AT+UHTTP=2,5,30<br>OK |
| Read | AT+UHTTP=<profile_id>,5 | +UHTTP: <profile_id>,5,<HTTP_port><br>OK | AT+UHTTP=2,5<br>+UHTTP: 2,5,30<br>OK |
| **HTTP secure option** | | | |
| Set | AT+UHTTP=<profile_id>,6,<HTTP_secure>[,<USECMNG_profile>] | OK | AT+UHTTP=2,6,1<br>OK |
| Read | AT+UHTTP=<profile_id>,6 | +UHTTP: <profile_id>,6,<HTTP_secure>[,<USECMNG_profile>]<br>OK | AT+UHTTP=2,6<br>+UHTTP: 2,6,1<br>OK |
| **HTTP add custom request headers** | | | |
| Set | AT+UHTTP=<profile_id>,9,<custom_request_header> | OK | AT+UHTTP=2,9,"0:hdr0:val0"<br>OK |
| Read | AT+UHTTP=<profile_id>,9 | +UHTTP: <profile_id>,9,<custom_request_header><br>OK | AT+UHTTP=2,9<br>+UHTTP: 2,9,"0:hdr0:val0"<br>OK |
| Read | AT+UHTTP=<profile_id> | OK | AT+UHTTP=2<br>OK |
| Test | AT+UHTTP=? | +UHTTP: (list of supported <profile_id>s),(list of supported <op_code>s)<br>OK | +UHTTP: (0-3),(0-9)<br>OK |

### 23.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <profile_id> | Number | HTTP profile identifier, in range 0-3 |
| <op_code> | Number | • 0: HTTP server IP address;<br>• 1: HTTP server name;<br>• 2: username<br>• 3: password<br>• 4: authentication type<br>• 5: HTTP server port |

| Parameter | Type | Description |
|---|---|---|
| | | • 6: HTTP Secure option (SSL encryption)<br>• 7: HTTP request timeout<br>• 8: reserved for internal use only<br>• 9: HTTP add custom request headers |
| <HTTP_server_IP_address> | String | HTTP server IP address; The factory-programmed value is an empty text string. For IP address format reference see the IP addressing. |
| <HTTP_server_name> | String | HTTP server name (e.g. "http.server.com"). The factory-programmed value is an empty text string. The maximum length is:<br>• SARA-R5 - 1024 characters |
| <username> | String | User name; the maximum length is 30 characters; it is used for the HTTP login procedure if the authentication is used. The factory-programmed value is an empty text string. |
| <password> | String | Password; the maximum length is 30 characters; it is used for the HTTP login procedure if the authentication is used. The factory-programmed value is an empty text string. |
| <HTTP_authentication> | Number | HTTP authentication method; the allowed values are:<br>• 0 (factory-programmed value): no authentication<br>• 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:<br>• 0 (factory-programmed value): HTTPS (SSL encryption) disabled and the HTTP server port set to 80<br>• 1: HTTPS (SSL encryption) enabled and the HTTP server port set to 443; an USECMNG profile can be specified with an additional parameter. |
| <USECMNG_profile> | Number | Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used |
| <custom_request_header> | String | Sets/clears the custom request header (string); the custom header option follows a defined format "hdr_id:hdr_name:hdr_value"; the hdr_id is a number in the range [0-4]; the hdr_name and hdr_value are strings having a maximum length of 64 characters (see examples below).<br>• "0:hdr0:val0": set header 0 with name hdr0 and value val0<br>• "0:": clear header 0<br>• "1:hdr1:val1": set header 1 with name hdr1 and value val1<br>• "1:": clear header 1<br>• "2:hdr2:val2": set header 2 with name hdr2 and value val2<br>• "2:": clear header 2<br>• "3:hdr3:val3": set header 3 with name hdr3 and value val3<br>• "3:": clear header 3<br>• "4:hdr4:val4": set header 4 with name hdr4 and value val4<br>• "4:": clear header 4<br>The following character is not allowed in the <custom_request_header> parameter:<br>• 0x3A (:) |
| <param_val> | Number / String | Type and supported content depend on the related <op_code> parameter; details are given above |
| <param_val1> | Number / String | Type and supported content depend on the related <op_code> parameter; details are given above. |

### 23.1.4 Notes

- HTTP server IP address and HTTP server name are mutually exclusive. If the HTTP server IP address is specified by the user, then the value for the HTTP server name is reset, or vice versa.

**SARA-R5**

- The read command for <op_code>=9 (HTTP add custom request headers) is not supported.
- If the +UPSD command sets the PSD profile protocol type to IPv6, an IPv6 address shall be used for parameter HTTP server IP address.

## 23.2 HTTP advanced control+UHTTPAC

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

### 23.2.1 Description

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

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

### 23.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UHTTPAC=<profile_id>,<param_tag>,<key>,<value> | OK | AT+UHTTPAC=0,0,0,"UBLX_SESSION_COOKIE_0"<br>OK |
| Read | AT+UHTTPAC=<profile_id>,<param_tag>,<key> | +UHTTPAC: <profile_id>,<param_tag>,<key>,<value><br>OK | AT+UHTTPAC=0,0,0<br>+UHTTP: 0,0,0,"UBLX_SESSION_COOKIE_0"<br>OK |
| Test | AT+UHTTPAC=? | +UHTTPAC: (list of supported <profile_id>s),(list of supported <param_tag>s),(list of supported <key>s)<br>OK | +UHTTPAC: (0-3),(0),(0-3)<br>OK |

### 23.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <profile_id> | Number | HTTP profile identifier, in range 0-3 |
| <param_tag> | Number | • 0: HTTP request COOKIES; manage request COOKIES sent to the HTTP server.<br>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.<br>o <value>: value of the cookie (string); the maximum length is 256 characters. The cookie values respect the following rules:<br>- Empty string (""): the cookie will be cleared and will not be present in the request;<br>- Simple one-value cookie: the cookie will be set and sent in the request;<br>- Complex multi-value cookie: the cookies will be set and sent in the request. The multiple cookies must be separated by a left-attached semicolon(";") and a space(" "); |
| <key> | Number/ String | Content depends on the related <param_tag> (see above). |
| <value> | Number/ String | Content depends on the related <param_tag> (see above). |

### 23.2.4 Examples and use cases

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

| Command | Response | Description |
|---|---|---|
| **Example 1** | | |
| AT+UHTTPAC=0,0,0,"" | OK | Clear the HTTP request cookie at index 0. |
| **Example 2** | | |
| AT+UHTTPAC=0,0,0,"SIMPLE_COOKIE" | OK | Set a simple HTTP request cookie at index 0. |
| **Example 3** | | |

| Command | Response | Description |
|---|---|---|
| AT+UHTTPAC=0,0,0,"COMPLEX_COOKIE; COMPLEX_COOKIE" | OK | Overwrite the HTTP request cookie at index 0 with a complex cookie. |

## 23.3 HTTP command +UHTTPC

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

### 23.3.1 Description

Triggers the HTTP command specified with <http_command> parameter, using the HTTP application profile parameters (previously set up by +UHTTP AT command), specified with <profile_id>. The response indicates if sending the command request to HTTP process was successful or not. The final result of HTTP command will be returned to the user via the +UUHTTPCR URC.

The timing before the +UUHTTPCR URC is issued on the AT terminal also depends by the DNS resolution. For further details about the estimated response time related to the DNS resolution, see the +UDNSRN AT command.

### 23.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+UHTTPC=<profile_id>,<http_command>,<path>,<filename>[,<param1>[,<param2>[,<param3>]]] | OK | AT+UHTTPC=0,1,"/path/file.html","responseFilename"<br>OK |
| **HEAD command** | | | |
| Set | AT+UHTTPC=<profile_id>,0,<path>,<filename> | OK | AT+UHTTPC=0,0,"/path/file.html","responseFilename"<br>OK |
| **GET command** | | | |
| Set | AT+UHTTPC=<profile_id>,1,<path>,<filename> | OK | AT+UHTTPC=0,1,"/path/file.html","responseFilename"<br>OK |
| **DELETE command** | | | |
| Set | AT+UHTTPC=<profile_id>,2,<path>,<filename> | OK | AT+UHTTPC=0,2,"/path/file.html","responseFilename"<br>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"<br>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<br>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<br>OK |
| **GET FOTA update file** | | | |
| Set | AT+UHTTPC=<profile_id>,100,<path> | OK | AT+UHTTPC=0,100,"/path/file.html"<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| Test | AT+UHTTPC=? | +UHTTPC: (list of supported <profile_id>s),(list of supported <http_command>s)<br>OK | +UHTTPC: (0-3),(0-5),100<br>OK |
| URC | | +UUHTTPCR: <profile_id>,<http_command>,<http_result>[,<http_status_code>,<md5_sum>] | +UUHTTPCR: 0,1,1 |

### 23.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <profile_id> | Number | HTTP profile identifier, in range 0-3 |
| <http_command> | Number | • 0: HEAD command; issue an HEAD request to the HTTP server<br>• 1: GET command; perform a GET request to the HTTP server<br>• 2: DELETE command; send a DELETE request to the HTTP server<br>• 3: PUT command; perform a PUT request to the HTTP server.<br>• 4: POST a file command; issue a POST request for sending a file to the HTTP server<br>• 5: POST data command; send a POST request to the HTTP server using the data specified in <data> parameter<br>• 100: GET FOTA update file; download the FOTA update file |
| <path> | String | Path of HTTP server resource; the maximum length is:<br>• SARA-R5 - 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:<br>• 0: application/x-www-form-urlencoded<br>• 1: text/plain<br>• 2: application/octet-stream<br>• 3: multipart/form-data<br>• 4: application/json (supported only for PUT and POST file command)<br>• 5: application/xml<br>• 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<br>• 1: success |
| <http_status_code> | Number | HTTP status code reported in the server response header after a GET FOTA update file request. This parameter is issued only for AT+UHTTPC=<profile_id>,100,<path> AT command. |
| <md5_sum> | String | MD5 checksum of the FOTA update file. This parameter is issued only for AT +UHTTPC=<profile_id>,100,<path> AT command. |

### 23.3.4 Notes

- The +UHTTPC command has a default timeout setting set to 180 s. The timeout is counted from the last successful network read or send operation performed by the HTTP application, so in a real timeout case the application might be executing a command more than 180 s.
- The data string must not exceed the maximum length of 128 bytes.

- If <http_command>=4 (POST a file) and the <HTTP_content_type>=3 (multipart/form-data), then the module automatically encapsulates the file content in the following multipart/form-data HTTP request:

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

- The response headers string (headers received in the HTTP response) must not exceed the maximum length of 256 bytes.

**SARA-R5**

- <http_command>=100 is not supported.

# 23.4 HTTP protocol error +UHTTPER

| +UHTTPER | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | No | No | - | +CME Error Appendix A.8 |

## 23.4.1 Description

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

## 23.4.2 Syntax

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

## 23.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <profile_id> | Number | HTTP profile identifier, in range 0-3 |
| <error_class> | Number | List of the allowed values is available in Appendix A.8 |
| <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.8.2 |

# 24 Ping

SARA-R5

The ping service requires the user to define and activate a connection profile before executing the +UPING command. See +UPSD, +UPSDA and +UPSND AT commands for establishing a PSD connection.

## 24.1 Ping command +UPING

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

### 24.1.1 Description

The ping command is the common method to know if a remote host is reachable on the internet.

The ping functionality is based on the ICMP protocol (Internet Control Message Protocol), it is part of the Internet Protocol Suite as defined in RFC 792 [46]. 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 AT+UPING allows the user to execute a ping command from the module to a remote peer. The results of the ping command execution is notified by means of these URCs:

- **+UUPING**: it reports the +UPING command result when no error occurred.
- **+UUPINGER**: it is raised if an error is occurred while processing the +UPING command. The URC reports the code of occurred error (see Ping error codes to get the meanings of the error result codes).

Some network operators may disallow ICMP packets traffic on their network, this means that the +UPING command may not work.

Some remote hosts might not reply to ICMP echo request for security reasons (e.g. firewall settings).

Some remote hosts might not reply to ICMP echo request if the data size of the echo request is too big.

If a remote peer does not reply to an ICMP echo request, it does not mean that for sure the peer cannot be reached in another way.

### 24.1.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UPING=<remote_host>[,<retry_num>,<p_size>,<timeout>,<ttl>] | OK | AT+UPING="www.google.com"<br>OK |
| Test | AT+UPING=? | +UPING: "remote_host",(list of supported <retry_num>),(list of supported <p_size>),(list of supported <timeout>),(list of supported <ttl>)<br>OK | +UPING: "remote_host",(1-64),(4-1460),(10-60000),(1-255)<br>OK |
| URC | | +UUPING: <retry_num>,<p_size>,<remote_hostname>,<remote_ip>,<ttl>,<rtt> | +UUPING: 1,32,"www.l-google.com","72.14.234.104",55,768 |
| URC | | +UUPINGER: <error_code> | +UUPINGER: 12 |

### 24.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <remote_host> | String | IP address (dotted decimal representation) or domain name of the remote host:<br>• Maximum length: 128 characters |
| <retry_num> | Number | Indicates how many times iterate the ping command:<br>• Range: 1-64<br>• Default value: 4 |
| <p_size> | Number | Size in bytes of the echo packet payload:<br>• SARA-R5 - The range goes from 4 to 1460. The default value is 32. |
| <timeout> | Number | The maximum time in milliseconds to wait for a echo reply response:<br>• Range: 10-60000<br>• 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:<br>• Range: 1-255<br>• Default value: 32 |
| <remote_hostname> | String | String representing the domain name (if available) of the remote host. It this information is not available, it will be an empty string (i.e. ""). |
| <remote_ip> | String | String representing the remote host IP address in dotted decimal form. |
| <rtt> | Number | RTT value, the time elapsed in milliseconds before receiving the echo reply response from the remote host. |
| <error_code> | Number | The error occurred while processing the +UPING command. See Ping error codes for the list of the allowed error result codes. |

### 24.1.4 Notes

- If the +UUPING URC reports <rtt> = -1 the timeout is elapsed (no response received).
- If the first +UUPING URC reports <rtt> = -2 the TTL used in the ping request is too low.
- Some network operators may return an ICMP time exceeded message when the remote host is not reachable. In these cases the first +UUPING URC reports <rtt> = -1 and the subsequent +UUPING URC report <rtt> = -2.

## 24.2 ICMP echo reply configuration +UDCONF=4

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

### 24.2.1 Description

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

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

### 24.2.2 Syntax

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

### 24.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <icmp_echo_reply> | Number | Enables or disables the ping response when a remote host performs a ping request to the module |

| Parameter | Type | Description |
|---|---|---|
| | | • 0: ping response disabled (the module does not reply to remote pings)<br>• 1 (factory-programmed value): ping response enabled (the module replies to remote pings) |

# 25 Positioning

## 25.1 NMEA

u-blox cellular modules support reading NMEA strings 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 AT+UGPS AT command to not provide the NMEA sentences.

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

## 25.2 AssistNow services

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

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

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

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

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

☞ UDP protocol for the AssistNow Online service is deprecated.

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

**AssistNow Autonomous** feature provides a functionality similar to AssistNow Offline without the need for a host and a connection. Based on a broadcast ephemeris downloaded from the satellite the receiver can

autonomously generate an accurate satellite orbit representation («AssistNow Autonomous data») that is usable for navigation much longer than the underlying broadcast ephemeris was intended for.

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

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

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

Table 29 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 HTTP for A-GNSS | | |
| | Configure Auth Token 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 29: AssistNow services Overview**

# 25.3 GNSS

## 25.3.1 GNSS power management +UGPS

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

### 25.3.1.1 Description

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

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

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

☞ SARA-R5
To establish a PSD connection see the +UPSD, +UPSDA and +UPSND 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.

☞ SARA-R5
For a more detailed description on aiding modes and possible suggestions, see SARA-R5 series positioning implementation application note [174].

It is possible to combine different aiding modes: to enable them the sum of the <mode> value of the interested aiding modes is needed (e.g.: aiding <aid_mode>=3 means local aiding plus AssistNow Offline). Moreover it is

also possible to switch from one aiding mode to another one without powering off the GNSS receiver. If the following sequence is provided (AT+UGPS=1,1 and then AT+UGPS=1,5) at the beginning the GNSS receiver will power on with local aiding support and after the second command will be added the AssistNow Online. After the second command the local aiding is not restarted, therefore the +UUGIND URC for it will not be sent again.

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

#### 25.3.1.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGPS=<mode>[,<aid_mode>[,<GNSS_systems>]] | OK | AT+UGPS=1,0,1<br>OK |
| Read | AT+UGPS? | +UGPS: <mode>[,<aid_mode>[,<GNSS_systems>]]<br>OK | +UGPS: 1,0,1<br>OK |
| Test | AT+UGPS=? | +UGPS: (list of supported <mode>s),(list of supported <aid_mode>),(list of supported <GNSS_systems>)<br>OK | +UGPS: (0-1),(0-15),(1-127)<br>OK |

#### 25.3.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | • 0 (default value): GNSS receiver powered off<br>• 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:<br>• 0 (default value): no aiding<br>• 1: automatic local aiding<br>• 2: AssistNow Offline<br>• 4: AssistNow Online<br>• 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):<br>• 1: GPS<br>• 2: SBAS<br>• 4: Galileo<br>• 8: BeiDou<br>• 16: IMES<br>• 32: QZSS<br>• 64: GLONASS |

#### 25.3.1.4 Notes

- If <GNSS_systems> type is not supported by the GNSS receiver, the set command turns on the GNSS receiver with built-in supported type. The current <GNSS_systems> can be queried by means of the read command or the +UUGIND URC.
- An error result code is provided in the following cases:
  - <mode>, <aid_mode> or <GNSS_systems> values are out of range
  - <mode> is set to 1 without <aid_mode> value
  - Attempt to power off the GNSS when it is already off
  - The value of <aid_mode> to be set is equal to the current GNSS aiding mode and the value of <GNSS_systems> to be set is equal to the last requested <GNSS_systems>

## 25.3.2 Assisted GNSS unsolicited indication +UGIND

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

### 25.3.2.1 Description

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

The URC returns the result of an assisted GNSS operation. This information is sent to all the interfaces. The URC is provided only if one or more aiding modes are enabled (for more details see the +UGPS and +UGAOP command descriptions).

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

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

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

If the connected GNSS receiver is Multi-GNSS then an additional +UUGIND=0,<GNSS_systems> URC for the currently activated GNSS systems is displayed.

### 25.3.2.2 Syntax

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

### 25.3.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | URC configuration:<br>• 0 (default value): disabled<br>• 1: enabled |
| <aid_mode> | Number | Provides the supported aiding mode:<br>• 0: GNSS system(s)<br>• 1: automatic local aiding<br>• 2: AssistNow Offline<br>• 4: AssistNow Online<br>• 8: AssistNow Autonomous |
| <GNSS_systems> | Number | Current activated GNSS types; the allowed values can be combined together:<br>• 1: GPS<br>• 2: SBAS<br>• 4: Galileo<br>• 8: BeiDou<br>• 16: IMES<br>• 32: QZSS |

| Parameter | Type | Description |
|---|---|---|
| | | • 64: GLONASS |
| <result> | Number | Represents the result of the aiding operation:<br>• 0: No error<br>• 1: Wrong URL (for AssistNow Offline)<br>• 2: HTTP error (for AssistNow Offline)<br>• 3: Create socket error (for AssistNow Online)<br>• 4: Close socket error (for AssistNow Online)<br>• 5: Write to socket error (for AssistNow Online)<br>• 6: Read from socket error (for AssistNow Online)<br>• 7: Connection/DNS error (for AssistNow Online)<br>• 8: File system error<br>• 9: Generic error<br>• 10: No answer from GNSS (for local aiding and AssistNow Autonomous)<br>• 11: Data collection in progress (for local aiding)<br>• 12: GNSS configuration failed (for AssistNow Autonomous)<br>• 13: RTC calibration failed (for local aiding)<br>• 14: feature not supported (for AssistNow Autonomous)<br>• 15: feature partially supported (for AssistNow Autonomous)<br>• 16: authentication token missing (required for aiding for u-blox M8 and future versions) |

#### 25.3.2.4 Notes

**SARA-R5**

- The command setting is not stored in the NVM.

## 25.3.3 GNSS profile configuration +UGPRF

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

#### 25.3.3.1 Description

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

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

☞ SARA-R5
To establish a PSD connection see the +UPSD, +UPSDA and +UPSND 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.

SARA-R5
AUX UART interface can be configured as GNSS tunneling. See +USIO command description for details.

#### 25.3.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGPRF=<GNSS_I/O_ configuration>[,<IP Port>,<server address string>] | OK | AT+UGPRF=0<br>OK |
| Read | AT+UGPRF? | +UGPRF: <GNSS_I/O_ configuration>,<IP port>,<server address string><br>OK | +UGPRF: 0,0,""<br>OK |
| Test | AT+UGPRF=? | +UGPRF: (list of supported <GNSS_I/O_configuration>),(list of supported <IP port>),<server address string><br>OK | +UGPRF: (0-127),(0-65535),"addr"<br>OK |

#### 25.3.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <GNSS_IO_ configuration> | Number | • 0: no data flow to multiplexer, file or IP address<br>• 1: GNSS data flow to and from USB (or alternatively AUX UART)<br>• 2: GNSS data flow to and from multiplexer<br>• 4: GNSS data flow saved to file<br>• 8: GNSS data flow over the air to an Internet host<br>• 16: GNSS data ready function<br>• 32: GNSS RTC sharing function<br>• 64: reserved<br>• 128: reset the GNSS after the GNSS power on (see AT+UGPS command description)<br>• 256: use the auxiliary GNSS receiver instead of the default one. If the feature is not provided then an error result code will be displayed<br>Allowed values:<br>• SARA-R500S / SARA-R510S - 0 (factory-programmed value), 1, 2, 4, 8, 16, 64, 128, 256<br>• SARA-R510M8S - 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. |

## 25.3.4 Aiding server configuration +UGSRV

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

#### 25.3.4.1 Description

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

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

SARA-R5
See +UPSD, +UPSDA and +UPSND AT commands for establishing a PSD connection.

For more details about Multi GNSS Assistance (MGA) feature please refer to AssistNow services.

#### 25.3.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGSRV=[<mga_primary_server>],[<mga_secondary_server>],<auth_token>[,<days>[,<period>[,<resolution>[,<GNSS_types>[,<mode>[,<datatype>]]]]]] | OK | AT+UGSRV="cell-live1.services.u-blox.com","cell-live2.services.u-blox.com","123456789abcdefghijklm",14,4,1,65,0,1<br>OK |
| Read | AT+UGSRV? | +UGSRV: <mga_primary_server>,<mga_secondary_server>,<auth_token>,<days>,<period>,<resolution>,<GNSS_types>,<mode>,<datatype><br>OK | +UGSRV: "cell-live1.services.u-blox.com","cell-live2.services.u-blox.com","123456789abcdefghijklm",14,4,1,65,0,1<br>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)<br>OK | +UGSRV: "srv1","srv2","token",(1,2,3,5,7,10,14),(1-5),(1-3),(1,64,65),(0-2),(0-15)<br>OK |

#### 25.3.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mga_primary_server> | String | Host name of the primary MGA server; the maximum length is 254 characters. Empty string is not allowed. 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:<br>• 1 (default and factory-programmed value): every day<br>• 2: every other day<br>• 3: every third day |
| <GNSS_types> | Number | Bitmask for combining the desired GNSS for the (offline) aiding<br>• 1: GPS<br>• 64: GLONASS<br>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<br>• 0 (default and factory-programmed value): AssistNow Online data are downloaded at GNSS receiver power up<br>• 1: AssistNow Online data automatically kept alive<br>• 2: manual AssistNow Online data download |
| <datatype> | Number | Bitmask for combining the desired data types for the (online) aiding |

| Parameter | Type | Description |
|---|---|---|
| | | • 0: time<br>• 1: position<br>• 2: ephemeris<br>• 4: almanac<br>• 8: auxiliary<br>• 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.<br>The default and factory-programmed value is all aidings without filter on visible satellites (15) |

## 25.3.5 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 |

### 25.3.5.1 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 refer to command +UGPS, Chapter 25.3.1).

### 25.3.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGAOS=<aid_mode> | OK | AT+UGAOS=0<br>OK |
| Test | AT+UGAOS=? | AT+UGAOS: (list of supported <aid_mode>s)<br>OK | +UGAOS: (0-8)<br>OK |

### 25.3.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <aid_mode> | Number | • 0: Upload of local aiding data from GNSS receiver to cellular module<br>• 1: Download of local aiding data from the cellular module to the GNSS receiver<br>• 2: AssistNow Offline file download request (file loaded into cellular module)<br>• 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<br>• 8: AssistNow autonomous<br>• Other values are reserved for future use |

## 25.3.6 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 |

### 25.3.6.1 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. This message is used only if the GNSS receiver HW is unknown (newer than the cellular module FW). In this case the UBX checksum bytes must be filled correctly.

☞ It is recommended to not send UBX messages to reset the GNSS receiver while it is in use, this will cause a misalignment between the 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.

#### 25.3.6.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGUBX=<UBX_string> | +UGUBX: <UBX_string_response><br>OK | AT+UGUBX="B562060108000106000100000000017DA"<br>+UGUBX: "B5620501020006010F38"<br>OK |

#### 25.3.6.3 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).<br>• SARA-R5 - 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 |

#### 25.3.6.4 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:".

### 25.3.7 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 |

#### 25.3.7.1 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.

#### 25.3.7.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGTMR=<time_zone> | OK | AT+UGTMR=-1<br>OK |
| Read | AT+UGTMR? | +UGTMR: <time_zone><br>OK | +UGTMR: -1<br>OK |
| Test | AT+UGTMR=? | +UGTMR: (list of supported <time_zone>s)<br>OK | +UGTMR: (-96 - 96)<br>OK |

#### 25.3.7.3 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.<br>• -96, 96: defined range |

#### 25.3.7.4 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" | |

### 25.3.8 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 |

#### 25.3.8.1 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.

#### 25.3.8.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGZDA=<state> | OK | AT+UGZDA=1<br>OK |
| Read | AT+UGZDA? | +UGZDA: <state>,<$ZDA msg><br>OK | +UGZDA: 1,$GPZDA,142351.00,12,12,2013,00,00*66<br>OK<br>+UGZDA: 0,NULL<br>OK |
| Test | AT+UGZDA=? | +UGZDA: (list of supported <state>s)<br>OK | +UGZDA: (0-1)<br>OK |

#### 25.3.8.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <state> | Number | • 0 (factory-programmed value): disable the NMEA $ZDA messages<br>• 1: enable the NMEA $ZDA messages |
| <$ZDA msg> | String | NMEA $ZDA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user. |

## 25.3.9 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 |

### 25.3.9.1 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.

### 25.3.9.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGGGA=<state> | OK | AT+UGGGA=1<br>OK |
| Read | AT+UGGGA? | +UGGGA: <state>,<$GGA msg><br>OK | +UGGGA: 1,$GPGGA,142351.00,,,,,0,00,99.99,,,,,,*66<br>OK<br>+UGGGA: 0,NULL<br>OK |
| Test | AT+UGGGA=? | +UGGGA: (list of supported <state>s)<br>OK | +UGGGA: (0-1)<br>OK |

### 25.3.9.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <state> | Number | • 0 (factory-programmed value): to disable the NMEA $GGA messages<br>• 1: to enable the NMEA $GGA messages |
| <$GGA msg> | String | NMEA $GGA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user. |

## 25.3.10 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 |

### 25.3.10.1 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.

### 25.3.10.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGGLL=<state> | OK | AT+UGGLL=1<br>OK |
| Read | AT+UGGLL? | +UGGLL: <state>,<$GLL msg><br>OK | +UGGLL: 1,$GPGLL,,,,,142351.00,V,N*4A<br>OK<br>+UGGLL: 0,NULL<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| Test | AT+UGGLL=? | +UGGLL: (list of supported <state>s)<br>OK | +UGGLL: (0-1)<br>OK |

#### 25.3.10.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <state> | Number | • 0 (factory-programmed value): to disable the NMEA $GLL messages<br>• 1: to enable the NMEA $GLL messages |
| <$GLL msg> | String | NMEA $GLL messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user. |

## 25.3.11 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 |

#### 25.3.11.1 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.

#### 25.3.11.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGGSV=<state> | OK | AT+UGGSV=1<br>OK |
| Read | AT+UGGSV? | +UGGSV: <state>,<$GSV msg><br>OK | +UGGSV: 1,$GPGSV,3,1,11,03,67,298,22,06,88,149,29,07,06,302,,08,05,332,25*73<br>$GPGSV,3,2,11,09,02,334,25,14,02,141,,15,10,041,43,16,46,209,16*7D<br>$GPGSV,3,3,11,18,48,066,35,21,26,070,35,27,80,314,25*40<br>$GLGSV,1,1,03,73,13,248,,74,23,298,20,75,09,348,19*51<br>OK<br>+UGGSV: 0,NULL<br>OK |
| Test | AT+UGGSV=? | +UGGSV: (list of supported <state>s)<br>OK | +UGGSV: (0-1)<br>OK |

#### 25.3.11.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <state> | Number | • 0 (factory-programmed value): to disable the NMEA $GSV messages<br>• 1: to enable the NMEA $GSV messages |
| <$GSV msg> | String | NMEA $GSV messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user. |

#### 25.3.11.4 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.

## 25.3.12 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 |

### 25.3.12.1 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.

### 25.3.12.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGRMC=<state> | OK | AT+UGRMC=1<br>OK |
| Read | AT+UGRMC? | +UGRMC: <state>,<$RMC msg><br>OK | +UGRMC: 1,$GPRMC,142351.00,V,,,,,,121213,,,N*7F<br>OK<br>+UGRMC: 0,NULL<br>OK |
| Test | AT+UGRMC=? | +UGRMC: (list of supported <state>s)<br>OK | +UGRMC: (0-1)<br>OK |

### 25.3.12.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <state> | Number | • 0 (factory-programmed value): to disable the NMEA $RMC messages<br>• 1: to enable the NMEA $RMC messages |
| <$RMC msg> | String | NMEA $RMC messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user. |

## 25.3.13 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 |

### 25.3.13.1 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.

### 25.3.13.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGVTG=<state> | OK | AT+UGVTG=1<br>OK |
| Read | AT+UGVTG? | +UGVTG: <state>,<$VTG msg><br>OK | +UGVTG: 1,$GPVTG,,,,,,,,,N*30<br>OK<br>+UGVTG: 0,NULL<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| Test | AT+UGVTG=? | +UGVTG: (list of supported <state>s)<br>OK | +UGVTG: (0-1)<br>OK |

#### 25.3.13.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <state> | Number | • 0 (factory-programmed value): to disable the NMEA $VTG messages<br>• 1: to enable the NMEA $VTG messages |
| <$VTG msg> | String | NMEA $VTG messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user. |

### 25.3.14 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 |

#### 25.3.14.1 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.

#### 25.3.14.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UGGSA=<state> | OK | AT+UGGSA=1<br>OK |
| Read | AT+UGGSA? | +UGGSA: <state>,<$GSA msg><br>OK | +UGGSA: 1,$GPGSA,A,1,,,,,,,,,,,,99.99,99.99,99.99*30<br>OK<br>+UGGSA: 0,NULL<br>OK |
| Test | AT+UGGSA=? | +UGGSA: (list of supported <state>s)<br>OK | +UGGSA: (0-1)<br>OK |

#### 25.3.14.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <state> | Number | • 0 (factory-programmed value): to disable the NMEA $GSA messages<br>• 1: to enable the NMEA $GSA messages |
| <$GSA msg> | String | NMEA $GSA messages or "Not available" if the NMEA string is enabled, but this information has not been still sent to the user. |

## 25.4 CellLocate and hybrid positioning

### 25.4.1 Ask for localization information +ULOC

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

#### 25.4.1.1 Description

Requests cellular module to provide the location data; the location can be determined using:

- GNSS receiver
- CellLocate® (location based on network cells data)
- Combination of both technologies (hybrid)

The final result code indicates if sending the command request to the localization information process was successful or not. The URC is issued to provide the requested information via +ULOC set command.

The GNSS interface and CellLocate® can be used at the same time: if the GNSS sensor is reserved to another interface an error result code is provided ("+CME ERROR: GPS busy" if +CMEE: 2).

It is possible to configure the hybrid positioning through +ULOCGNSS and +ULOCCELL AT commands even if it is running: the parameters are stored in NVM and will be applied at the next +ULOC command.

☞ If the +ULOC command is sent while a previous +ULOC activity is still in progress the previous activity is aborted, the available position is immediately output and the next +ULOC request is served.

☞ The data connection cannot be immediately dropped at the +ULOC timeout expiration. This could lead to a delay in the expected response time.

☞ Depending on the aiding chosen, a data connection could be required; see the AT+UGPS command description.

☞ If no position is available (no GNSS coverage, no network information and no previous data available) then the <lat> latitude and <long> longitude will be set to '0'.

☞ If the previous position degradated by the elapsed time satisfies the desired accuracy then the sensor '0' is reported in the information text response.

☞ If multi-hypothesis is required the GNSS solution and the CellLocate® solutions are reported, if available. If no GNSS or CellLocate® solutions are present, the previous position degradated is used instead.

☞ If 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.

☞ SARA-R5
The location by means of CellLocate® requires an active data context: for more details about the activation of a PSD context, see +UPSD, +UPSDA and +UPSND AT commands.

#### 25.4.1.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULOC=<mode>,<sensor>,<response_type>,<timeout>,<accuracy>[,<num_hypothesis>] | OK | AT+ULOC=2,3,0,120,1<br>OK |
| Read | AT+ULOC? | +ULOC: <mode>,<sensor>,<response_type>,<timeout>,<accuracy>,<num_hypotesis><br>OK | +ULOC: 2,3,1,0,20,0<br>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)<br>OK | +ULOC: (0-2),(0-3),(0-2),(1-999),(1-999999),(1-16)<br>OK |
| URC | | If <response_type>=0:<br>+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:<br>+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 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | If <response_type>=2, <sensor_used>= 1 and <num_hypothesis>=N:<br>+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:<br>+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:<br>+UULOC: <sol>,<num>,<sensor_used>,<date>,<time>,<lat>,<long>,<alt>,<uncertainty> | +UULOC: 1,1,0,08/04/2015,09:03:45.000,45.7140290,13.7410695,0,32 |

#### 25.4.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | • 0: reserved<br>• 1: reserved<br>• 2: single shot position |
| <sensor> | Number | Sensor selection: it is possible to combine different sensors summing <sensor> values of the selected sensors:<br>• 0: use the last fix in the internal database and stop the GNSS receiver<br>• 1: use the GNSS receiver for localization<br>• 2: use cellular CellLocate® location information |
| <response_type> | Number | Type of response:<br>• 0: standard (single-hypothesis) response<br>• 1: detailed (single-hypothesis) response<br>• 2: multi-hypotheses response |
| <timeout> | Number | Timeout period in seconds (1 - 999) |
| <accuracy> | Number | Target accuracy in meters (1 - 999999) |
| <num_hypothesis> | Number | Maximum desired number of responses from CellLocate® (up to 16): multiple positions followed by their ellipsoidal uncertainties. This value has to be increased by 1 (GNSS solution) to get the maximum number of possible solutions. This optional parameter can be used only if <response_type>=2. The default value is 1. |
| <date> | String | GPS date[2] (DD/MM/YY) of the estimated position |
| <time> | String | GPS time[2] (hh:mm:ss.sss) of the estimated position |
| <lat> | String | Estimated latitude, in degrees |
| <long> | String | Estimated longitude, in degrees |
| <alt> | Number | Estimated altitude, in meters[3] |
| <uncertainty> | Number | Estimated 50% confidence level error, in meters (0 - 20000000) |
| <speed> | Number | Speed over ground m/s[3] |
| <direction> | Number | Course over ground in degree (0 deg - 360 deg)(3) |
| <vertical_acc> | Number | Vertical accuracy, in meters[3] |
| <sensor_used> | Number | Sensor used for the position calculation |
| <SV_used> | Number | Number of satellite used to calculate the position[3] |

[2] Coming either from the CellLocate® server or the GNSS receiver (GPS time)
[3] only for GNSS positioning, 0 in case of CellLocate®

| Parameter | Type | Description |
|---|---|---|
| <sol> | Number | Solution index (between 1 and <num>) |
| <num> | Number | Total number of the available hypotheses (less than or equal to <num_hypothesis>) |
| <lat50>/<lat95> | String | Estimated latitude (50/95% confidence levels), in degrees |
| <long50>/<long95> | String | Estimated longitude (50/95% confidence levels), in degrees |
| <major50>/<major95> | Number | Semi-major axis of the ellipse (50/95% confidence levels), in meters |
| <minor50>/<minor95> | Number | Semi-minor axis of the ellipse (50/95% confidence levels), in meters |
| <orientation50>/<orientation95> | Number | Orientation of the ellipse (50/95% confidence levels), in degrees |
| <confidence50>/<confidence95> | Number | 50/95% confidence levels, in percentage |
| <antenna_status> | Number | Antenna status (0 - 4)[3]. For more details see the u-blox GNSS receiver protocol specification |
| <jamming_status> | Number | Jamming status[3]. For more details see the u-blox GNSS receiver protocol specification |

#### 25.4.1.4 Notes

- If AssistNow Online aiding data has been configured by means of the <aiding> parameter of +ULOCGNSS AT command, the +ULOC request using <sensor>=1 (GNSS receiver only) can provide a +UULOC URC reporting a CellLocate solution (<sensor_used>=2). This can happen if:
  - a GNSS fix is not available.
  - 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.

### 25.4.2 Localization information request status unsolicited indication +ULOCIND

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

#### 25.4.2.1 Description

Configures sending of URCs from MT to TE in the case of +ULOC operations. The URC provides the result of the steps of an +ULOC operation.

#### 25.4.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULOCIND=<mode> | OK | AT+ULOCIND=1<br>OK |
| Read | AT+ULOCIND? | +ULOCIND: <mode><br>OK | +ULOCIND: 1<br>OK |
| Test | AT+ULOCIND=? | +ULOCIND: (list of supported <mode>'s)<br>OK | +ULOCIND: (0-1)<br>OK |
| URC | | +UULOCIND: <step>,<result><br>OK | +UULOCIND: 1,0<br>OK |

#### 25.4.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | URC configuration: |

| Parameter | Type | Description |
|---|---|---|
| | | • 0 (default value): disabled<br>• 1: enabled |
| <step> | Number | Informs the user about the operation in progress:<br>• 0: network scan start<br>• 1: network scan end<br>• 2: requesting data to the server<br>• 3: received data from the server<br>• 4: sending feedback to the server |
| <result> | Number | Represents the result of the aiding operation:<br>• 0: no error<br>• 1: wrong URL<br>• 2: HTTP error<br>• 3: create socket error<br>• 4: close socket error<br>• 5: write to socket error<br>• 6: read from socket error<br>• 7: connection/DNS error<br>• 8: authentication token missing or wrong (required for aiding for u-blox M8 and future versions)<br>• 9: generic error<br>• 10: user terminated<br>• 11: no data from server |

#### 25.4.2.4 Notes

**SARA-R5**

- The command setting is not stored in the NVM.

## 25.4.3 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 |

#### 25.4.3.1 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).

#### 25.4.3.2 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<br>OK |
| Read | AT+ULOCAID? | +ULOCAID: <index>,<date>,<time>,<lat>,<long>,<major>,<minor>,<orientation>[,<speed>,<direction>]<br>OK | If <speed> and <direction> set:<br>+ULOCAID: 0,"10/03/2015","11:37:32.000","45.23456","11.12345",1300,789,34,34,121 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | OK |
| | | | If <speed> and <direction> unknown:<br>+ULOCAID: 0,"10/03/2015","11:37:32.000","45.23456","11.12345",1300,789,34<br>OK |
| **Location estimate from hypothesis selected (<index> greater than 0)** | | | |
| Set | AT+ULOCAID=<index>[,,,,,,,,<speed>,<direction>] | OK | If <speed> and <direction> unknown:<br>AT+ULOCAID=1<br>OK |
| | | | If <speed> and <direction> set:<br>AT+ULOCAID=1,,,,,,,,34,121<br>OK |
| Read | AT+ULOCAID? | +ULOCAID: <index>,<date>,<time>,<lat>,<long>,<major>,<minor>,<orientation>[,<speed>,<direction>]<br>OK | If <speed> and <direction> unknown:<br>+ULOCAID: 1,"0/0/0","0:0:0.000","0.0000000","0.0000000",0,0,0<br>OK |
| | | | If <speed> and <direction> set:<br>+ULOCAID: 1,"0/0/0","0:0:0.000","0.0000000","0.0000000",0,34,121<br>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)<br>OK | +ULOCAID: (0-17),"","","","",(0-63000000),(0-6300000),(0-179),(0-255),(0-359)<br>OK |

### 25.4.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <index> | Number | Multi-hypotesis index:<br>• 0: location estimate from other sensors (following fields are used)<br>• 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. |

## 25.4.4 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 |

### 25.4.4.1 Description

Configures the GNSS sensor that can be used with the +ULOC AT command.

SARA-R5
The configured GNSS sensor is used also by the +UTIME AT command.

### 25.4.4.2 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<br>OK |
| Read | AT+ULOCGNSS? | +ULOCGNSS: <aiding>,<psv_mode>,<minSV>,<minCNO>,<ini_3d_fix>,<staticHoldMode>,<SBAS>,<jamming>,<antenna>,<BBthreshold>,<CWthreshold>,<GNSS_system>,<reserved1>,<reserved2><br>OK | +ULOCGNSS: 15,1,6,8,0,1,1,1,1,1,1,0,0,0<br>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)<br>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)<br>OK |

### 25.4.4.3 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:<br>• 1: local aiding (including RTC sharing)<br>• 2: AssistNow Offline<br>• 4: AssistNow Online<br>• 8: AssistNow Autonomous<br>All the modes (15) are enabled as a factory programmed setting. |
| <psv_mode> | Number | Power Save Mode (UBX-CFG-RXM):<br>• 0 (factory-programmed value): disabled<br>• 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): |

| Parameter | Type | Description |
|---|---|---|
| | | • 0 (factory-programmed value): disabled<br>• 1: enabled |
| <staticHoldMode> | Number | Static Hold Mode (UBX-CFG-NAV5). The range goes from 0 to 255 cm/s. (factory-programmed value: 0).<br>If the parameter is omitted, the Static Hold Mode threshold will not be configured to GNSS. |
| <SBAS> | Number | SBAS configuration:<br>• 0 (factory-programmed value): disabled<br>• 1: enabled |
| <jamming> | Number | Jamming indicator (UBX-CFG-ITFM):<br>• 0 (factory-programmed value): disabled<br>• 1: enabled |
| <antenna> | Number | Antenna setting:<br>• 0 (factory-programmed value): unknown<br>• 1: passive<br>• 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):<br>• 1 (factory-programmed value): GPS<br>• 2: SBAS<br>• 4: Galileo<br>• 8: BeiDou<br>• 16: IMES<br>• 32: QZSS<br>• 64: GLONASS |
| <Reserved1> | Number | 0 (reserved value) |
| <Reserved2> | Number | 0 (reserved value) |

#### 25.4.4.4 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.

## 25.4.5 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 |

#### 25.4.5.1 Description

Configures the Cellular location sensor (CellLocate®) used with the +ULOC command.

☞ This command influences the amount of data exchanged with the server.

#### 25.4.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULOCCELL=<scan_mode>[,<reserved1>[,<reserved2>[,<reserved3>[,<reserved4>[,<reserved5>]]]]] | OK | AT+ULOCCELL=0<br>OK |
| Read | AT+ULOCCELL? | +ULOCCELL: <scan_mode>,<reserved1>,<reserved2>, | +ULOCCELL: 0,0,"","",0,0<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | <reserved3>,<reserved4>,<br><reserved5><br>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>)<br>OK | +ULOCCELL: (0-1),(0),"","",(0),(0)<br>OK |

#### 25.4.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <scan_mode> | Number | Network scan mode:<br>• 0 (factory-programmed value): normal<br>• 1: deep scan |
| <reserved1> | Number | RFU |
| <reserved2> | String | RFU |
| <reserved3> | String | "" (reserved value) |
| <reserved4> | Number | 0 (reserved value) |
| <reserved5> | Number | 0 (reserved value) |

# 25.5 UTIME

## 25.5.1 Ask for time information +UTIME

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

#### 25.5.1.1 Description

Provides timing information from the cellular module to the user application with:

- a time pulse
- unsolicited result codes (URC) with the corresponding time information
- an estimation of the time accuracy

The final result code indicates if sending the command request was successful or not. The URC is issued to provide the requested information via the +UTIME set command.

The time information source may be GNSS or the autonomous time propagation (LTE modem clock).

It is possible to configure which aiding types and GNSS systems are available to the GNSS sensor through +ULOCGNSS AT command.

If the GNSS sensor is reserved for another interface, an error result code is provided ("+CME ERROR: GPS busy" if +CMEE: 2).

This AT command must be issued after a proper configuration of the GPIO via the +UGPIOC command. For more details, see Notes.

#### 25.5.1.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UTIME=<mode>[,<sensor>] | OK | AT+UTIME=1,1<br>OK |
| Read | AT+UTIME? | +UTIME: <mode>[,<sensor>]<br>OK | +UTIME: 1,1<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| Test | AT+UTIME=? | +UTIME: (list of supported <mode>s),(list of supported <sensor>s)<br>OK | +UTIME: (0-3),(1-2)<br>OK |
| URC | | +UUTIME: <date>,<time>, <milliseconds>,<accuracy>, <source> | **If <source>=0:**<br>+UUTIME: 01/01/2018,00:11:22, 123.456789,1.500000000,0 |
| | | | **If <source>=1:**<br>+UUTIME: 22/08/2020,11:22:33, 123.456789,0.000083000,1 |

#### 25.5.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | Allowed values:<br>• 0 (default value): stop UTIME<br>• 1: PPS (pulse-per-second output generation)<br>• 2: one shot (single output pulse with time stamp)<br>• 3: time stamp of external interrupt |
| <sensor> | Number | Source of the timing info; the parameter is mandatory if <mode>=1, 2 or 3<br>• 1: GNSS/LTE (best effort)<br>• 2: LTE only |
| <date> | String | Date (DD/MM/YY) of the estimated position |
| <time> | String | Time (hh:mm:ss) of the day |
| <milliseconds> | Number | Fractional part of the time information, in milliseconds. Six decimal values are provided |
| <accuracy> | Number | Accuracy of the time information, in seconds. Nine decimal values are provided |
| <source> | Number | Source of the time information:<br>• 0: LTE BS propagated time (local time scale)[4]<br>• 1: GNSS receiver |

#### 25.5.1.4 Notes

**SARA-R5**

- Properly configure the GPIO function to the "Time pulse output" mode by means of the +UGPIOC AT command (<gpio_mode>=22) in order to provide the time information as a time pulse.
- Properly configure the GPIO function to the "Time stamp of external interrupt" mode by means of the +UGPIOC AT command (<gpio_mode>=23) in order to trigger via interrupt the generation of a URC timestamp.

**SARA-R500S / SARA-R510S**

In order to support an external GNSS receiver as source of the timing information:

- Properly configure the GPIO function to the "External GNSS time pulse input" mode by means of the +UGPIOC AT command (<gpio_mode>=28) in order to receive the PPS reference from an external GNSS receiver.
- Properly configure the GPIO function to the "External GNSS time stamp of external interrupt" mode by means of the +UGPIOC AT command (<gpio_mode>=29) in order to trigger via interrupt the generation of a URC timestamp from an external GNSS receiver.

[4] default time origin: 1st of January 2018 (01/01/2018,00:00:00,000.000000)

## 25.5.2 Time information request status unsolicited indication +UTIMEIND

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

### 25.5.2.1 Description

Configures sending of URCs from the MT to the TE in the case of +UTIME operations. The URC provides the status of the timekeeping in the module.

### 25.5.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UTIMEIND=<mode> | OK | AT+UTIMEIND=1<br>OK |
| Read | AT+UTIMEIND? | +UTIMEIND: <mode><br>OK | +UTIMEIND: 1<br>OK |
| Test | AT+UTIMEIND=? | +UTIMEIND: (list of supported <mode>s)<br>OK | +UTIMEIND: (0-1)<br>OK |
| URC | | +UUTIMEIND: <status>,<time_info>,<abs_time>,<result>[,<offset_ns>,<offset_s>]<br>OK | +UUTIMEIND: 1,1,1,0<br>OK |

### 25.5.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <mode> | Number | URC configuration:<br>• 0 (default value): URC disabled<br>• 1: URC enabled |
| <status> | Number | Status of the operation in progress:<br>• 0: UTIME operations are off<br>• 1: PPS generation<br>• 2: one shot pulse generation<br>• 3: time stamp of the external interrupt<br>• 4: best effort (GNSS or LTE) accurate time propagation |
| <time_info> | Number | Source used for timekeeping:<br>• 0: Init - initialization of sensors (GNSS and LTE) after starting UTIME operations<br>• 1: GNSS - synchronized with GNSS time pulse<br>• 2: LTE - synchronized with LTE base station<br>• 3: RTC - using local clock |
| <abs_time> | Number | Whether time is in UTC or on an arbitrary time scale:<br>• 0: local time scale (default time origin: 01/01/2018,00:00:00,000.000000)<br>• 1: UTC time |
| <result> | Number | Result of intermediate operation steps:<br>• 0: no error<br>• 1: alignment with the UTC time. The alignment with UTC time generates a discontinuity in the local time<br>• 2: offset detection. When propagating time using LTE, discontinuities may occur. These discontinuities can be detected<br>• 3: timeout<br>• 4: PIN error<br>• 5: generic error |
| <offset_ns>,<offset_s> | Number | When synchronizing with UTC time (by means of the GNSS) (<result>=1) the local time scale experiences a discontinuity. The knowledge of this discontinuity is needed to compare in time two events occurred before and after the re-synchronization. The parameter is issued only in the +UUTIMEIND URC:<br>• <offset_ns>: integer nanoseconds |

| Parameter | Type | Description |
|---|---|---|
| | | • <offset_s>: integer seconds |

## 25.5.3 Sets UTIME configuration +UTIMECFG

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

### 25.5.3.1 Description

Sets the +UTIME configuration parameters.

### 25.5.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UTIMECFG=<offset_nano>[,<offset_sec>] | OK | AT+UTIMECFG=500000<br>OK |
| Read | AT+UTIMECFG? | +UTIMECFG: <offset_nano>,<offset_sec><br>OK | +UTIMECFG: 500000,0<br>OK |
| Test | AT+UTIMECFG=? | +UTIMECFG: (range of supported <offset_nano>),(range of supported <offset_sec>)<br>OK | +UTIMECFG: (-999999999:999999999),(-999999999:999999999)<br>OK |

### 25.5.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <offset_nano> | Number | Sub-second offset expressed in nanoseconds to correct/align the local time |
| <offset_sec> | Number | Offset expressed in seconds to correct/align the local time. If the parameter is omitted the parameter is set to 0 |

# 26 I²C

## 26.1 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".

## 26.2 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 |

### 26.2.1 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.

### 26.2.2 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<br>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)<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | supported <bit_rate>),(<device_ address> range),(list of supported <address_width>s)<br>OK | |

### 26.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <I2C_controller_ number> | Number | $I^2C$ HW controller to use:<br>• 1: controller 1 |
| <bus_mode> | Number | $I^2C$ bus mode type:<br>• 0: Bus Mode Standard (0 - 100 kbaud)<br>• 1: Bus Mode Fast (0 - 400 kbaud) |
| <bit_rate> | Number | $I^2C$ bit rate:<br>• 0: 100 kb/s<br>• 1: 400 kb/s |
| <device_address> | Hex number | Device address in HEX format<br>• SARA-R5 - The range goes from 0x0000 to 0xFFFF. |
| <address_width> | Number | $I^2C$ size of the controller address:<br>• 0: 7 bit address<br>• 1: 10 bit address |

## 26.3 $I^2C$ 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 |

### 26.3.1 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).

### 26.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UI2CW=<hex_data>,<nof_byte_ to_write> | OK | AT+UI2CW="0011AABBCCDDEEFF", 8<br>OK |
| Test | AT+UI2CW=? | +UI2CW: (byte to write),(range of supported <nof_byte_to_write>)<br>OK | +UI2CW: "data", (1-100)<br>OK |

### 26.3.3 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 |

## 26.4 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 |

### 26.4.1 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.

### 26.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Read | AT+UI2CR=<nof_bytes_to_read> | +UI2CR: <index_1>: <byte_1><br>[+UI2CR: <index_n>: <byte_n><br>[..]]<br>OK | AT+UI2CR=3<br>+UI2CR: 0: 0xA3<br>+UI2CR: 1: 0x0F<br>+UI2CR: 2: 0xDB<br>OK |
| Test | AT+UI2CR=? | +UI2CR: (list of supported <nof_byte_to_read>s)<br>OK | +UI2CR: (1-100)<br>OK |

### 26.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <nof_bytes_to_read> | Number | Number of bytes to read from the slave I²C device:<br>• SARA-R5 - 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). |

## 26.5 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 |

### 26.5.1 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.

### 26.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Read | AT+UI2CREGR=<register_address>,<nof_bytes_to_read> | +UI2CREGR: <index_1>: <byte_1><br>[+UI2CREGR: <index_n>: <byte_n><br>[..]]<br>OK | AT+UI2CREGR=0x42,3<br>+UI2CREGR: 0: 0xA3<br>+UI2CREGR: 1: 0x0F<br>+UI2CREGR: 2: 0xDB<br>OK |
| Test | AT+UI2CREGR=? | +UI2CREGR: (list of supported <register_address>s),(list of supported <nof_bytes_to_read>s)<br>OK | +UI2CREGR: (0x00-0xFF),(1-100)<br>OK |

### 26.5.3 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.<br>• SARA-R5 - 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). |

## 26.6 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 |

### 26.6.1 Description

Closes the I²C logical channel being used.

The logical channel must be closed before opening a new one.

### 26.6.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Action | AT+UI2CC | OK | AT+UI2CC<br>OK |
| Test | AT+UI2CC=? | OK | OK |

# 27 Networking

## 27.1 Configure the port forwarding +UPORTFWD

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

### 27.1.1 Description

Defines rules for configuring the port forwarding for NCM or PPP interfaces:

- **NCM**: the configuration is applied when the data context mapped to the NCM interface is activated. Any port forwarding rule added in a later stage (i.e. when the data context mapped to the NCM is already active) is not applied immediately, these new rules will be applied on the next data context activation.
- **PPP**: the configuration is applied during PPP link establishment procedure. Any port forwarding rule added in a later stage (i.e. when the PPP link is already up) is not applied immediately, these new rules will be applied next time a dialup is performed.

### 27.1.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+UPORTFWD=<action>,<cmd_specific_param>,[,< ... cmd_specific_params ... >] | AT+UPORTFWD: <action>,<rule_id><br>OK | AT+UPORTFWD=0,0,0,6,88<br>+UPORTFWD: 0,0<br>OK |
| **Add rule** | | | |
| Set | AT+UPORTFWD=0,<if_type>,<if_num>,<protocol>,<public_port>[,<private_port>[,<private_ipv4>]] | +UPORTFWD: 0,<rule_id><br>OK | AT+UPORTFWD=0,0,0,17,88,1088<br>+UPORTFWD: 0,1<br>OK |
| **Delete rule** | | | |
| Set | AT+UPORTFWD=1,<rule_id> | +UPORTFWD: 1,<rule_id><br>OK | AT+UPORTFWD=1,2<br>+UPORTFWD: 1,2<br>OK |
| Read | AT+UPORTFWD? | +UPORTFWD: <rule_id>,<if_type>,<if_num>,<protocol>,<public_port>,<private_port>,<private_ipv4><br>...<br>+UPORTFWD: <rule_id>,<if_type>,<if_num>,<protocol>,<public_port>,<private_port>,<private_ipv4><br>OK | +UPORTFWD: 0,0,0,6,88,88,"192.168.9.1"<br>+UPORTFWD: 1,0,0,17,88,1088,"192.168.9.1"<br>OK |

### 27.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <action> | Number | Action type:<br>• 0: add rule<br>• 1: delete rule |
| <if_type> | Number | Interface type identifier:<br>• 0: NCM<br>• 1: PPP<br>Allowed values:<br>• SARA-R5 - 1 |
| <if_num> | Number | Interface identifier: |

| Parameter | Type | Description |
|---|---|---|
| | | • NCM: the allowed value is 0<br>• PPP: the allowed range is 0-11 (<cid> range, see the <cid> parameter definition) |
| <protocol> | Number | Transport protocol:<br>• 6: TCP<br>• 17: UDP |
| <public_port> | Number | Port of the public address to be mapped to the internal address. The range goes from 1 to 65535. |
| <private_port> | Number | Port of the private address on which redirect the traffic from <public_port>. The range goes from 1 to 65535. If the parameter is not inserted, the same value of the <public_port> parameter will be applied |
| <private_ipv4> | String | The private IPv4 address on which redirect the traffic.<br>If the parameter is not inserted, the default value will be applied according to the following rules:<br>• NCM: first IP address of DHCP IP range<br>• PPP: this parameter shall be empty |
| <rule_id> | Number | Identifier of the port forwarding rule. |

### 27.1.4 Examples

| Command | Response | Description |
|---|---|---|
| AT+UPORTFWD=0,0,0,6,88 | +UPORTFWD: 0,0<br>OK | Map public TCP port 88 of the PDN connection mapped to the NCM to port 88 of the default private IP address. |
| AT+UPORTFWD=0,0,0,17,88,1088 | +UPORTFWD: 0,1<br>OK | Map public UDP port 88 of the PDN connection mapped to the NCM to port 1088 of the default private IP address. |
| AT+UPORTFWD=0,0,0,6,6000,6000,"192.168.9.5" | +UPORTFWD: 0,2<br>OK | Map public TCP port 6000 of the PDN connection mapped to the NCM to port 6000 of the private IP address 192.168.9.5. |
| AT+UPORTFWD=0,1,4,6,6000,5000,"192.168.9.5" | +CME ERROR: operation not supported | Map public TCP port 6000 of the PDN connection (+CGDCONT cid=4) mapped to the PPP to port 5000 of the private IP address of PPP peer.<br>Error is returned because the IP address SHALL not be specified for PPP interface. |
| AT+UPORTFWD=0,1,4,6,6000,5000 | +UPORTFWD: 0,3<br>OK | Map public TCP port 6000 of the PDN connection (+CGDCONT <cid>=4) mapped to the PPP to port 5000 of the private IP address of PPP peer. |
| AT+UPORTFWD? | +UPORTFWD: 0,0,0,6,88,88,"192.168.9.1"<br>+UPORTFWD: 1,0,0,17,88,1088,"192.168.9.1"<br>+UPORTFWD: 2,0,0,6,6000,6000,"192.168.9.5"<br>+UPORTFWD: 3,1,4,6,6000,5000<br>OK | Read the configuration. |
| AT+UPORTFWD=1,2 | +UPORTFWD: 1,2<br>OK | Delete rule 2 |
| AT+UPORTFWD=1,10 | +CME ERROR: operation not allowed | Delete rule 10.<br>An error result code is returned because <rule_id>=10 does not exist. |
| AT+UPORTFWD? | +UPORTFWD: 0,0,0,6,88,88,"192.168.9.1"<br>+UPORTFWD: 1,0,0,17,88,1088,"192.168.9.1"<br>+UPORTFWD: 3,1,4,6,6000,5000<br>OK | Read the configuration again. |

# 28 Constrained Application Protocol (CoAP)

## 28.1 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.

## 28.2 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 |

### 28.2.1 Description

Configures, reads and resets the current profile parameters of the CoAP client. A set command for each <op_code> parameter must be issued to set each CoAP client profile parameter (CoAP server address, CoAP URI, CoAP PDU option mask).

To store in the NVM the configured CoAP client profile parameters issue the AT+UCOAP=6,<profile_number> command where the <profile_number> parameter is the profile number.

To initiate a TCP session, instead of UDP session, in CoAP, provide the "coap+tcp" scheme by means of the <COAP_URI> parameter.

To initiate the secure session in CoAP, provide the "coaps" or "coaps+tcp" scheme by means of the <COAP_URI> parameter. Issue the AT+UCOAP=8,<USECMNG_profile> command to configure a CoAP secure session; the USECMNG profile number is set by means of the <USECMNG_profile> parameter.

SARA-R5
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.

SARA-R5
Parameter <COAP_server_IP_address> is not supported and can be provided as URI-HOST in <COAP_URI>.

### 28.2.2 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"<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| 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 |
| | | | 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 |
| | | | +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 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | +UCOAP: INVALID PROFILE NUMBER 3<br>OK |
| **Select USECMNG profile** | | | |
| Set | AT+UCOAP=8,<USECMNG_profile> | OK | AT+UCOAP=8,0<br>OK |
| **RAI configuration** | | | |
| Set | AT+UCOAP=9,<rai_flag> | OK | AT+UCOAP=9,0<br>OK |
| Test | AT+UCOAP=? | +UCOAP: (list of supported <op_code>s)<br>OK | +UCOAP: (0-9)<br>OK |

### 28.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | Specific parameter in profile. Allowed values are:<br>• 0: CoAP server address configuration<br>• 1: CoAP URI configuration<br>• 2: CoAP PDU option mask configuration<br>• 3: current profile number<br>• 4: current profile valid<br>• 5: restore profile from the NVM<br>• 6: store profile to the NVM<br>• 7: read all profiles from the NVM<br>• 8: CoAP secure option (SSL encryption)<br>• 9: release assistance indication (RAI) |
| <COAP_server_IP_address> | String | Remote CoAP server IP address in IPv4 format. For IP address format reference see the IP addressing. |
| <COAP_port> | String | Remote CoAP server port; the default CoAP port is 5683, in case of secure option the default port is 5684. |
| <COAP_URI> | String | URI scheme supported are:<br>• UDP connection: "coap://"URI_HOST[ ":"URI_PORT ] [URI_PATH] ["?"URI_QUERY ]<br>• DTLS connection: "coaps://"URI_HOST[ ":"URI_PORT ] [URI_PATH] ["?"URI_QUERY ]<br>☞ SARA-R5<br>Optional URI scheme (RFC 8323 [192]) supported are:<br>• TCP connection: "coap+tcp://"URI_HOST[ ":"URI_PORT] [URI_PATH] ["?"URI_QUERY ]<br>• TLS connection: "coaps+tcp://"URI_HOST[":"URI_PORT] [URI_PATH] ["?"URI_QUERY ]<br>URI limitation are:<br>• SARA-R5 - The maximum supported length of the URI is 783 characters, where URI_HOST, URI_PATH and URI_QUERY options are limited to 255 characters each as per RFC 7252 [132]. |
| <PDU_option> | Number | PDU option to be added in PDU header. Allowed values are:<br>• 0: URI_HOST<br>• 1: URI_PORT<br>• 2: URI_PATH<br>• 3: URI_QUERY<br>• 4: CONTENT_FORMAT (CONTENT_FORMAT option in the PDU by means of the +UCOAPC AT command)<br>• 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:<br>• 0 (default value): clear the corresponding option flag<br>• 1: set the corresponding option flag |
| <profile_number> | Number | Profile number to be used: |

| Parameter | Type | Description |
|---|---|---|
| | | • 0: profile 0<br>• 1: profile 1<br>• 2: profile 2<br>• 3: profile 3 |
| <valid_flag> | Number | Sets the current profile as valid or invalid:<br>• 0: invalid profile<br>• 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:<br>• 0: RAI disabled<br>• 1: release the connection after the uplink data is sent. It can not be selected with confirmable message type.<br>• 2: release the connection after the first data is received in downlink. It can not be selected with non-confirmable message type. |
| <param_name> | String | Verbose description for the specific parameter, provided with their numeric values for each profile. Supported values:<br>• "DST_IP_ADDRESS"<br>• "PORT"<br>• "URI_STR"<br>• "OPT_MASK"<br>• "PROFILE_NUM"<br>• "STATUS FLAG"<br>• "USECMNG PROFILE"<br>• "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. |

### 28.2.4 Notes

- No profiles are defined by factory-programmed setting.

**SARA-R5**

- <op_code>=0 (CoAP server address configuration) is not supported.
- The <COAP_server_IP_address> and <COAP_port> parameters are not returned while reading CoAP profile.
- 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.

## 28.3 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 |

### 28.3.1 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 [132].

### 28.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UCOAPC=<coap_command>[,<payload>,<identifier>[,<block_number>,<more_block>]] | OK | AT+UCOAPC=1<br>OK |
| Test | AT+UCOAPC=? | +UCOAPC: (list of supported <coap_command>s)<br>OK | +UCOAPC: (1,4)<br>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 |

### 28.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <coap_command> | Number | CoAP action. Allowed values:<br>• 1: GET request to the CoAP server; optional parameters are not allowed<br>• 2: DELETE request to the CoAP server; optional parameters are not allowed<br>• 3: PUT request to the CoAP server<br>• 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 [195]. |
| <identifier> | Number | CoAP Content-Type identifier. Allowed values:<br>• 0: text / plain<br>• 1: application / link format<br>• 2: application / xml<br>• 3: application / octet stream<br>• 4: application / rdf xml<br>• 5: application / exi<br>• 6: application / json<br>• 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:<br>• 0: last block<br>• 1: more blocks available |
| <response_code> | Number | Numeric code added in the response from the server. Allowed values:<br>• 0: empty message<br>• 2: success<br>• 4: client error<br>• 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:<br>• 0: fail<br>• 1: success |

### 28.3.4 Notes

**SARA-R5**

- 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.

## 28.4 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.8 |

### 28.4.1 Description

Returns the error code of the latest CoAP operation.

### 28.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Action | AT+UCOAPER | +UCOAPER: <error_class>,<error_code><br>OK | AT+UCOAPER<br>+UCOAPER: 15,4<br>OK |

### 28.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <error_class> | Number | List of the allowed values is available in listed in Appendix A.8. |
| <error_code> | Number | Value of CoAP specific error code, the allowed <error_code> values are listed in Appendix A.8.6. |

# 29 MQTT

## 29.1 Introduction

☞ MQTT AT commands are implemented according with MQTT version 3.1.1. For a more detailed overview on MQTT protocol, see MQTT version 3.1.1 - OASIS standard [135].

The Message Queueing Telemetry Transport (MQTT) protocol specifies a simple and lightweight messaging protocol, designed for constrained devices and low-bandwidth, high-latency, or unreliable networks. An MQTT client uses publish and subscribe methods to interact over a TCP connection with an MQTT message broker (henceforth referred to as an MQTT server). The u-blox modules can be configured to operate as an MQTT client.

To publish or subscribe, the MQTT client must first establish a TCP connection to an MQTT server.

The MQTT protocol specifies case-sensitive topics, with topic names containing topic level separators "/" to which messages will be published. For example, a message of "78 Fahrenheit or 25 Celsius" could be published to the topic name of "/heat/sensor/SD/bldg5/DelMarConfRm". MQTT clients subscribe to topic filters to determine if the client receives messages published to a given topic name.

The topic filters may exactly specify a topic name or may contain either of the following wildcards:

- **'+'** - (single level wildcard) applies to a single topic level;
- **'#'** - (multi-level wildcard) applies to potentially many topic levels (and must be the last character specified in a topic filter).

'#' can be specified on its own or following a topic level separator ('/'). For example, the topic filter, "/heat/sensor/SD/#", would receive any messages published to the "/heat/sensor/SD/bldg5/DelMarConfRm" topic name.

☞ MQTT specification states that topic filters starting with either wildcard will not match any topic name that starts with "$".

The MQTT protocol also specifies a Quality of Service (QoS) level to be applied to message transactions:

- **0** (default setting): at most once delivery
- **1**: at least once delivery
- **2**: exactly once delivery

The MQTT protocol also allows an MQTT client to create a will message, which the MQTT remote server will store and only publish (to the topic name specified as the will topic name) when the MQTT client gets disconnected from the MQTT server, but not if the MQTT client explicitly sends a disconnect command.

## 29.2 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 |

### 29.2.1 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.

### 29.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+UMQTT=<op_code>[,<param1>[,<param2>]] | +UMQTT: <op_code>,<result><br>OK | AT+UMQTT=12,1<br>+UMQTT: 12,1<br>OK |
| **MQTT unique client ID** | | | |
| Set | AT+UMQTT=0,<client_id> | +UMQTT: 0,<result> | AT+UMQTT=0,"352753090041680" |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | OK | +UMQTT: 0,1<br>OK |
| **MQTT local TCP port number** | | | |
| Set | AT+UMQTT=1,<local_port> | +UMQTT: 1,<result><br>OK | AT+UMQTT=1,1883<br>+UMQTT: 1,1<br>OK |
| **MQTT server name** | | | |
| Set | AT+UMQTT=2,<server_name>[,<server_port>] | +UMQTT: 2,<result><br>OK | AT+UMQTT=2,"www.commercialmqttbroker.com"<br>+UMQTT: 2,1<br>OK |
| **MQTT server IP address** | | | |
| Set | AT+UMQTT=3,<IP_address>[,<server_port>] | +UMQTT: 3,<result><br>OK | AT+UMQTT=3,"192.168.1.0",1883<br>+UMQTT: 3,1<br>OK |
| **User name and password** | | | |
| Set | AT+UMQTT=4,<username>,<password> | +UMQTT: 4,<result><br>OK | AT+UMQTT=4,"test","abc123"<br>+UMQTT: 4,1<br>OK |
| **Last will QoS** | | | |
| Set | AT+UMQTT=6,<will_QoS> | OK | AT+UMQTT=6,1<br>OK |
| **Last will retain** | | | |
| Set | AT+UMQTT=7,<will_retain> | OK | AT+UMQTT=7,1<br>OK |
| **Last will topic** | | | |
| Set | AT+UMQTT=8,<will_topic> | OK | AT+UMQTT=8,"u-blox/publish"<br>OK |
| **Last will message** | | | |
| Set | AT+UMQTT=9,<will_message>[,<hex_mode>] | OK | AT+UMQTT=9,"Unrequested disconnect"<br>OK |
| **Inactivity timeout** | | | |
| Set | AT+UMQTT=10,<timeout> | +UMQTT: 10,<result><br>OK | AT+UMQTT=10,3600<br>+UMQTT: 10,1<br>OK |
| **MQTT secure option** | | | |
| Set | AT+UMQTT=11,<MQTT_secure>[,<USECMNG_profile>] | +UMQTT: 11,<result><br>OK | AT+UMQTT=11,1,2<br>+UMQTT: 11,1<br>OK |
| **MQTT clean session** | | | |
| Set | AT+UMQTT=12,<clean_session> | +UMQTT: 12,<result><br>OK | AT+UMQTT=12,1<br>+UMQTT: 12,1<br>OK |
| Read | AT+UMQTT=<op_code> | +UMQTT: <op_code>,<param1>[,<param2>]<br>OK | +UMQTT: 4,"my_username"<br>OK |
| Read | AT+UMQTT? | +UMQTT: 0,<client_id><br>+UMQTT: 2,<server_name>,<server_port> | +UMQTT: 0,"352848080012186"<br>+UMQTT: 2,"",1883<br>+UMQTT: 3,"",1883 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | +UMQTT: 3,IP_address>,<server_port><br>+UMQTT: 4,<username><br>+UMQTT: 6,<will_QoS><br>+UMQTT: 7,<will_retain><br>+UMQTT: 8,<will_topic><br>+UMQTT: 9,<wm_length>,<will_message><br>+UMQTT: 10,<timeout><br>+UMQTT: 11,<MQTT_secure>[,<USECMNG_profile>]<br>OK | +UMQTT: 4,""<br>+UMQTT: 6,0<br>+UMQTT: 7,0<br>+UMQTT: 8,""<br>+UMQTT: 9,0,""<br>+UMQTT: 10,0<br>+UMQTT: 11,0<br>OK |
| Test | AT+UMQTT=? | +UMQTT: (list of supported <op_code>s)<br>OK | +UMQTT: (0-4,10-12)<br>OK |
| URC | | +UUMQTT<op_code>: <param1>[,<param2>] | +UUMQTT0: "352753090041680" |

### 29.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | MQTT parameter:<br>• 0: MQTT unique client id<br>• 1: MQTT local port number<br>• 2: MQTT server name<br>• 3: MQTT IP address<br>• 4: MQTT username and password<br>• 6: MQTT last will QoS value<br>• 7: MQTT last will retain<br>• 8: MQTT last will topic<br>• 9: MQTT last will message<br>• 10: MQTT inactivity timeout period<br>• 11: MQTT secure<br>• 12: MQTT clean session<br>• 14: MQTT terse/verbose mode; the set command is not supported<br>Allowed values:<br>• SARA-R5 - 0, 2, 3, 4, 6, 7, 8, 9, 10, 11 |
| <result> | Number | Allowed values:<br>• 0: failure<br>• 1: success |
| <client_id> | String | Client identifier for the MQTT session.<br>• SARA-R5 - The maximum length is 256 characters.<br>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.<br>• SARA-R5 - The maximum length is 128 characters.<br>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.<br>• SARA-R5 - 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: |

| Parameter | Type | Description |
|---|---|---|
| | | • SARA-R5 - The maximum length is 512 characters. |
| <password> | String | Password for the MQTT login procedure. The default value is an empty string:<br>• SARA-R5 - The maximum length is 512 characters. |
| <timeout> | Number | Inactivity timeout expressed in seconds. According to the MQTT specification, an MQTT server must disconnect a client if it receives nothing from the client within 1.5x the inactivity timeout. An inactivity timeout value of 0 indicates no timeout. The default value is 0. The maximum value is 65535 (corresponding to 18 hours, 12 minutes and 15 seconds). |
| <will_QoS> | Number | MQTT last will Quality of Service:<br>• 0 (default value): at most once delivery<br>• 1: at least once delivery<br>• 2: exactly once delivery |
| <will_retain> | Number | Whether or not the last will message will be retained across disconnects:<br>• 0 (default value): the last will message will not be retained by the MQTT broker<br>• 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.<br>• SARA-R5 - The maximum length is 256 characters. |
| <will_message> | String | Last will message: ASCII or hexadecimal data.<br>• SARA-R5 - The maximum length is 256 characters. In case of hexadecimal data the parameter length must be even. |
| <hex_mode> | Number | Allowed values:<br>• 0 (default value): ASCII input for <will_message><br>• 1: hexadecimal input for <will_message> |
| <wm_length> | Number | Number of octets in <will_message>. |
| <MQTT_secure> | Number | Enables / disables the secure option of MQTT service:<br>• 0 (default value): no TLS encryption<br>• 1: enable the MQTT TLS encryption |
| <USECMNG_profile> | Number | USECMNG profile (number). Defines the USECMNG profile which specifies the SSL/TLS properties to be used for the SSL/TLS connection. The range goes from 0 to 4. If no profile is set a default USECMNG profile is used (see +USECMNG AT command description). |
| <clean_session> | Number | Clean session value. Allowed values:<br>• 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<br>• 1: (default value) indicates that disconnects clean all session state information |
| <param1> | Number / String | Type and supported content depend on the related <op_code> parameter (details are given above). If <param1> is not specified the value of the corresponding parameter <op_code> is reset to the default value. |
| <param2> | Number / String | Type and supported content depend on the related <op_code> parameter (details are given above). If <param2> is not specified the value of the corresponding parameter <op_code> is reset to the default value. |

### 29.2.4 Notes

- The information text response to the read command does not display the password.
- Some network operators do not allow secure MQTT. In this case the AT+UMQTTC=1 command (MQTT login) will return a failure response by means of the +UUMQTTC URC after an TLS timeout of 30 s.

**SARA-R5**

- 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.

## 29.3 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 |

### 29.3.1 Description

Either saves all of the MQTT client profile parameters to NVM (non-volatile memory) or sets all of the MQTT client profile parameters to either factory-programmed or non-volatile stored values.

For the complete list of parameters that can be stored in the NVM, see the +UMQTT AT command.

SARA-R5
The set command does not provide the information text response: only the final result code is issued.

### 29.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UMQTTNV=<NVM_mode> | [+UMQTTNV: <NVM_mode>, <result>]<br>OK | AT+UMQTTNV=2<br>+UMQTTNV: 2,1<br>OK |
| Test | AT+UMQTTNV=? | +UMQTTNV: (list of <NVM_mode>s)<br>OK | +UMQTTNV: (0-2)<br>OK |

### 29.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <NVM_mode> | Number | Operation to set or save the MQTT client profile parameters as follows:<br>• 0: restore MQTT client profile parameters to the factory-programmed setting<br>• 1: set MQTT client profile parameters to values previously stored in the NVM<br>• 2: store current MQTT client profile parameters to the NVM |
| <result> | Number | Operation result:<br>• 0: failure<br>• 1: success |

## 29.4 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 |

### 29.4.1 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.

SARA-R5
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.

SARA-R5
The +UUMQTTC: 0,100 URC is notified when the MQTT broker releases the connection after a period of inactivity (timeout).
The +UUMQTTC: 0,101 URC is notified when the network connection is lost.

SARA-R5
The +UUMQTTC: 0,102 URC is notified when the MT releases the connection because there is a protocol violation in receiving an MQTT message.

### 29.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |
| Set | AT+UMQTTC=<op_code>[,<param1>[,<param2>][,<param3>][,<param4>][,<param5>]] | OK | AT+UMQTTC=1<br>OK |
| URC | | +UUMQTTC: <op_code>,<param1>[,<param2>,<param3>] | +UUMQTTC: 4,0,2,"sensor/heat/#" |
| **MQTT logout** | | | |
| Set | AT+UMQTTC=0 | OK | AT+UMQTTC=0<br>OK |
| URC | | +UUMQTTC: 0,<logout_result> | +UUMQTTC: 0,1 |
| **MQTT login** | | | |
| Set | AT+UMQTTC=1 | OK | AT+UMQTTC=1<br>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"<br>OK |
| | | | AT+UMQTTC=2,0,0,1,"sensor/heat/SD/bldg5/DelMarConfRm","32332064656772656573 2043656C73697573"<br>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"<br>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/#"<br>OK |
| URC | | **In case of success**<br>+UUMQTTC: 4,1,<QoS>,<topic_name><br>**In case of failure**<br>+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/#"<br>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><br>OK | AT+UMQTTC=6,1<br>+UMQTTC: 6,0,31,13,"sensor/heat/#",18,"23 degrees Celsius"<br>OK |
| URC | | +UUMQTTC: 6,<num_unread_msgs>,<memory_full> | +UUMQTTC: 6,3,0 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | **If an error occurs while receiving a publish message**<br>+UUMQTTC: 6,0 | |
| **Ping MQTT broker** | | | |
| Set | AT+UMQTTC=8,<ping_ON_OFF> | OK | AT+UMQTTC=8,1<br>OK |
| **Publish a binary message to a topic** | | | |
| Set | AT+UMQTTC=9,<QoS>,<retain>,<topic_name>,<pub_msg_length><br>After the ">" prompt <pub_msg_length> bytes of data are entered | ><pub_bin_message><br>OK | AT+UMQTTC=9,1,0,"u-blox/test",33<br>>AABB--> execute this \nand "this"<br>OK |
| URC | | +UUMQTTC: 9,<MQTT_result> | +UUMQTTC: 9,1 |
| Test | AT+UMQTTC=? | +UMQTT: (list of supported <op_codes>s)<br>OK | +UMQTTC: (0-9)<br>OK |

## 29.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | MQTT command request.<br>• 0: logs out/disconnects from MQTT server. The will message will not be sent<br>• 1: logs in/connects to MQTT server<br>• 2: publish a message to a specific topic to the MQTT message broker<br>• 3: publish a message from a file to a specific topic to the MQTT message broker<br>• 4: subscribe to a topic from the MQTT message broker<br>• 5: unsubscribe to a topic from the MQTT message broker. This should exactly match the Topic Filter used during the Subscribe<br>• 6: read all unread messages received from MQTT message broker, at the terse/verbose mode set at the time of message reception<br>• 7: sets the terse/verbose format for received messages (i.e. the amount of information and headers with each received MQTT message)<br>• 8: ping the MQTT message broker<br>• 9: publish a message in binary mode. It is used for publishing any binary data<br>Allowed values:<br>• SARA-R5 - 0, 1, 2, 3, 4, 5, 6, 8, 9 |
| <MQTT_result> | Number | Result of an MQTT command request:<br>• 0: fail; for more details, see the +UMQTTER AT command<br>• 1: success |
| <login_result> | Number | Result of an MQTT login request. Allowed values:<br>• 0: connection accepted<br>• 1: the server does not support the level of the MQTT protocol requested by the client<br>• 2: the client identifier is correct UTF-8 but not allowed by the server<br>• 3: the network connection has been made but the MQTT service is unavailable<br>• 4: the data in the user name or password is malformed<br>• 5: the client is not authorized to connect<br>• 6-255: reserved for future use |
| <logout_result> | Number | Result of an MQTT command request:<br>• 0: fail; for more details, see the +UMQTTER AT command<br>• 1: success<br>Result of an unsolicited notification for an MQTT session interruption caused by:<br>• 100: timeout, the MQTT broker released the connection.<br>• 101: lost network connection.<br>• 102: protocol violation in receiving an MQTT message. |
| <QoS> | Number | Quality of service:<br>• 0 (default value): at most once delivery<br>• 1: at least once delivery<br>• 2: exactly once delivery |

| Parameter | Type | Description |
|---|---|---|
| <retain> | Number | Whether or not the message will be retained across disconnects. Allowed values:<br>• 0 (default value): the message will not be retained by the MQTT broker<br>• 1: the message will be retained by the MQTT broker |
| <hex_mode> | Number | Allowed values:<br>• 0 (default value): ASCII input for <pub_msg>/<message><br>• 1: hexadecimal input for <pub_msg>/<message> |
| <pub_msg> | String | ASCII or hexadecimal data, 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 | File name containing the message to be published.<br>• SARA-R5 - The maximum parameter length is 250 characters and the maximum file content depends on the filesystem, see File system limits. |
| <max_QoS> | Number | Maximum QoS level at which the MQTT broker can send messages to the MT. For more details, see MQTT version 3.1.1 - OASIS standard [135].<br>• 0: at most once delivery<br>• 1: at least once delivery<br>• 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.<br>• SARA-R5 - The maximum length is 256 characters. |
| <topic_name> | String | Indicates the topic to which the given MQTT message was published.<br>• SARA-R5 - The maximum length is 256 characters. |
| <reason> | Number | Result of an MQTT subscribe request:<br>• 0-2: success<br>• 128: failure<br>Allowed values:<br>• SARA-R5 - 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:<br>• 0: no formating. All messages will be concatenated into a single line with no separation between meeages<br>• 1 (default value): each messages will contain the <topic_name> and <message><br>• 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:<br>• 0: read all received messages<br>• 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.<br>• SARA-R5 - The maximum length is 12288 octets. |
| <ping_ON_OFF> | Number | Allowed values:<br>• 0 (default value): ping disabled<br>• 1: ping enabled the MT will ping the MQTT broker. The ping is issued when the MQTT inactivity timeout period expires. See AT+UMQTT=10,<timeout>. |
| <memory_full> | Number | Indicates the message memory status. Allowed values:<br>• 0: message memory is available<br>• 1: message memory is full |
| <pub_msg_length> | Number | Specifies the number of octets in <pub_bin_message>, the maximum length is 1024 octets. |

| Parameter | Type | Description |
|---|---|---|
| <pub_bin_message> | String | Data bytes to be published.<br>• SARA-R5 - The maximum length is 1024 octets. |

### 29.4.4 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.

**SARA-R5**

- 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 [15].
  - 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.

## 29.5 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<br>MQTT Error |

### 29.5.1 Description

Retrieves the error class and code of the last MQTT operation that provided an error.

### 29.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Action | AT+UMQTTER | +UMQTTER: <error_code1>,<error_code2><br>OK | AT+UMQTTER<br>+UMQTTER: 1,1<br>OK |

### 29.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <error_code1> | Number | • SARA-R5 - Value of error class. Values are listed in Internet suite error classes. |
| <error_code2> | Number | • SARA-R5 - Value of class-specific error code. The values are listed in MQTT class error codes. |

# 30 MQTT-SN

## 30.1 Introduction

MQTT-SN AT commands are implemented according with MQTT-SN protocol specification version 1.2. For a more detailed overview on the MQTT-SN protocol, see MQTT-SN version 1.2 - standard [136].

The Message Queuing Telemetry Transport for Sensor Network (MQTT-SN) is a lightweight messaging protocol which is designed as close as MQTT. MQTT-SN is optimized for low bandwidth, high link failures and low cost. Specifically designed for low overhead, mobile devices with constrained resources of storage and management. The u-blox cellular modules can be configured to operate as an MQTT-SN client.

To publish or subscribe, the MQTT-SN client must first establish a UDP connection to a MQTT-SN gateway and register itself.

The MQTT-SN protocol specifies case-sensitive topics, with topic names containing topic level separators "/" to which messages will be published. For example, a message of "78 Fahrenheit or 25 Celsius" could be published to the topic name of "/heat/sensor/SD/bldg5/DelMarConfRm". MQTT-SN clients subscribe to topic filters to determine if the client receives messages published to a given topic name.

The topic filters may exactly specify a topic name or may contain either of the following wildcards:

- **'+'** - (single level wildcard) applies to a single topic level
- **'#'** - (multi-level wildcard) applies to potentially many topic levels (and must be the last character specified in a topic filter);

'#' can be specified on its own or following a topic level separator ('/'). For example, the topic filter, "/heat/sensor/SD/#", would receive any messages published to the "/heat/sensor/SD/bldg5/DelMarConfRm" topic name.

MQTT-SN specification states that topic filters starting with either wildcard will not match any topic name that starts with "$".

The MQTT-SN protocol also specifies a Quality of Service (QoS) level to be applied to message transactions:

- **-1**: send and forget (value valid only for publish messages)
- **0** (default setting): at most once delivery
- **1**: at least once delivery
- **2**: exactly once delivery

The MQTT-SN protocol also allows an MQTT-SN client to create a will message, which the MQTT-SN remote server will store and only publish (to the topic name specified as the will topic name) when the MQTT-SN client gets disconnected from the MQTT-SN server, but not if the MQTT-SN client explicitly sends a disconnect command.

SARA-R5
Broadcast messages are not supported so it is not possible to send a search gateway message or receive an advertisement from the gateway.

## 30.2 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 |

### 30.2.1 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.

### 30.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| **Generic syntax** | | | |

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UMQTTSN=<op_code>,<param1>[,<param2>] | OK | AT+UMQTTSN=12,1<br>OK |
| **MQTT-SN unique client ID** | | | |
| Set | AT+UMQTTSN=0,<client_id> | OK | AT+UMQTTSN=0,"352753090041680"<br>OK |
| **MQTT-SN server name** | | | |
| Set | AT+UMQTTSN=1,<server_name>[,<server_port>] | OK | AT+UMQTTSN=1,"www.testMQTTSNbroker.com"<br>OK |
| **MQTT-SN server IP address** | | | |
| Set | AT+UMQTTSN=2,<IP_address>[,<server_port>] | OK | AT+UMQTTSN=2,"192.168.1.0",1883<br>OK |
| **MQTT-SN gateway radius** | | | |
| Set | AT+UMQTTSN=3,<radius> | OK | AT+UMQTTSN=3,1<br>OK |
| **Last will QoS** | | | |
| Set | AT+UMQTTSN=4,<will_QoS> | OK | AT+UMQTTSN=4,1<br>OK |
| **Last will retain** | | | |
| Set | AT+UMQTTSN=5,<will_retain> | OK | AT+UMQTTSN=5,1<br>OK |
| **Last will topic** | | | |
| Set | AT+UMQTTSN=6,<will_topic> | OK | AT+UMQTTSN=6,"u-blox/publish"<br>OK |
| **Last will message** | | | |
| Set | AT+UMQTTSN=7,<will_message> | OK | AT+UMQTTSN=7,"Unrequested disconnect."<br>OK |
| **MQTT-SN connection duration** | | | |
| Set | AT+UMQTTSN=8,<duration> | OK | AT+UMQTTSN=8,20<br>OK |
| **MQTT-SN secure option** | | | |
| Set | AT+UMQTTSN=9,<secure>[,<USECMNG_profile>] | OK | AT+UMQTTSN=9,1<br>OK |
| **MQTT-SN clean session** | | | |
| Set | AT+UMQTTSN=10,<clean_session> | OK | AT+UMQTTSN=10,1<br>OK |
| Read | AT+UMQTTSN? | +UMQTTSN: 0,<client_id><br>+UMQTTSN: 1,<server_name>,<server_port><br>+UMQTTSN: 2,IP_address>,<server_port><br>+UMQTTSN: 3,<radius><br>+UMQTTSN: 4,<will_QoS><br>+UMQTTSN: 5,<will_retain><br>+UMQTTSN: 6,<will_topic><br>+UMQTTSN: 7,<will_message><br>+UMQTTSN: 8,<duration><br>+UMQTTSN: 9,<secure>[,<USECMNG_profile>] | +UMQTTSN: 0,"352753090041680"<br>+UMQTTSN: 1,"www.commercialmqttbroker.com",1884<br>+UMQTTSN: 2,"192.168.1.0",1884<br>+UMQTTSN: 3,1<br>+UMQTTSN: 4,1<br>+UMQTTSN: 5,1<br>+UMQTTSN: 6,"u-blox/publish"<br>+UMQTTSN: 7,"unrequested disconnect"<br>+UMQTTSN: 8,20<br>+UMQTTSN: 9,1,1 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | +UMQTTSN: 10,<clean_session><br><br>OK | +UMQTTSN: 10,1<br><br>OK |
| Test | AT+UMQTTSN=? | +UMQTTSN: (list of supported <op_code>s)<br><br>OK | +UMQTTSN: (0-2,4-9)<br><br>OK |

### 30.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | MQTT-SN parameter:<br>• 0: MQTT-SN unique client id<br>• 1: MQTT-SN server name<br>• 2: MQTT-SN IP address<br>• 3: MQTT-SN radius<br>• 4: MQTT-SN last will QoS<br>• 5: MQTT-SN last will retain<br>• 6: MQTT-SN last will topic<br>• 7: MQTT-SN last will message<br>• 8: MQTT-SN connection duration<br>• 9: MQTT-SN secure<br>• 10: MQTT-SN clean session |
| <client_id> | String | Client identifier for the MQTT-SN session.<br>• SARA-R5 - The maximum length is 256 characters.<br>The default value is the IMEI of the MT. |
| <server_name> | String | Remote server name. The maximum length is 128 characters. The default value is an empty string. |
| <server_port> | Number | MQTT-SN server port. The range goes from 1 to 65535. The default value is 1884. |
| <IP_address> | String | Remote server IP address. The default value is an empty string. For IP address format reference, see the IP addressing. |
| <radius> | Number | The broadcast radius of this message. |
| <will_QoS> | Number | MQTT-SN last will quality of service:<br>• 0 (default value): at most once delivery<br>• 1: at least once delivery<br>• 2: exactly once delivery |
| <will_retain> | Number | Whether or not the last will message will be retained across disconnects:<br>• 0 (default value): the last will message will not be retained by the MQTT-SN gateway<br>• 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 [136], an MQTT-SN server must disconnect a client if it receives nothing from the client within 1.5x the keep alive duration. The default value is 0, which indicates no timeout. The maximum value is 65535 (corresponding to 18 hours, 12 minutes and 15 seconds). |
| <clean_session> | Number | Clean session value. Allowed values:<br>• 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<br>• 1 (default value): indicates that disconnections clean all session state information |
| <secure> | Number | Enables / disables the secure option of the MQTT-SN service:<br>• 0: (default value): no DTLS encryption<br>• 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. |

| Parameter | Type | Description |
|---|---|---|
| <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. |

### 30.2.4 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.

**SARA-R5**

- <op_code>=3 (radius for broadcasting search gateway message) is not supported.
- <op_code>=10 (clean session) is not supported, the session is always cleaned on disconnection.

## 30.3 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 |

### 30.3.1 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.

### 30.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UMQTTSNNV=<NVM_mode> | OK | AT+UMQTTSNNV=2<br>OK |
| Test | AT+UMQTTSNNV=? | +UMQTTSNNV: (list of <NVM_mode>s)<br>OK | +UMQTTSNNV: (0-2)<br>OK |

### 30.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <NVM_mode> | Number | Operation to set or save the MQTT-SN client profile parameters as follows:<br>• 0: restore MQTT-SN client profile parameters to the factory-programmed setting<br>• 1: set MQTT-SN client profile parameters to values previously stored in the NVM<br>• 2: store current MQTT-SN client profile parameters to the NVM |

## 30.4 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 |

### 30.4.1 Description

Triggers the MQTT-SN actions corresponding to the <op_code> parameter. The final result code indicates if sending the command request to the MQTT-SN process was successful or not.

The +UUMQTTSNC URC provides the result of the requested action from the MQTT-SN gateway. In addition, the +UUMQTTSNC URC also provides the notification that unread messages are available from the MQTT-SN gateway. The +UUMQTTSNC URC is by default enabled.

SARA-R5
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.

### 30.4.2 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>]]<br>OK | AT+UMQTTSNC=1<br>+UMQTTSNC: 1,1<br>OK |
| **MQTT-SN disconnect** | | | |
| Set | AT+UMQTTSNC=0[,<duration>] | OK | AT+UMQTTSNC=0<br>OK |
| URC | | +UUMQTTSNC: 0,<logout_result> | +UUMQTTSNC: 0,1 |
| **MQTT-SN connect** | | | |
| Set | AT+UMQTTSNC=1 | OK | AT+UMQTTSNC=1<br>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"<br>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>,<message> | OK | AT+UMQTTSNC=4,1,0,0,0,"1","23 degrees Celsius"<br>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"<br>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"<br>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"<br>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"<br>OK |

| Type | Syntax | Response | Example |
|---|---|---|---|
| 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>,<msg_length>,<message><br>OK | AT+UMQTTSNC=9,1<br>+UMQTTSNC: 9,1,0,19,1,"1",18,"23 degrees Celsius"<br>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<br>OK |
| URC (only in case of no ping response received) | | +UUMQTTSNC: 10,0 | +UUMQTTSNC: 10,0 |
| **MQTT-SN publish a file to a topic** | | | |
| Set | AT+UMQTTSNC=11,<QoS>,<retain>,<topic_type>,<topic>,<filename> | OK | AT+UMQTTSNC=11,1,0,0,"2","msg.txt"<br>OK |
| URC | | +UUMQTTSNC: 11,<MQTTSN_result> | +UUMQTTSNC: 11,1 |
| Test | AT+UMQTTSNC=? | +UMQTTSN: (list of supported <op_codes>s)<br>OK | +UMQTTSNC: (0-2,4-11)<br>OK |
| URC | | +UUMQTTSNC: <op_code>,<param1>[,<param2>,...,<paramN>] | +UUMQTTSNC: 5,1,0,1 |

## 30.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <op_code> | Number | MQTT-SN command request. Allowed values:<br>• 0: logs out/disconnects from the MQTT-SN server. The will message will not be sent<br>• 1: logs in/connects to the MQTT-SN server<br>• 2: register message to request a topic ID against a normal topic name from the gateway<br>• 3: search gateway message; broadcasted by a client when it searches for a gateway<br>• 4: publish a message to a specific topic to the gateway<br>• 5: subscribe to a topic<br>• 6: unsubscribe to a topic.This should exactly match the topic filter used during the Subscribe<br>• 7: update the will topic name stored in the gateway/server<br>• 8: update the will message stored in the gateway/server<br>• 9: read all unread messages received from the gateway<br>• 10: ping the MQTT-SN gateway<br>• 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:<br>• 0: fail; for more details, see the +UMQTTSNER AT command<br>• 1: success |
| <login_result> | Number | Result of a MQTT-SN login request. Allowed values:<br>• 0: connection accepted<br>• 1: rejected due to a congestion<br>• 2: rejected due to an invalid topic ID<br>• 3: rejected because not supported<br>• 4-255: reserved for future use |
| <logout_result> | Number | Result of an MQTT-SN command request:<br>• 0: fail; for more details, see the +UMQTTSNER AT command<br>• 1: success |

| Parameter | Type | Description |
|---|---|---|
| | | Result of an unsolicited notification for an MQTT-SN session interruption caused by:<br>• 100: timeout, the MQTT-SN gateway released the connection.<br>• 101: lost network connection. |
| <topic_name> | String | Indicates the topic name to request a topic ID value from the gateway. |
| <topic_id> | Number | Indicates the topic ID value to be used in the publish messages. |
| <gateway_id> | Number | Indicates the gateway ID. |
| <QoS> | Number | Quality of service:<br>• 0: at most once delivery<br>• 1: at least once delivery<br>• 2: exactly once delivery<br>• 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:<br>• 0: the message will not be retained by the MQTT broker<br>• 1: the message will be retained by the MQTT broker |
| <hex_mode> | Number | Allowed values:<br>• 0 (default value): ASCII input for <message><br>• 1: hexadecimal input for <message> |
| <topic_type> | Number | Indicates the type of the topic contained in the topic field:<br>• 0: normal<br>• 1: predefined<br>• 2: short |
| <topic> | String | Contains the topic ID value or the short/normal topic name for which the data is published. |
| <message> | String | ASCII or hexadecimal data.<br>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. |
| <publish_result> | Number | Result of a MQTT-SN publish request. Allowed values:<br>• 0: accepted<br>• 1: rejected due to an invalid topic ID<br>• 2: rejected due to congestion |
| <max_QoS> | Number | Maximum requested QoS level for this topic:<br>• 0: at most once delivery<br>• 1: at least once delivery<br>• 2: exactly once delivery |
| <sub_result> | Number | Result of a MQTT-SN subscription request. Allowed values:<br>• 0: accepted<br>• 1: rejected due to an invalid topic ID<br>• 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:<br>• 0: at most once delivery<br>• 1: at least once delivery<br>• 2: exactly once delivery |
| <will_retain> | Number | Whether or not the last will message will be retained across disconnections:<br>• 0: the last will message will not be retained by the MQTT-SN gateway<br>• 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>. |

| Parameter | Type | Description |
|---|---|---|
| <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:<br>• 0: read all received messages<br>• 1: read only one message |
| <ping_ON_OFF> | Number | Allowed values:<br>• 0 (default value): ping disabled<br>• 1: ping enabled; the MT will ping the MQTT-SN gateway. The ping is issued when the MQTT-SN keep alive period expires. See AT+UMQTT=8,<duration> |
| <paramx> | Number / String | Type and supported content depend on the related <op_code> parameter (details are given above). |
| <filename> | String | File name containing the payload of the message to be published. The maximum parameter length is 250 characters and the maximum file content is 1017 characters. |

# 30.5 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<br>MQTT-SN error |

## 30.5.1 Description

Retrieves the error class and code of the last MQTT-SN operation that provided an error.

## 30.5.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+UMQTTSNER | +UMQTTSNER: <error_class>,<error_code><br>OK | AT+UMQTTSNER<br>+UMQTTSNER: 14,1<br>OK |

## 30.5.3 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. |

# 31 Lightweight M2M

## 31.1 LwM2M Objects management

### 31.1.1 Introduction

#### 31.1.1.1 SARA-R5 object management

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 [134].

LwM2M objects implemented as Lua scripts act as the container for the objects, object instances, and resources.

u-blox cellular modules allows adding, removing or querying an object from the LwM2M object table of available objects with these AT commands:

- **+ULWM2MADD** dynamically adds an object, that has been previously copied to the device file system, to the LwM2M object table. An object must be added to the LwM2M object table before create or delete operations can be performed. The LwM2M object shall be downloaded by means of file system AT commands with the "XLWM2M" tag, for more details see File tags.
- **+ULWM2MREMOVE** dynamically removes an object from the LwM2M object table, along with any existing instances. The object file on the device file system is not removed. An object that has been removed from the LwM2M object table cannot have a create operation performed.
- **+ULWM2MLIST** lists the object ID and the object instances of a specific LwM2M object. The command allows also to list the object IDs of all objects and object instances in the LwM2M object table. An object that does not appear listed by +ULWM2MLIST must be added before create operations can be performed.

SARA-R5
All the supported LwM2M objects, that are defined internally in the MT, can be extended (adding new object definitions) or overridden (redefined) by adding corresponding Lua scripts with the "XLWM2M" tag; they will be loaded when the LwM2M client is reinitialized (e.g. with AT+ULWM2M=2).

Additional object files may be added by means of file system AT commands with the "XLWM2M" tag, for more details see File tags.

It is possible to modify LwM2M objects that have already been added to the LwM2M object table, using the following AT commands:

- **+ULWM2MCREATE** creates an object instance associated with a given server ID. The object must already be added to the LwM2M object table (see +ULWM2MADD AT command).
- **+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. Otherwise, it must be added with +ULWM2MLIST before writing.
- **+ULWM2MREAD** reads an object, object instance, or resource. The read target must already exist and be listed by the +ULWM2MLIST AT command.

### 31.1.2 Load LwM2M object definition +ULWM2MADD

| +ULWM2MADD | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | No | No | - | - |

#### 31.1.2.1 Description

Loads a LwM2M object into LwM2M objects table from a Lua definition file. Additional Lua definition files can be stored into the file system by means of the +UDWNFILE AT command using "XLWM2M" tag (for more details, see File tags).

#### 31.1.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2MADD=<filename> | OK | AT+ULWM2MADD="object_location.lua"<br>OK |
| Test | AT+ULWM2MADD=? | +ULWM2MADD: "filename"<br>OK | +ULWM2MADD: "filename"<br>OK |

#### 31.1.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <filename> | String | Name of the Lua file defining an object to load. The directory is assumed to be /lua/ objects on alternate encrypted file system. |

### 31.1.3 Remove LwM2M object definition +ULWM2MREMOVE

| +ULWM2MREMOVE | | | | | | |
|---|---|---|---|---|---|---|
| Modules | All products | | | | | |
| Attributes | Syntax | PIN required | Settings saved | Can be aborted | Response time | Error reference |
| | full | No | No | No | - | - |

#### 31.1.3.1 Description

Deletes all instances of an object and removes the object definition from LwM2M objects table. The Lua file is NOT deleted.

#### 31.1.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2MREMOVE=<object_ID> | OK | AT+ULWM2MREMOVE="/3300"<br>OK |
| Test | AT+ULWM2MREMOVE=? | +ULWM2MREMOVE: "Object Id"<br>OK | +ULWM2MREMOVE: "Object Id"<br>OK |

#### 31.1.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <object_id> | String | URI to an object ID for an object loaded into LwM2M objects table |

### 31.1.4 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 | - | - |

#### 31.1.4.1 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.

#### 31.1.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2MLIST=<object_URI> | +ULWM2MLIST: [<1st_URI>[,<2nd_URI>[,...[,<nth_URI>]]]]<br>OK | AT+ULWM2MLIST="/"<br>+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"<br>OK |
| Test | AT+ULWM2MLIST=? | OK | OK |

#### 31.1.4.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <object_URI> | String | Uniform Resource Identifier (URI) of the LwM2M object to query. The format is "/object_ID".<br>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 |

#### 31.1.4.4 Notes

**SARA-R5**

- 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.

### 31.1.5 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 | - | - |

#### 31.1.5.1 Description

Creates a new instance of a LwM2M object.

#### 31.1.5.2 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<br>OK |
| Test | AT+ULWM2MCREATE=? | +ULWM2MCREATE: "JSON",(list of supported <server_id>s)<br>OK | +ULWM2MCREATE: "JSON",(1-65534)<br>OK |

#### 31.1.5.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <JSON> | String | JSON-formatted LwM2M resource or object instance; for more details, Lightweight Machine to Machine Technical Specification [134]. 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. |

### 31.1.6 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 | - | - |

#### 31.1.6.1 Description

Deletes an instance of a LwM2M object.

#### 31.1.6.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2MDELETE=<URI> | OK | AT+ULWM2MDELETE="/14/7" |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | OK |
| Test | AT+ULWM2MDELETE=? | +ULWM2MDELETE: "Object Id/ Resource Id" | +ULWM2MDELETE: "Object Id/ Resource Id" |
| | | OK | OK |

#### 31.1.6.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <URI> | String | Uniform Resource Identifier (URI) to existing object |

### 31.1.7 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 | - | - |

#### 31.1.7.1 Description

Writes a LwM2M object, object instance, or resource.

#### 31.1.7.2 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" | +ULWM2MWRITE: "JSON" |
| | | OK | OK |

#### 31.1.7.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <JSON> | String | JSON-formatted LwM2M resource or object instance; for more details, Lightweight Machine to Machine Technical Specification [134]. If the JSON data contains embedded double quotes, they must be properly escaped with a backslash character '\'. |
| <mode> | Number | Allowed values:<br>• 0 (default value): partial write that changes only resources given<br>• 1: replace write, overwriting multi-instance resources with the array passed in JSON |

### 31.1.8 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 | - | - |

#### 31.1.8.1 Description

Displays the value of a LwM2M object, object instance, or resource.

#### 31.1.8.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2MREAD=<URI> | +ULWM2MREAD: <JSON> | AT+ULWM2MREAD="/1/1/1" |
| | | OK | +ULWM2MREAD: {"bn":"/1/1/1/","e":[{"n":"1","v":1000}]} |
| | | | OK |
| Test | AT+ULWM2MREAD=? | +ULWM2MREAD: "URI" | +ULWM2MREAD: "URI" |
| | | OK | OK |

#### 31.1.8.3 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 [134]. The maximum length is:<br>• SARA-R5 - 3072 characters<br>If the returned JSON length exceeds the parameter maximum length an error result code is issued. |

#### 31.1.8.4 Notes

**SARA-R5**

- The command AT+ULWM2MREAD="/0" is not allowed in order not to disclose some security parameters.

## 31.2 LwM2M connectivity

### 31.2.1 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 |

#### 31.2.1.1 Description

Enables the URC reporting status for LwM2M client.

#### 31.2.1.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2MSTAT=<n> | OK | AT+ULWM2MSTAT=1<br>OK |
| Read | AT+ULWM2MSTAT? | +ULWM2MSTAT: <n><br>OK | +ULWM2MSTAT: 1<br>OK |
| Test | AT+ULWM2MSTAT=? | +ULWM2MSTAT: (list of supported <n>s)<br>OK | +ULWM2MSTAT: (0,1)<br>OK |
| **Generic syntax** | | | |
| URC | | +ULWM2MSTAT: <event>, <param1>[,<param2>] | +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** | | | |
| URC | | +ULWM2MSTAT: 3,<server_id>, <URI> | +ULWM2MSTAT: 3,123,"/3300/0 /5700" |
| **LwM2M client status** | | | |
| URC | | +ULWM2MSTAT: 4,<client_status> | +ULWM2MSTAT: 4,7 |

#### 31.2.1.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <n> | Number | Enables and disables the +ULWM2MSTAT URC:<br>• 0: LwM2M status URC disabled<br>• 1: LwM2M status +ULWM2MSTAT URC enabled |

| Parameter | Type | Description |
|---|---|---|
| | | The factory-programmed value is:<br>• SARA-R5 - 0 |
| <event> | Number | Event type:<br>• 0: bootstrap status<br>• 1: registration status<br>• 2: remaining time until the next registration update<br>• 3: notification. A notify message has been triggered as per Lightweight Machine to Machine Technical Specification [134]<br>• 4: LwM2M client 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:<br>• SARA-R5<br>o 0: deregistered<br>o 1: registration hold<br>o 2: registration pending<br>o 3: registration success<br>o 4: registration failed<br>o 5: registration update pending<br>o 6: registration update needed<br>o 7: registration full update needed<br>o 8: deregistration needed<br>o 9: deregistration pending<br>o 10: bootstrap hold off<br>o 11: bootstrap initiated<br>o 12: bootstrap pending<br>o 13: bootstrap finishing<br>o 14: bootstrap finished<br>o 15: bootstrap failing<br>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:<br>• 0: initial<br>• 1: bootstrap required<br>• 2: bootstrapping<br>• 3: registration required<br>• 4: registering<br>• 5: ready<br>• 6: command mode only. No server communication occurs.<br>• 7: client shut down |
| <param1> | Number | Content depend on related <event> (details are given above). |
| <param2> | String | Content depend on related <event> (details are given above). |

## 31.2.2 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 | - | - |

### 31.2.2.1 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.

SARA-R5

- The AT+ULWM2M=1 (stop/disable the LwM2M client) or AT+ULWM2M=0 (start/enables the LwM2M client) command save the <activation_mode> in NVM.
- If the regulatory (<MNO>=0) or GCF-PTCRB (<MNO>=201) profile is selected (see the +UMNOPROF AT command), the LwM2M client is disabled even if +ULWM2M: 0 (LwM2M client enabled). 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.

#### 31.2.2.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2M=<activation_mode> | OK | AT+ULWM2M=1<br>OK |
| Read | AT+ULWM2M? | +ULWM2M: <activation_mode><br>OK | +ULWM2M: 1<br>OK |
| Test | AT+ULWM2M=? | +ULWM2M: (list of supported <activation_mode>s)<br>OK | +ULWM2M: (1-2)<br>OK |

#### 31.2.2.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <activation_mode> | Number | Operation type:<br>• 0: activates and enables the LwM2M client<br>• 1: stops or disables the LwM2M client<br>• 2: reset the LwM2M client (erases the LwM2M object database)<br>• 3: communication with NTT DoCoMo servers disabled<br>• 4: communication with NTT DoCoMo servers enabled<br>Allowed values:<br>• SARA-R5 - 0 (factory-programmed value), 1, 2 |

### 31.2.3 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 | - | - |

#### 31.2.3.1 Description

Forces the bootstrap or the registration for a specific LwM2M server.

#### 31.2.3.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2MREG=<server_id> | OK | AT+ULWM2MREG=123<br>OK |
| Read | AT+ULWM2MREG? | +ULWM2MREG: <server_id>, <server_status>[,<registration_interval>]<br>OK | +ULWM2MREG: 721,2,175<br>OK |
| Test | AT+ULWM2MREG=? | +ULWM2MREG: (0, list of supported <server_id>s)<br>OK | +ULWM2MREG: (0,721,123)<br>OK |

#### 31.2.3.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <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:<br>• SARA-R5<br>o 0: deregistered<br>o 1: registration hold<br>o 2: registration pending<br>o 3: registration success<br>o 4: registration failed<br>o 5: registration update pending<br>o 6: registration update needed<br>o 7: registration full update needed<br>o 8: deregistration needed<br>o 9: deregistration pending<br>o 10: bootstrap hold off<br>o 11: bootstrap initiated<br>o 12: bootstrap pending<br>o 13: bootstrap finishing<br>o 14: bootstrap finished<br>o 15: bootstrap failing<br>o 16: bootstrap failed |
| <registration_interval> | Number | For successfully registered servers (see the <status> parameter) this is the number of seconds until the next registration update |

## 31.2.4 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 | - | - |

#### 31.2.4.1 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.

#### 31.2.4.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2MDEREG=<server_id> | OK | AT+ULWM2MDEREG=0<br>OK |
| Test | AT+ULWM2MDEREG=? | +ULWM2MDEREG: (0,list of supported <server_id>s)<br>OK | +ULWM2MDEREG: (0,721)<br>OK |

#### 31.2.4.3 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. |

## 31.2.5 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 |

### 31.2.5.1 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.

### 31.2.5.2 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> | OK | AT+ULWM2MCONFIG=721,0,2,1,1,0,0,0<br>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><br>[...]<br>OK | +ULWM2MCONFIG: 721,0,2,1,1,0,0,0<br>+ULWM2MCONFIG: 123,0,1,1,0,0,0,0<br>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)<br>OK | +ULWM2MCONFIG: (1-65535),(0-1),(1-3),(1-8),(0-1),(0-1),(0-1),(0-1)<br>OK |

### 31.2.5.3 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:<br>• 0: disable a bootstrap attempt after a failed registration<br>• 1: enable a bootstrap attempt after a failed registration |
| <pdn_ip_type> | Number | Packet data network (PDN) type. Allowed values:<br>• 1: IPv4<br>• 2: IPv6<br>• 3: IPv4v6 |
| <cid> | Number | See <cid>. |
| <usec_psk> | Number | Use the pre-shared key (PSK) generated by the root of trust. Allowed values:<br>• 0: disabled<br>• 1: enabled<br>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:<br>• 0: disabled |

| Parameter | Type | Description |
|---|---|---|
| | | • 1: enabled |
| <dtls_session_ resumption> | Number | Enable the DTLS session resumption. For more details, see RFC 7925 [194]. Allowed values:<br>• 0: disabled<br>• 1: enabled |
| <full_registration_ after_fota> | Number | Force a full registration with the LwM2M server after a FOTA has been performed. Allowed values:<br>• 0: disabled<br>• 1: enabled |

#### 31.2.5.4 Notes

**SARA-R5**

- 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.

## 31.2.6 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 |

#### 31.2.6.1 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.

#### 31.2.6.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2MCONFIGEXT= <connection_teardown_timer>, <out_of_coverage_timer>, <communication_retry_timer>, <communication_retry_count>, <general_data_cid> | OK | AT+ULWM2MCONFIGEXT=60,3600 ,120,5,0<br>OK |
| Read | AT+ULWM2MCONFIGEXT? | +ULWM2MCONFIGEXT: <connection_teardown_timer>, <out_of_coverage_timer>, <communication_retry_timer>, <communication_retry_count>, <general_data_cid><br>OK | +ULWM2MCONFIGEXT: 60,3600, 120,5,0<br>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)<br>OK | +ULWM2MCONFIGEXT: (0-86400), (0-86400),(1-86400),(0-65535),(0-11)<br>OK |

#### 31.2.6.3 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. |

| Parameter | Type | Description |
|---|---|---|
| <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. |
| <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. |
| <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. |
| <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>. |

#### 31.2.6.4 Notes

**SARA-R5**

- 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.

### 31.2.7 Lightweight M2M pulse configuration +ULWM2MPULSE

| +ULWM2MPULSE | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | NVM | No | - | +CME Error |

#### 31.2.7.1 Description

Configures the LwM2M pulse feature that allows the sending of a LwM2M generated pulse. The LwM2M pulse can be properly configured both for the duration and for the polarity.

The information text response to the read command provides the configuration of GPIO pins set to LwM2M pulse feature in separate rows.

Properly configure the GPIO function to the LwM2M pulse mode by means of the +UGPIOC AT command (<gpio_mode>=25).

The LwM2M pulse is generated by calling the lua_send_pulse(gpio_id) function from the Lua scripts; for more details on the trigger definition, see the LwM2M objects and commands application note [180]. The LwM2M pulse feature can be triggered by the LwM2M server and also by the +ULWM2MCREATE, +ULWM2MWRITE, +ULWM2MDELETE, +ULWM2MREAD AT commands.

#### 31.2.7.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2MPULSE=<gpio_id>,<active_polarity>,<duration>,<boot_with_last_event> | OK | AT+ULWM2MPULSE=16,1,100,0<br>OK |
| Read | AT+ULWM2MPULSE? | +ULWM2MPULSE:<br><gpio_id>,<gpio_mode>,<active_polarity>,<duration>,<boot_with_last_event><br>[...]<br>OK | +ULWM2MPULSE:<br>16,25,0,5000,1<br>19,25,0,5000,1<br>23,25,0,5000,1<br>24,25,0,5000,1<br>25,25,0,5000,1<br>42,25,0,5000,1 |

| Type | Syntax | Response | Example |
|---|---|---|---|
| | | | OK |
| Test | AT+ULWM2MPULSE=? | +ULWM2MPULSE: (list of supported <gpio_id>s),(list of supported <active_polarity>s), (list of supported <duration>s), (list of supported <boot_with_last_event>s)<br>OK | +ULWM2MPULSE: (16,19,23,24,25,42),(0-1),(0-10000),(0-1)<br>OK |

#### 31.2.7.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <gpio_id> | Number | GPIO pin identifier: pin number.<br>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 | GPIO mode identifier: configured function. Allowed value:<br>• 25: LwM2M pulse |
| <active_polarity> | Number | Allowed values:<br>• 0: active low (i.e., normally high)<br>• 1: active high (i.e., normally low) |
| <duration> | Number | Provide the pulse duration expressed in milliseconds. The range goes from 0 to 10000 where 0 means to be left asserted. |
| <boot_with_last_event> | Number | Configures the pulse behaviour at the module power-on. Allowed values:<br>• 0: always negated<br>• 1: comes up asserted or negated according to last state at power down/reset |

### 31.2.8 LwM2M object notification +ULWM2MNOTIFY

| +ULWM2MNOTIFY | | | | | | |
|---|---|---|---|---|---|---|
| **Modules** | All products | | | | | |
| **Attributes** | **Syntax** | **PIN required** | **Settings saved** | **Can be aborted** | **Response time** | **Error reference** |
| | full | No | NVM | No | - | - |

#### 31.2.8.1 Description

Enables or disables the +ULWM2MNOTIFY URC defined in the Lua objects. The trigger which determines when the +ULWM2MNOTIFY URC is issued and the returned message string are custom, according to the object Lua script definition; for more details on the URC definition, see the LwM2M objects and commands application note [180]. The +ULWM2MNOTIFY URC can be triggered by the +ULWM2MCREATE, +ULWM2MWRITE, +ULWM2MDELETE, +ULWM2MREAD AT commands.

#### 31.2.8.2 Syntax

| Type | Syntax | Response | Example |
|---|---|---|---|
| Set | AT+ULWM2MNOTIFY=<enable> | OK | AT+ULWM2MNOTIFY=1<br>OK |
| Read | AT+ULWM2MNOTIFY? | +ULWM2MNOTIFY: <enable> | +ULWM2MNOTIFY: 0<br>OK |
| Test | AT+ULWM2MNOTIFY=? | +ULWM2MNOTIFY: (list of supported <enable>s)<br>OK | +ULWM2MNOTIFY: (0,1)<br>OK |
| URC | | +ULWM2MNOTIFY: <LwM2M_Lua_string> | +ULWM2MNOTIFY: write to resource 5750, value Accelerometer |

#### 31.2.8.3 Defined values

| Parameter | Type | Description |
|---|---|---|
| <enable> | Number | Allowed values:<br>• 0: +ULWM2MNOTIFY URC disabled<br>• 1: +ULWM2MNOTIFY URC enabled<br>The factory-programmed value is: |

| Parameter | Type | Description |
|---|---|---|
| | | • SARA-R5 - 0 |
| <LwM2M_Lua_string> | String | String as passed to the Lua API function lua_send_urc(), called from the Lua scripts. |

## 31.2.9 LwM2M host device information +ODIS

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

### 31.2.9.1 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 (see the +UMNOPROF AT command, <MNO>=2) and the command is issued, the module returns an error result code.

Upon the command execution the new setting is saved in a file in the file system and is persistent across power cycles.

SARA-R5
If the +UFACTORY AT command is issued, the factory-programmed setting is restored.

### 31.2.9.2 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"<br>OK |
| Read | AT+ODIS? | +ODIS: <Host_Device_Manufacturer>,<Host_Device_Model>,<Host_Device_Software_Version><br>OK | +ODIS: "u-blox","C030-R510","A1.01"<br>OK |
| Test | AT+ODIS=? | +ODIS: (Host Device ID),(Host Device Manufacturer),(Host Device Model),(Host Device Software Version)<br>OK | +ODIS: (Host Device ID),(Host Device Manufacturer),(Host Device Model),(Host Device Software Version)<br>OK |

### 31.2.9.3 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 |
| 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 |
| 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 |
| 213 | SIM data download error |
| 287 | Network failure unspecified |
| 290 | Network no resource |
| 296 | Radio Resources not Aailable due to DUAL SIM operation |

| Numeric error code | Description |
|---|---|
| 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 |
| 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 |

| Numeric error code | Description |
|---|---|
| 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 |
| 583 | Temporary Forbidden Call Attempt No Service |
| 584 | Temporary Forbidden Call Attempt Limited Service |
| 585 | Client Temporary Barred |
| 586 | Dual Service Call Active |

| Numeric error code | Description |
|---|---|
| 587 | Atc Fclass Not Speech |
| 590 | Client Not Registrated |
| 591 | Active Client Gone |
| 595 | Rejected By Call Control |
| 601 | Invalid ALS Line |
| 604 | MM No Service (out of coverage) |
| 605 | MM Access Class Barred (RR_REL_IND During RR Conn. Establishment) |
| 606 | ME Busy -CM Service Request Already Pending |
| 608 | Rejected Due To SUP Timer Expiry |
| 609 | Rejected Due To USSD Busy |
| 610 | Rejected Due To SS Busy |
| 612 | SIM Toolkit Request Is Rejected, Because Another SIM Toolkit Request Is Pending |
| 614 | Rejected Because SIM Toolkit Request Is Not Yet Answered By The User |
| 615 | MN Setup SS Error |
| 616 | Call Controller Blocked (Other Call Command Pending) |
| 618 | Environment Parameter Not Set Correctly (Fclass/Cmod) |
| 619 | Other Blocking Call Present |
| 620 | Lower Layer Failure |
| 621 | The Authentication Proedure Failed |
| 622 | The Packet-Switched Registration Procedure Failed |
| 623 | CM Service Reject From The Network |
| 624 | The ABORT Message Was Received From The Network |
| 625 | Timer Expiry |
| 626 | IMSI Deatch Was Initiated |
| 627 | Normal RR Connection Release (2G) |
| 628 | Registration Failed |
| 630 | Failure Due To Handover |
| 631 | Link Establishment Failure |
| 632 | Random Access Failure |
| 633 | Radio Link Aborted |
| 634 | Lower Layer Failure in Layer 1 |
| 635 | Immediate Assignment Reject |
| 636 | Failure Due To Paging |
| 637 | Abnormal Release Unspecified |
| 638 | Abnormal Release Channel Unacceptable |
| 639 | Abnormal Release Timer Expired |
| 640 | Abnormal Release No Act On Radio Path |
| 641 | Preemptive Release |
| 642 | UTRAN Configuration Unknown |
| 643 | Handover Impossible |
| 644 | Channel Mode Unacceptable |
| 647 | Lower Layer Failure From NW |
| 649 | Conditional IE Error |
| 650 | No Cell Allocation Available |
| 653 | Re Establishment Reject |
| 654 | Directed Sigconn Re Establishment |
| 656 | Release of RRC connection Witout Network Activity(3G) Lower Layer Failure Downlink |
| 657 | Lower Layer Failure Uplink |
| 658 | Cell Barred Due To Authentication Failure |
| 659 | Signalling Connection Release |
| 660 | CS Connection Release Triggered By MM |
| 661 | RRC Connection Establishment Failure |
| 662 | RRC Connection Establsihment Reject With Redirection |

| Numeric error code | Description |
|---|---|
| 663 | Resource Conflict |
| 664 | Lower Layer Failure in Layer 2 |
| 665 | L2 Cause T200 Expiry N200 Plus 1 Times |
| 669 | RR Connection Release Due to BAND Change (2G) |
| 670 | Release of the RRC Connection Due to Out of Service in Cell_Fach (3G) |
| 671 | Release of the RRC Connection Due to Not Matching PLMN in Shared Networks(3G) |
| 672 | Error Happens While Call Is Already Disconnected / Late Error |
| 674 | SIM Toolkit Cannot Initiate A Call, Because MMI Is Not Registered |
| 675 | SIM Toolkit Call Setup Request Is Rejected Due User Did Not Accept |
| 676 | Proactive SIM Appl Terminated By User |
| 677 | SIM Toolkit Originated SIM Reset (Refresh Request) |
| 680 | Dial String/Number Incorrect |

# A.3 +CEER error result codes

## A.3.1 SARA-R5 series

The following table lists the supported values for <cause> (number) and <error_description> (string) for +CEER AT command if <type> assumes one of these values:

- "CC setup error"
- "CC modification error"
- "CC release"
- "SM activation error"
- "SM deactivation

| <cause> | <error_description> |
|---|---|
| 0 | No cause information available |
| 1 | Unassigned (unallocated) number |
| 3 | No route to destination |
| 6 | Channel unacceptable |
| 16 | Normal call clearing |
| 17 | User busy |
| 18 | No user responding |
| 19 | User alerting, no answer |
| 21 | Call rejected |
| 22 | Number changed |
| 26 | Non selected user clearing |
| 27 | Destination out of order |
| 28 | Invalid number format (incomplete number) |
| 29 | Facility rejected |
| 30 | Response to STATUS ENQUIRY |
| 31 | Normal, unspecified |
| 34 | No circuit/channel available |
| 38 | Network out of order |
| 41 | Temporary failure |
| 42 | Switching equipment congestion |
| 43 | Access information discarded |
| 44 | Requested circuit/channel not available |
| 47 | Resources unavailable, unspecified |
| 49 | Quality of service unavailable |
| 50 | Requested facility not subscribed |
| 55 | Incoming calls barred within the CUG |
| 57 | Bearer capability not authorized |
| 58 | Bearer capability not presently available |
| 63 | Service or option not available, unspecified |

| <cause> | <error_description> |
|---|---|
| 65 | Bearer service not implemented |
| 68 | ACM equal to or greater than ACMmax |
| 69 | Requested facility not implemented |
| 70 | Only restr. digital information bearer capability |
| 79 | Service or option not implemented, unspecified |
| 81 | Invalid transaction identifier value |
| 87 | User not member of CUG |
| 88 | Incompatible destination |
| 91 | Invalid transit network selection |
| 102 | Recovery on timer expiry |
| 103 | Illegal MS |
| 106 | Illegal ME |
| 107 | GPRS service not allowed |
| 108 | GPRS and non GPRS services not allowed |
| 111 | PLMN not allowed |
| 112 | Location area not allowed |
| 113 | Roaming not allowed in this location area |
| 124 | MBMS bearer capabilities insufficient for the service |
| 125 | LLC or SNDCP failure |
| 126 | Insufficient resources |
| 127 | Missing or unknown APN |
| 128 | Unknown PDP address or PDP type |
| 129 | Outgoing calls barred within CUG |
| 130 | No CUG selected |
| 131 | Unknown CUG index |
| 132 | CUG index incompatible with requested basic service |
| 133 | CUG call failure, unspecified |
| 134 | CLIR not subscribed |
| 135 | CCBS possible |
| 136 | CCBS not possible |
| 137 | QoS not accepted |
| 138 | Network failure |
| 139 | Reactivation requested |
| 140 | Feature not supported |
| 141 | Semantic error in the TFT operation |
| 142 | Syntactical error in the TFT operation |
| 143 | Unknown PDP context |
| 144 | Semantic errors in packet filter(s) |
| 145 | Syntactical errors in packet filter(s) |
| 146 | PDP context without TFT already activated |
| 148 | Unspecified GPRS error |
| 149 | PDP authentication error |
| 152 | Single address bearers only allowed |
| 153 | ESM information not received |
| 154 | PDN connection does not exist |
| 155 | Multiple PDN connections for a given APN not allowed |
| 156 | Collision with network initiated request |
| 159 | Unsupported QCI value |
| 160 | Bearer handling not supported |
| 165 | Maximum number of EPS bearers reached |
| 166 | Requested APN not supported in current RAT and PLMN combination |
| 181 | Invalid PTI value |
| 182 | APN restriction value incompatible with active EPS bearer context |
| 183 | PTI already in use |
| 184 | EPS QoS not accepted |

| <cause> | <error_description> |
|---|---|
| 185 | Invalid EPS bearer identity |
| 186 | PTI mismatch |
| 187 | Last PDN disconnection not allowed |
| 188 | PDN type IPv4 only allowed |
| 189 | PDN type IPv6 only allowed |
| 212 | APN resriction |
| 256 | Internal, unspecified |
| 257 | Out of memory |
| 258 | Invalid parameters |
| 259 | Data call active |
| 260 | Speech call active |
| 262 | Missing ACM information |
| 263 | Temporary forbidden |
| 264 | Called party is blacklisted |
| 265 | Blacklist is full |
| 266 | No service |
| 267 | Limited service |
| 268 | Client conflict |
| 269 | Dual service call active |
| 271 | Unknown SIM error |
| 274 | Active Client is Gone |
| 277 | SIM status failure |
| 278 | Rejected by call control |
| 279 | FDN failed |
| 280 | BDN failed |
| 283 | CCBS possible |
| 284 | Invalid alternate service line |
| 285 | LND overflow |
| 287 | MM network failure unspecified |
| 288 | MM no service |
| 289 | MM access class barred |
| 290 | MM RR no resource |
| 291 | MM ME busy |
| 292 | MM unspecified |
| 296 | Dual sim radio conflict |
| 297 | No service due to dual sim radio conflict |
| 301 | MMI not registered |
| 303 | Rejected by user |
| 304 | Rejected due to time out |
| 306 | Disconnected due to SIM-Toolkit call setup |
| 307 | Pending SIM-Toolkit call setup |
| 310 | SIM reset |
| 340 | MM sapi3 release |
| 341 | MM lower layer failure |
| 342 | MM authentication failure |
| 343 | MM PS reject |
| 344 | MM service rejected |
| 345 | MM abort by network |
| 346 | MM timeout |
| 347 | MM detach |
| 348 | MM RR connection release |
| 349 | MM not registered |
| 350 | MM re-establishment failure |
| 351 | Failure due to handover |
| 352 | Link establishment failure |

| <cause> | <error_description> |
|---|---|
| 353 | Random access failure |
| 354 | Radio link aborted |
| 355 | Lower layer failure in Layer 1 |
| 356 | Immediate Assignment Reject |
| 357 | Failure due to paging |
| 358 | Abnormal release unspecified |
| 359 | Abnormal release channel unacceptable |
| 360 | Abnormal release timer expired |
| 361 | Abnormal release no act on radio path |
| 362 | Preemptive release |
| 363 | UTRAN configuration unknown |
| 364 | Handover impossible |
| 365 | Channel mode unacceptable |
| 366 | Frequency not implemented |
| 367 | Originator leaving call group area |
| 368 | Lower layer failure from network |
| 369 | Call already cleared |
| 370 | Semantically incorrect message |
| 371 | Invalid mandatory info |
| 372 | Message type non existing |
| 373 | Message type incompatible in state |
| 374 | Conditional information element error |
| 375 | No cell allocation available |
| 376 | Protocol error unspecified |
| 377 | Normal event |
| 378 | Unspecified |
| 379 | Preemptive release |
| 380 | Congestion |
| 381 | RE establishment reject |
| 382 | Directed sig conn establishment |
| 383 | User inactivity |
| 384 | Lower layer failure downlink |
| 385 | Lower layer failure uplink |
| 386 | Cell barred due to authentication failure |
| 387 | signalling connection release |
| 388 | CS connection release triggered by MM |
| 389 | RRC connection establishment failure |
| 390 | RRC connection establishment reject with redirection |
| 391 | resource conflict |
| 392 | Layer 2 sequence error |
| 393 | Layer 2 T200 exp N200 plus 1 times |
| 394 | Layer 2 unsolicited DM resp MFES |
| 395 | Layer 2 contention resolution |
| 396 | Layer 2 normal cause |
| 397 | RR connection release due to BAND change (2G) |
| 400 | MM RR connection error while release |
| 500 | Local user disconnect/normal call clearing |
| 510 | Remote user or NW disconnect ormal call clearing, during any other call state than "CALL PROCEEDING" |
| 511 | Remote user or NW disconnect ormal call clearing, during the call state "CALL PROCEEDING" |
| 512 | Request rejected, BCM violation |

The following table lists the supported values for <cause> (number) and <error_description> (string) for +CEER AT command if <type> assumes one of these values:

- "SM attach error"
- "SM detach"

| <cause> | <error_description> |
|---|---|
| 0 | No cause information available |
| 2 | SIM not provisioned |
| 3 | SIM not allowed |
| 4 | Call Failed |
| 5 | Call Failed |
| 6 | Phone not allowed |
| 7 | GPRS Service not allowed |
| 8 | GPRS Service and Non GPRS service not allowed |
| 9 | MS Identity cannot be Derived by network |
| 11 | SOS/Emergency calls only,PLMN not allowed |
| 12 | SOS/Emergency calls only,LA not allowed |
| 13 | SOS/Emergency calls only,roaming not allowed in LA |
| 15 | No Suitable cells in Location Area |
| 22 | Error Congestion |
| 23 | SIM not allowed |
| 34 | Service temporarily out of order |
| 38 | Call cannot be Identifed |
| 40 | NO PDP Context Active |
| 48 | Retry on New Cell beginning |
| 63 | Retry on New Cell End |

The following table lists the supported values for <cause> (number) and <error_description> (string) for +CEER AT command if <type> assumes one of these values:

- EMM cause

| <cause> | <error_description> |
|---|---|
| 0 | No cause information available |
| 2 | IMSI unknown in HSS |
| 3 | Illegal UE |
| 5 | IMEI not accepted |
| 6 | Illegal ME |
| 7 | EPS services not allowed |
| 8 | EPS services and non-EPS services not allowed |
| 9 | UE identity cannot be derived by the network |
| 10 | Implicitly detached |
| 11 | PLMN not allowed |
| 12 | Tracking area not allowed |
| 13 | Roaming not allowed in this tracking area |
| 14 | EPS services not allowed in this PLMN |
| 15 | No suitable cells in tracking area |
| 16 | MSC temporarily not reachable |
| 17 | Network failure |
| 18 | CS domain not available |
| 19 | ESM failure |
| 20 | MAC (Message Authentication Code) failure |
| 21 | Synch failure |
| 22 | Congestion |
| 23 | UE security capabilities mismatch |
| 24 | Security mode rejected, unspecified |
| 25 | Not authorized for this CSG |
| 26 | Non-EPS authentication unacceptable |
| 35 | Requested service option not authorized in this PLMN |
| 39 | CS service temporarily not available |
| 40 | No EPS bearer context activated |
| 42 | Severe network failure |
| 95 | Semantically incorrect message |

| <cause> | <error_description> |
|---|---|
| 96 | Invalid mandatory information |
| 97 | Message type non-existent or not implemented |
| 98 | Message type not compatible with protocol state |
| 99 | Information element non-existent or not implemented |
| 100 | Conditional IE error |
| 101 | Message not compatible with protocol state |
| 111 | Protocol error, unspecified |

The following table lists the supported values for <cause> (number) and <error_description> (string) for +CEER AT command if <type> assumes one of these values:

- ESM attach error
- ESM detach

| <cause> | <error_description> |
|---|---|
| 0 | No cause information available |
| 8 | Operator Determined Barring |
| 26 | Insufficient resources |
| 27 | Missing or unknown APN |
| 28 | Unknown PDN type |
| 29 | User authentication failed |
| 30 | Request rejected by Serving GW or PDN GW |
| 31 | Request rejected, unspecified |
| 32 | Service option not supported |
| 33 | Requested service option not subscribed |
| 34 | Service option temporarily out of order |
| 35 | PTI already in use |
| 36 | Regular deactivation |
| 37 | EPS QoS not accepted |
| 38 | Network failure |
| 39 | Reactivation requested |
| 41 | Semantic error in the TFT operation |
| 42 | Syntactical error in the TFT operation |
| 43 | Invalid EPS bearer identity |
| 44 | Semantic errors in packet filter(s) |
| 45 | Syntactical error in packet filter(s) |
| 47 | PTI mismatch |
| 49 | Last PDN disconnection not allowed |
| 50 | PDN type IPv4 only allowed |
| 51 | PDN type IPv6 only allowed |
| 52 | single address bearers only allowed |
| 53 | ESM information not received |
| 54 | PDN connection does not exist |
| 55 | Multiple PDN connections for a given APN not allowed |
| 56 | Collision with network initiated request |
| 59 | Unsupported QCI value |
| 60 | Bearer handling not supported |
| 65 | Maximum number of EPS bearers reached |
| 66 | Requested APN not supported in current RAT and PLMN combination |
| 81 | Invalid PTI value |
| 95 | Semantically incorrect message |
| 96 | Invalid mandatory information |
| 97 | Message type non-existent or not implemented |
| 98 | Message type not compatible with protocol state |
| 99 | Information element non-existent or not implemented |
| 100 | Conditional IE error |
| 101 | Message not compatible with protocol state |

| <cause> | <error_description> |
|---|---|
| 111 | Protocol error, unspecified |
| 112 | APN restriction value incompatible with active EPS bearer context |

# A.4 Firmware install final result codes

The +UFWINSTALL command issues a final result code providing the result of the FW install procedure. In case the FW install procedure fails, the error result code provides some indication about the error cause (syntax error or issue during the installation procedure).

## A.4.1 SARA-R5 final result codes

Syntax error resulting from the +UFWINSTALL command:

| Numeric error code | Verbose description | Description |
|---|---|---|
| 4 | +CME ERROR: not supported | One of the following cases:<br>• Wrong serial port number<br>• Wrong baud rate<br>• Number of parameters not allowed<br>• File name too long |
| 1624 | +CME ERROR: FFS file not found | The delta file is not stored in the module FS or the file name is wrong |

### A.4.1.1 SARA-R5 final result codes

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 command:

- 128: FW update successfully performed
- In case a different error result code is provided please contact u-blox Technical Support offices for support

# A.5 FOAT error result codes

See +UFWUPD command description.

## A.5.1 SARA-R5 error result codes

| Error result code | Description |
|---|---|
| ERROR1 | The operation has been interrupted and the actual FW is unchanged; the module drops out from Firmware Update Mode |
| ERROR2 | The operation has been interrupted during FW updating; the actual firmware is corrupted and the module remains in Firmware Update Mode |
| ERROR3 | The signature check fails |
| ERROR4 | The module has received unexpected EOT because not all excepted bytes have been received |
| ERROR5 | The boot does not support the selected baudrate |
| ERROR6 | Invalid AT command sent during boot |
| FLS header decoding failed | An error occurs during decoding of file header |
| Buffer Data Overrun | The buffers are not filled at least with a 1029 packet: data comes too slowly |
| Timeout | The command must be re-sent: no data is coming |

## A.5.2 SARA-R5 extended error result codes

Here below are listed the allowed final result codes that can be issued at the finalization of the install procedure by means of the +UFWUPD command:

- 128: FW update successfully performed
- In case a different error result code is provided please contact u-blox Technical Support offices for support

## A.6 Dynamic DNS unsolicited indication codes

The following table lists the available values of <error_code> parameter of the last Dynamic DNS update provided through +UUDYNDNS URC (for more details see the +UDYNDNS AT command description).

| Numeric error code | Description |
|---|---|
| 0 | Success |
| 1 | Data connection lost while performing update |
| 2 | Cannot update dynamic DNS because a private IP address has been assigned to the module |
| 3 | Connection to dynamic DNS server failed |
| 4 | Error occurred sending data to dynamic DNS server |
| 5 | Error occurred reading response from dynamic DNS server |
| 6 | Timeout while waiting response from dynamic DNS server |
| 7 | Dynamic DNS server closed connection unexpectedly |
| 8 | Unexpected response from dynamic DNS server |
| 9 | Dynamic DNS response seems to be incomplete |
| 10 | Update has been delayed in order to respect DNS update protocol timing specification |
| 40 | Dynamic DNS protocol specific: good (TZO code 200) |
| 41 | Dynamic DNS protocol specific: nochg (TZO code 304) |
| 42 | Dynamic DNS protocol specific: notfqdn |
| 43 | Dynamic DNS protocol specific: nohost |
| 44 | Dynamic DNS protocol specific: numhost |
| 45 | Dynamic DNS protocol specific: badauth (TZO code 401) |
| 46 | Dynamic DNS protocol specific: badagent (TZO code 405) |
| 47 | Dynamic DNS protocol specific: !donator |
| 48 | Dynamic DNS protocol specific: abuse |
| 49 | Dynamic DNS protocol specific: dnserr |
| 50 | Dynamic DNS protocol specific: 911 |
| 51 | Dynamic DNS protocol specific: badsys |
| 52 | Dynamic DNS protocol specific: !yours |
| 53 | Dynamic DNS protocol specific: TZO code 403 |
| 54 | Dynamic DNS protocol specific: TZO code 407 |
| 55 | Dynamic DNS protocol specific: TZO code 414 |
| 56 | Dynamic DNS protocol specific: TZO code 415 |
| 57 | Dynamic DNS protocol specific: TZO code 480 |
| 100-108 | Internal errors |

☞ The meaning of dynamic DNS protocol specific codes depends on the provider used; see the provider documentation.

☞ Errors 45, 46, 53, 54 and 56 trigger a client self deactivation when the provider is TZO.com.

☞ Errors 42, 43, 44, 46, 48, 51 and 52 trigger a client self deactivation when the selected provider is DynDNS.org or DynDNS.it or No-IP.org or DynamicDNS.org.

## A.7 Internal TCP/UDP/IP stack class error codes

The following table lists all allowed error classes that can be provided by the internal TCP/UDP/IP stack through +USOER and +USOCTL (with <param_id>=1) AT commands.

| Numeric error code | Description | Resulting from the following commands |
|---|---|---|
| 0 | No error | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |
| 1 | EPERM - Operation not permitted (internal error) | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |

| Numeric error code | Description | Resulting from the following commands |
|---|---|---|
| 2 | ENOENT - No such resource (internal error) | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |
| 4 | EINTR - Interrupted system call (internal error) | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |
| 5 | EIO - I/O error (internal error) | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |
| 9 | EBADF - Bad file descriptor (internal error) | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |
| 10 | ECHILD - No child processes (internal error) | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |
| 11 | EWOULDBLOCK / EAGAIN - Current operation would block, try again | +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 |

| Numeric error code | Description | Resulting from the following commands |
|---|---|---|
| 104 | ECONNRESET - Connection reset by peer | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |
| 105 | ENOBUFS - No buffer space available | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |
| 106 | EISCONN - Transport endpoint is already connected | +USOCO |
| 107 | ENOTCONN - Transport endpoint is not connected | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |
| 108 | ESHUTDOWN - Cannot send after transport endpoint shutdown | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |
| 110 | ETIMEDOUT - Connection timed out | +USOCO, +USOST, +USORD, +USORF |
| 111 | ECONNREFUSED - Connection refused | +USOCO |
| 112 | EHOSTDOWN - Host is down | +USOCL, +USOCO, +USOWR, +USOST, +USORD, +USORF |
| 113 | EHOSTUNREACH - No route to host | +USOCO, +USOWR, +USOST, +USORD, +USORF |
| 115 | EINPROGRESS - Operation now in progress | +USOCR, +USOSO, +USOGO, +USOCO, +USOWR, +USOST, +USORD, +USORF, +USOLI |
| 160 | ENSRNODATA - DNS server returned answer with no data | +UDNSRN |
| 161 | ENSRFORMERR - DNS server claims query was misformatted | +UDNSRN |
| 162 | ENSRSERVFAIL - DNS server returned general failure | +UDNSRN |
| 163 | ENSRNOTFOUND - Domain name not found | +UDNSRN |
| 164 | ENSRNOTIMP - DNS server does not implement requested operation | +UDNSRN |
| 165 | ENSRREFUSED - DNS server refused query | +UDNSRN |
| 166 | ENSRBADQUERY - Misformatted DNS query | +UDNSRN |
| 167 | ENSRBADNAME - Misformatted domain name | +UDNSRN |
| 168 | ENSRBADFAMILY - Unsupported address family | +UDNSRN |
| 169 | ENSRBADRESP - Misformatted DNS reply | +UDNSRN |
| 170 | ENSRCONNREFUSED - Could not contact DNS servers | +UDNSRN |
| 171 | ENSRTIMEOUT - Timeout while contacting DNS servers | +UDNSRN |
| 172 | ENSROF - End of file | +UDNSRN |
| 173 | ENSRFILE - Error reading file | +UDNSRN |
| 174 | ENSRNOMEM - Out of memory | +UDNSRN |
| 175 | ENSRDESTRUCTION - Application terminated lookup | +UDNSRN |
| 176 | ENSRQUERYDOMAINTOOLONG - Domain name is too long | +UDNSRN |
| 177 | ENSRCNAMELOOP - Domain name is too long | +UDNSRN |

## A.8 Internet suite error classes

The following table lists all allowed error classes that can be provided by the <error_class> parameter for these AT error commands:

- SARA-R5 - +UFTPER, +UHTTPER, +UMQTTER, +UMQTTSNER that provide the error of the last FTP, HTTP, MQTT, MQTT-SN 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.8.1 | +UFTPC, +UFTP |
| 3 | HTTP Protocol error class | See the Appendix A.8.2 | +UHTTP, +UHTTPC |
| 4 | Flash File System error class | See the Appendix A.8.3 | +UFTPC, +UFTPER, +UHTTPC |
| 5 | DNS error class | | +UFTPC, +UHTTPC, +USMTPC |

| <error_class> | Description | <error_codes> | Resulting from the following commands |
|---|---|---|---|
| 6 | Socket error class | BSD error codes standard | All |
| 7 | Dynamic Memory error | 0 | All |
| 8 | Wrong FTP API usage (e.g. missing/null parameters) | See the Appendix A.8.1 | +UFTPC, +UFTP |
| 10 | Wrong HTTP API usage (e.g. missing/null parameters) | See the Appendix A.8.2 | +UHTTP, +UHTTPC |
| 11 | Syntax error in high layer Protocol (wrong/missing/ corrupted data) | | +UFTPC, +UHTTPC, +USMTPC |
| 12 | Unspecified error | 0 | All |
| 13 | MQTT error class | See the Appendix A.8.4 | +UMQTT, +UMQTTC, +UMQTTWTOPIC, +UMQTTWMSG |
| 14 | MQTT-SN error class | See the Appendix A.8.5 | +UMQTTSN, +UMQTTSNC |
| 15 | CoAP error class | See the Appendix A.8.6 | +UCOAP, +UCOAPC |

### A.8.1 FTP class error codes

The following table lists the available values of <error_code> parameter of the last FTP operation provided through +UFTPER AT command if <error_class>=1 or 8 (for more details see the AT+UFTP, AT+UFTPC commands description).

| Numeric error code | Description |
|---|---|
| 0 | No error |
| 1 | User missing |
| 2 | Password missing |
| 3 | Account missing |
| 4 | Server missing |
| 5 | Directory name missing |
| 6 | File name missing |
| 7 | Null parameter |
| 8 | Unknown FTP command |
| 9 | Unknown file action |
| 10 | Wrong FTP state |
| 11 | Wrong parameter |
| 12 | PSD or CSD connection not established |
| 13 | No memory available for allocation |
| 14 | Reserved internal code |
| 15 | Length of given web server (address or hostname) too long or too short |
| 16 | Hostname of given web server invalid |
| 17 | Address of given web server is invalid |
| 18 | Username too long or too short |
| 19 | Password too long or too short |
| 20 | Account too long or too short |
| 21 | Operation not allowed because FTP client is busy |
| 22 | Not possible to connect to FTP server |
| 23 | Error occurred in FTP request |
| 24 | Reserved internal code |
| 25 | FFS filename pointer is null or its length is 0 |
| 26-30 | Reserved internal code |
| 31 | Timeout elapsed while performing requested operation |
| 32 | Internal processing error |
| 33 | Not logged in |
| 34 | Login incorrect |
| 35 | File unavailable (not found or no access) |
| 36 | File not ready |
| 37 | Filename not allowed |
| 38 | Folder not found |

| Numeric error code | Description |
|---|---|
| 39 | Folder no access |
| 40 | Operation aborted by user |
| 41 | Permission denied |
| 42 | Cannot open FTP data channel |
| 43 | Socket invalid parameter |
| 44 | Invalid socket |
| 45 | No socket available |
| 46 | Cannot create socket |
| 47 | Cannot bind socket to network interface |
| 48 | Cannot resolve hostname |
| 49 | Cannot connect socket |
| 50 | Cannot get socket name |
| 51 | Cannot bind socket to port |
| 52 | Socket cannot listen |
| 53 | Socket cannot accept |
| 54 | Socket would block |
| 55 | Socket cannot write |
| 56 | Socket cannot read |
| 57 | Reserved internal code |
| 58 | No socket data to send |
| 59 | Socket cannot get available data |
| 60 | No socket data to read |
| 61 | Socket no response code found |
| 62 | Socket not connected |
| 63 | Cannot set secure socket |
| 64 | Socket cannot decode password |
| 65 | Socket cannot get size |
| 66 | FFS Invalid parameter |
| 67 | FFS invalid handle |
| 68 | FFS cannot open file |
| 69 | FFS cannot seek file |
| 70 | FFS cannot get file size |
| 71 | FFS cannot read |
| 72 | FFS bad offset |
| 73 | FFS cannot write |
| 74 | Direct link internal error |
| 75 | Failed to open extended passive mode |
| 76 | Failed to parse extended passive mode server reply |
| 77 | Internal error |
| 78 | Client IP protocol not supported - try passive mode |
| 79 | Data transfer error. The transferred (received/sent) data is not complete |
| 226 | Closing data connection; requested file action successful (for example, file transfer or file abort) |
| 250 | Requested file action okay, completed |
| 350 | Requested file action pending further information |
| 421 | Service not available, closing control connection.<br>User limit reached<br>Not authorized to make the connection<br>Maximum connections reached<br>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) |

| Numeric error code | Description |
|---|---|
| 451 | Requested action aborted: local error in processing |
| 452 | Requested action not taken. Insufficient storage space in system |
| 500 | Syntax error, command unrecognized, command line too long |
| 501 | Syntax error in parameters or arguments |
| 502 | Command not implemented |
| 503 | Bad sequence of commands |
| 504 | Command not implemented for that parameter |
| 530 | User not logged in |
| 532 | Need account for storing files |
| 550 | Requested action not taken. File unavailable, not found, not accessible |
| 552 | Requested file action aborted. Exceeded storage allocation |
| 553 | Requested action not taken. Filename not allowed |

☞ For all the errors not listed in the table see the RFC 959 [62] and RFC 2428 [63].

### A.8.2 HTTP class error codes

The following table lists the available values of <error_code> parameter of the last HTTP operation provided through +UHTTPER AT command if <error_class>=3 or 10 (for more details see the AT+UHTTP and AT +UHTTPC commands description).

| Numeric error code | Description |
|---|---|
| 0 | No error |
| 1 | Invalid profile ID |
| 2 | Invalid input |
| 3 | Server hostname too long |
| 4 | Invalid server hostname |
| 5 | Invalid server IP address |
| 6 | Invalid authorization method |
| 7 | Server missing |
| 8 | Username length exceeded |
| 9 | Password length exceeded |
| 10 | Internal error |
| 11 | Server connection error |
| 12 | Error occurred in HTTP request |
| 13 | Internal error |
| 14 | Internal error |
| 15 | Invalid POST data size |
| 16 | Empty FFS file name |
| 17 | Invalid FFS file length |
| 18 | Invalid content-type specified |
| 19 | Internal error |
| 20 | Internal error |
| 21 | Internal error |
| 22 | PSD or CSD connection not established |
| 23 | Server or proxy hostname lookup failed |
| 24 | User authentication failed on server |
| 25 | User authentication failed on proxy |
| 26 | Connection timed out |
| 27 | Request prepare timeout expired |
| 28 | Response receive timeout expired |
| 29 | Request send timeout expired |
| 30 | HTTP operation in progress |
| 31 | Invalid HTTP parameter TCP port not in range (1-65535) |
| 32 | Invalid HTTP parameter secure |
| 33 | Invalid HTTP parameter authentication username |

| Numeric error code | Description |
|---|---|
| 34 | Invalid HTTP parameter authentication password |
| 35 | Invalid HTTP parameter output filename |
| 36 | Invalid HTTP parameter output filename length |
| 37 | Invalid HTTP parameter server path |
| 38 | Invalid HTTP parameter server path length |
| 39 | Invalid HTTP parameter content filename length |
| 40 | Invalid custom content type string |
| 41 | Output file open error |
| 42 | Output file close error |
| 43 | Output file write error |
| 44 | Connection lost |
| 45 | Operation not allowed in current state |
| 46 - 72 | Internal error |
| 73 | Secure socket connect error |

### A.8.3 File system class error codes

SARA-R5

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.8.4 SARA-R5 MQTT error codes

### A.8.4.1 SARA-R5 MQTT class error codes

The following table lists the available values of <error_code> parameter of the last MQTT operation provided through the +UMQTTER AT command.

| Numeric error code | Description |
|---|---|
| 0 | Operation performed with success |
| 1 | Memory failure |
| 2 | Invalid parameter |
| 3 | Invalid parameter range |
| 4-8 | Internal error |
| 9 | Invalid client identifier |
| 10 | Client identifier length out of range |
| 11 | Syntax error in client identifier |
| 12 | Invalid broker |
| 13 | Broker length out of range |
| 14 | Broker port out of range |
| 15 | Invalid username or password |
| 16 | Username length out of range |
| 17 | Password length out of range |
| 18 | Keep alive time out of range |
| 19 | Security mode out of range |
| 20 | Wrong Security Manager Profile |
| 21 | Security Manager Profile out of range |
| 22 | Invalid topic |
| 23 | Topic length out of range |
| 24 | Missing message or filename |
| 25 | Cannot get file size |
| 26 | File size out of range |
| 27 | Cannot open file |
| 28 | Cannot read file |
| 29 | QOS out of range |
| 30 | Retain out of range |
| 31 | Wrong will message length |
| 32 | Wrong publish message length |
| 33 | Timeout error |
| 34 | No Network service |
| 35 | Broker not connected |
| 36 | Broker connection refused |
| 37 | Broker connection refused, wrong protocol version |
| 38 | Broker connection refused, identifier rejected |
| 39 | Broker connection refused, server unavailable |
| 40 | Broker connection refused, bad user name or password |
| 41 | Broker connection refused, not authorized |
| 42 | MQTT client out of buffer |
| 43 | MQTT client malformed remaining length |
| 44 | MQTT client packet type mismatch |
| 45 | MQTT client packet Id mismatch |
| 46 | MQTT client invalid internal state |
| 47 | MQTT client TLS connect error |
| 48 | MQTT client STDIN Wake error |
| 49 | Incoming message cannot be saved |
| 50 | PSD or CSD connection not established |
| 51 | Error in callback |
| 52 | Malformed packet |

## A.8.5 SARA-R5 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.8.5.1 SARA-R5 MQTT-SN class error codes

| Numeric error code | Description |
|---|---|
| 0 | Operation performed with success |
| 1 | Memory failure |
| 2 | Invalid parameter |
| 3 | Invalid parameter range |
| 4-8 | Internal error |
| 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 |

## A.8.6 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 AT+UCOAP and AT+UCOAPC commands description).

| Numeric error code | Description |
|---|---|
| 0 | No error |
| 1 | Internal error |
| 2 | Invalid input |
| 3 | Invalid 2nd parameter |
| 4 | Invalid 3rd parameter |
| 5 | Parameter count incomplete |
| 6 | Parameter count exceeded |
| 7 | Op code invalid |
| 8 | Server URI missing |
| 9 | Server URI invalid |
| 10 | Server URI length exceeded |
| 11 | Option mask invalid |

| Numeric error code | Description |
|---|---|
| 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.9 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 AT+UIPCHGN 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.10 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 AT+UPING command description).

| Numeric error code | Description |
|---|---|
| 0 | Success (no error) |
| 1 - 6 | Internal error (ping level) |
| 7 | Empty remote host |
| 8 | Cannot resolve host |
| 9 | Unsupported IP version (RFU) |
| 10 | Invalid IPv4 address |
| 11 | Invalid IPv6 address (RFU) |
| 12 | Remote host too long |
| 13 | Invalid payload size |

| Numeric error code | Description |
|---|---|
| 14 | Invalid TTL value |
| 15 | Invalid timeout value |
| 16 | Invalid retries number |
| 17 | PSD or CSD connection not established |
| 100 - 105 | Internal error (ICMP level) |
| 106 | Error creating socket for ICMP |
| 107 | Error settings socket options for ICMP |
| 108 | Cannot end ICMP packet |
| 109 | Read for ICMP packet failed |
| 110 | Received unexpected ICMP packet |
| 111-115 | Internal error (socket level) |

# B Appendix: AT Commands List

| | AT command | Call control | | |
|---|---|---|---|---|
| | | D | S0 | |
| SARA | R500S-00B / R510S-00B | • | • | |
| | R510M8S-00B | • | • | |

| AT command | | File System | | | | | |
|---|---|---|---|---|---|---|---|
| | | +UDELFILE | +UDWNFILE | +ULSTFILE | +URDBLOCK | +URDFILE | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | |

| AT command | | General commands | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +CCID | +CGMI | +CGMM | +CGMR | +CGSN | +CIMI | +CSCS | +GCAP | +GMI | +GMM | +GMR | +GSN | I | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | |

| AT command | | GPIO interface | | | |
|---|---|---|---|---|---|
| | | +UGPIOC | +UGPIOR | +UGPIOW | |
| SARA | R500S-00B / R510S-00B | • | • | • | |
| | R510M8S-00B | • | • | • | |

| AT command | | I2C interface | | | | | |
|---|---|---|---|---|---|---|---|
| | | +UI2CC | +UI2CO | +UI2CR | +UI2CREGR | +UI2CW | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | |

| AT command | | Internet suite | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +UDCONF=4 | +UDNSRN | +UDYNDNS | +UFTP | +UFTPC | +UFTPER | +UHTTP | +UHTTPAC | +UHTTPC | +UHTTPER | +UPING | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | |

| AT command | | Device and data security | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +USECC2C | +USECCHIP | +USECCONN | +USECDATADEC | +USECDATAENC | +USECDEVCERT | +USECDEVINFO | +USECE2EDATAENC | +USECE2EFILEENC | +USECFILEDEC | +USECFILEENC | +USECFW | +USECMNG | +USECMODE | +USECPRF | +USECPSK | +USECROTUID | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |

| AT command | | Localization features | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +UGAOS | +UGGGA | +UGGLL | +UGGSA | +UGGSV | +UGIND | +UGPRF | +UGPS | +UGRMC | +UGSRV | +UGTMR | +UGUBX | +UGVTG | +UGZDA | +ULOC | +ULOCAID | +ULOCCELL | +ULOCGNSS | +ULOCIND | +UTIME | +UTIMECFG | +UTIMEIND | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |

| AT command | | Mobile equipment control and status | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +CALA | +CALD | +CCLK | +CEER | +CFUN | +CIND | +CMEE | +CMER | +CPAS | +CPWROFF | +CSGT | +CTZR | +CTZU | +UCIND | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |

| AT command | | Network service | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +CEDRXRDP | +CEDRXS | +CEINFO | +CESQ | +CNUM | +COPN | +COPS | +CPLS | +CPOL | +CRCES | +CREG | +CSCON | +CSQ | +PACSP | +UBANDMASK | +UCELLINFO | +UCGED | +UDCONF=81 | +UDOPN | +UJAD | +UMETRIC | +UMNOPROF | +URAT |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |

| AT command | | Network service | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | +URATCONF | +URPM | +URPMCONF | +VZWAPNE | +VZWRSRP | +VZWRSRQ | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | |

| AT command | | Networking | |
|---|---|---|---|
| | | +UPORTFWD | |
| SARA | R500S-00B / R510S-00B | • | |
| | R510M8S-00B | • | |

| AT command | | Packet switched data services | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +CABTRDP | +CEMODE | +CEREG | +CEUS | +CGACT | +CGATT | +CGCMOD | +CGCONTRDP | +CGDATA | +CGDCONT | +CGDEL | +CGDSCONT | +CGEQOS | +CGEQOSRDP | +CGEREP | +CGPADDR | +CGPIAF | +CGREG | +CGSCONTRDP | +CGTFT | +CGTFTRDP | +UAUTHREQ | +UDCONF=66 |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |

| AT command | | Packet switched data services | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +UDCONF=75 | +UDCONF=76 | +UDCONF=9 | +UFGI | +UGCNTRD | +UGCNTSET | +UPSD | +UPSDA | +UPSND | +UTGSINK | D* | H | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | |

| AT command | | Phonebook | | | | |
|---|---|---|---|---|---|---|
| | | +CPBF | +CPBR | +CPBS | +CPBW | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | |

| AT command | | Device lock | | | | | |
|---|---|---|---|---|---|---|---|
| | | +CLCK | +CPIN | +CPWD | +UPINCNT | +USIMLCK | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | |

| AT command | | Serial interface | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | &C | &D | &F | &K | &S | &V | &W | &Y | +CMUX | +ICF | +IFC | +IPR | E | O | Q | S12 | S2 | S3 | S4 | S5 | S7 | V | Z |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |

| AT command | | Serial interface | |
|---|---|---|---|
| | | 9 | |
| SARA | R500S-00B / R510S-00B | • | |
| | R510M8S-00B | • | |

| AT command | | Short Messages Service | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +CGSMS | +CMGD | +CMGF | +CMGL | +CMGR | +CMGS | +CMGW | +CMMS | +CMSS | +CNMA | +CNMI | +CPMS | +CRES | +CSAS | +CSCA | +CSCB | +CSDH | +CSMP | +CSMS | +UCMGP | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |

| AT command | | SIM functionalities | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +CCHC | +CCHO | +CGLA | +CLAN | +CRLA | +CRSM | +CSIM | +CUAD | +UBIP | +UCATPROF | +UCSP | +UDCONF=50 | +USIMSTAT | +UUICC | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |

| AT command | | System features | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +UANTR | +UCTS | +UFACTORY | +UFOTA | +UFOTASTAT | +UFWINSTALL | +UFWUPD | +ULGASP | +URING | +USIO | +USTS | +UTEST | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | |

| AT command | | Power management | | | | | |
|---|---|---|---|---|---|---|---|
| | | +CEPPI | +CPSMS | +UCPSMS | +UPSMR | +UPSV | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | |

| AT command | | Internet protocol transport layer | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +UDCONF=1 | +UDCONF=10 | +UDCONF=5 | +UDCONF=6 | +UDCONF=7 | +UDCONF=8 | +UIPCHGN | +USOCL | +USOCLCFG | +USOCO | +USOCR | +USOCTL | +USODL | +USOER | +USOGO | +USOLI | +USORD | +USORF | +USOSEC | +USOSO | +USOST | +USOWR | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |

| AT command | | MQTT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | +UMQTT | +UMQTTC | +UMQTTER | +UMQTTNV | +UMQTTSN | +UMQTTSNC | +UMQTTSNER | +UMQTTSNNV | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | |
| | R510M8S-00B | • | • | • | • | • | • | • | • | |

| AT command | | CoAP | | | |
|---|---|---|---|---|---|
| | | +UCOAP | +UCOAPC | +UCOAPER | |
| SARA | R500S-00B / R510S-00B | • | • | • | |
| | R510M8S-00B | • | • | • | |

| AT command | | Lightweight M2M | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | +ODIS | +ULWM2M | +ULWM2MADD | +ULWM2MCONFIG | +ULWM2MCONFIGEXT | +ULWM2MCREATE | +ULWM2MDELETE | +ULWM2MDEREG | +ULWM2MLIST | +ULWM2MNOTIFY | +ULWM2MPULSE | +ULWM2MREAD | +ULWM2MREG | +ULWM2MREMOVE | +ULWM2MSTAT | +ULWM2MWRITE | |
| SARA | R500S-00B / R510S-00B | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | |
| | R510M8S-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) |
| &D | DTR status | No | 1 (DTR enabled) |
| &K | Flow control status | No | • SARA-R5 - 3 (RTS/CTS DTE flow control enabled) |
| &S | DSR override | No | 1 (DSR line set to ON in data mode and to OFF in command mode) |
| +CGREG | GPRS network registration status reporting | Yes | • SARA-R5 - The command settings is not stored in the personal profile |
| +CMEE | Mobile termination error reporting | Yes | • SARA-R5 - The command settings is not stored in the personal profile |
| +CMGF | Preferred message format | Yes | 0 (format of messages in PDU mode) |
| +CNMI | New message indication | Yes | • 1 (discard indication and reject new received message URCs when MT-DTE link is reserved)<br>• 0 (no SMS-DELIVER indications are routed to the TE)<br>• 0 (no CBM indications to the DTE)<br>• 0 (no SMS-STATUS-REPORTs are routed to the DTE)<br>• 0 (MT buffer of URCs defined within this command is flushed to the DTE when >mode< 1...3 is entered) |
| +COPS | Operator selection | Yes | • 0 (autoregistration enabled)<br>• 0 (operator expressed in long alphanumeric format)<br>• FFFFF (undefined PLMN to register when +COPS: 1) |
| +CPMS | Preferred message storage | No | • SARA-R5 - The command setting is stored in the NVM |
| +CREG | Network registration status reporting | Yes | • SARA-R5 - The command settings is not stored in the personal profile |
| +CSCA | Service center address | No | • SARA-R5 - The command setting is not stored in the personal profile |
| +CSCB | Cell broadcast message types | No | • SARA-R5 - The command setting is not stored in the personal profile |
| +CSMP | Select message service | No | • SARA-R5 - The command setting is not stored in the personal profile |
| +CSCS | Select character set configuration | No | • SARA-R5 - The command setting is not stored in the personal profile |
| +CSMS | Select message service | No | • SARA-R5 - The command setting is not stored in the personal profile |
| +ICF | DTE-DCE character framing | No | • SARA-R5 - 3, 1 (framing format: 8 data 1 stop, no parity) |
| +IFC | DTE-DCE local flow control | No | 2 (<DCE_by_DTE> on circuit 106 (CTS)), 2 (<DTE_by_DCE> on circuit 105 (RTS)) |
| +IPR | Baud rate | No | • SARA-R5 - 0 (autobauding enabled) |
| +UPSV | Power saving control | Yes | • SARA-R5 - 0 (power saving disabled) |

| AT command | Description | AT interface configuration sharing | Factory-programmed value / Remarks |
|---|---|---|---|
| +USIO | Serial interfaces configuration | Yes | • SARA-R5 - The command setting is stored in the NVM |
| +USTS | Smart temperature supervisor | Yes | • SARA-R5 - 0 (smart temperature feature disabled) |
| E | Echo status | No | 1 (echo enabled) |
| Q | Result code suppression | No | 0 (DCE transmits result codes) |
| S0 | Automatic answer | No | 0 (automatic answering disabled) |
| S2 | Escape character selection | No | 43 (043 corresponds the '+' character) |
| S3 | Command line termination character | No | 13 (0x0d corresponds to the carriage return character) |
| S4 | Response formatting character | No | 10 (0x0a corresponds to the line feed character) |
| S5 | Command line editing character | No | 8 (008 corresponds to the backspace character) |
| S7 | Connection completion timeout | No | 60<br>• SARA-R5 - The command setting is not stored in the personal profile |
| V | DCE response format | No | 1 (Verbose response text) |

## B.2 Parameters stored in non volatile memory

The following table lists the AT commands which setting can be stored in the non volatile memory with their parameters and the factory-programmed values.

| AT command | Description | Factory-programmed value / Comment |
|---|---|---|
| E | Echo status | • SARA-R5 - The command setting is stored in the personal profile. |
| &Y | Designate a default reset profile | 0 (profile 0 selected) |
| +CALA | Alarm | No alarms are stored |
| +CCLK | Clock | • SARA-R5 - "04/01/01,00:00:00+00" |
| +CEDRXS | eDRX setting | 0 (use of eDRX disabled) |
| +CEMODE | UE modes of operation for EPS | • SARA-R5 - 2 (CS/PS mode 2 of operation; "data centric") |
| +CGDCONT | PDP context definition | • SARA-R5 - all contexts are undefined |
| +CGSMS | Select service for MO SMS messages | • 1 (CS service selected) |
| +CPMS | Preferred message storage | • SARA-R5 - <mem1>, <mem2> and <mem3> are set to "MT"= "ME"+"SM" with "ME" preferred |
| +CPSMS | Power Saving Mode setting | • SARA-R5 - 0 (PSM disabled) |
| +CSCA | Service center address setting | • SARA-R5 - The command setting is not stored in NVM |
| +CSCB | Accepted cell broadcast message types configuration | • SARA-R5 - The command setting is not stored in NVM |
| +CSCON | Connection status signalling | • SARA-R5 - 0 (URC disabled) |
| +CSCS | Select character set configuration | • SARA-R5 - The command setting is not stored in the NVM |
| +CSGT | Set greeting text | Greeting text is empty |
| +CSMS | Message service configuration | • SARA-R5 - The command setting is not stored in NVM |
| +CTZR | Time zone reporting | • SARA-R5 - The command setting is not stored in NVM |
| +CTZU | Automatic time zone update | • SARA-R5 - 1 (automatic time zone via NITZ enabled) |
| +IPR | Baud rate | • SARA-R5 - The command setting is stored in the personal profile |

| AT command | Description | Factory-programmed value / Comment |
|---|---|---|
| +UBANDMASK | Band selection bitmask | LTE-M bands bitmask (decimal value):<br>• SARA-R5 - 185473183 (bands 1,2,3,4,5,8,12,13,18,19,20,25,26 and 28)<br>NB-IoT bands bitmask (decimal value):<br>• SARA-R5 - LTE Cat NB1 is not supported |
| +UBIP | Bearer Independent Protocol status indication | 0 (BIP status indication disabled) |
| +UCOAP | CoAP profile configuration | Empty profile |
| +UCTS | CTS line state in case of disabled HW flow control | 0 (legacy behavior: CTS line is set to ON state if HW flow control is disabled) |
| +UDCONF=9 | Uplink user data plane configuration | 1 (uplink user data plane enabled) |
| +UDCONF=50 | SIM hot insertion detection | 0 (disabled) |
| +UDCONF=66 | IPv6 configuration | • SARA-R5 - 3 (IPv6 interface identifier (IID) randomization) |
| +UDCONF=75 | PDP IP configuration when roaming | • SARA-R5 - No context is defined |
| +UDCONF=76 | Disable data when roaming | • SARA-R5 - No context is defined |
| +UDCONF=81 | Integrity check on test networks configuration | • SARA-R5 - 1 (integrity check on test networks enabled) |
| +UDYNDNS | Dynamic DNS | 0 (Client disabled), 0 (TZO.com as dynamic DNS service provider), "" (Domain name empty), "" (Username empty), "" (Password empty) |
| +UFACTORY | Restore factory configuration | 0 (no FS factory restore), 0 (no NVM factory restore) |
| +UFOTASTAT | FOTA reporting | • SARA-R5 - The command setting is not stored in the NVM |
| +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 | • SARA-R5 - The command setting is not stored in the NVM |
| +UGPIOC | GPIO functionality setting | • SARA-R5 - GPIO1: 255, GPIO2: 255, GPIO3: 255, GPIO4: 255, EXT_INT: 255, GPIO5: 255, GPIO6: 255 |
| +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) |
| +UGVTG | Get course over ground and ground speed | 0 (NMEA $VTG messages disabled) |
| +UGZDA | Get GPS time and date | 0 (NMEA $ZDA messages disabled) |
| +UIPCHGN | IP change notification | 0 (IP change notification disabled) |
| +UJAD | Smart jamming detection | • SARA-R5 - 0 (smart jamming detection disabled) |
| +ULGASP | Last gasp configuration | • SARA-R5<br>o <GPIO_mode>: 0 (disabled)<br>o <text>: "Last Gasp"<br>o <msg_format>: 0 (text)<br>o <tel_number>: "" (empty)<br>o <profile_id>: 0<br>o <IP_protocol>: 17 (UDP)<br>o <IP_addr:PORT>: "" (empty) |

| AT command | Description | Factory-programmed value / Comment |
|---|---|---|
| | | o <method>: 0 (send SMS)<br>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 | • SARA-R5 - The command setting is not stored in the NVM |
| +ULWM2M | LwM2M client activation/ deactivation | • SARA-R5 - 0 (LwM2M client enabled) |
| +ULWM2MNOTIFY | LwM2M object notification | • SARA-R5 - 0 (+ULWM2MNOTIFY URCs disabled) |
| +ULWM2MPULSE | Lightweight M2M pulse configuration | No GPIO pins are configured as LwM2M pulse |
| +ULWM2MSTAT | LwM2M reporting | • SARA-R5 - 0 (LwM2M status +ULWM2MSTAT URC disabled) |
| +UMNOPROF | MNO profile configuration | • SARA-R5 - 2 (AT&T) |
| +UPSV | Power saving control | • SARA-R5 - The command setting is stored in the personal profile |
| +UPSD | Packet switched data | • SARA-R5 - The command setting is not stored in the NVM |
| +UPSMR | PSM indication | 0 (PSM URC disabled) |
| +URAT | Selection of Radio Access Technology | • SARA-R5 - 7 (LTE Cat.M1) |
| +URATCONF | Radio manager configuration | 0 (radio manager disabled) |
| +URING | RING line handling | 0 (feature disabled (RING line is only asserted on incoming call and incoming SMS)) |
| +URPM | RPM activation | 0 (Radio Policy Manager deactivated) |
| +URPMCONF | Radio Policy Manager (RPM) configuration | <PLMN> empty, i.e. no PLMNs available |
| +USECMODE | Secure data suite features configuration | 1 (secure data suite features enabled) |
| +USIMSTAT | (U)SIM initialization status reporting | 0 (URC +UUSIMSTAT disabled) |
| +USIO | Serial interfaces configuration | • SARA-R5 - 0 (AT command on 7-wire UART, diagnostic log on USB-NCM, SPI and SDIO, no AUX UART) |
| +USOCLCFG | Configure Dormant Close Socket Behavior | 1 (TCP socket Graceful Dormant Close feature enabled) |
| +UTEST | End user test | Antenna dynamic tuner control: 0 (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)<br>• 1,1,"IMS","ipv4v6","LTE","Enabled",0<br>• 2,2,"VZWADMIN","ipv4v6","LTE","Enabled",0<br>• 3,3,"VZWINTERNET","ipv4v6","LTE","Enabled",0<br>• 4,4,"VZWAPP","ipv4v6","LTE","Enabled",0<br>• 6,6,"ENTERPRISE","ipv4v6","LTE","Enabled",0<br>• 7,7,"THINGSPACE","ipv4v6","LTE","Enabled",0<br>Class 1 APN in table above may differ from the one here specified. Refer to +VZWAPNE for details. |

## B.3 Saving AT commands configuration

The following procedure can be used to store the AT commands configuration for the AT commands listed in Appendix B.1:

- SARA-R5 - Write the run-time configuration of the AT commands listed in Appendix B.1 to the RAM profile mirror by means of the AT&W command (e.g. AT&W0)
- SARA-R5 - Confirm that the boot loading is performed with the desired parameter profile (e.g. profile 0 if the parameter save was performed with AT&W0; use AT&Y0 to select this)

The following procedure can be used to store the AT commands configuration for the AT commands listed in Appendix B.2:

- SARA-R5 - Since the permanently saving of NVM content is achieved by a low priority process, the time depends on all the other activities as network procedures, call management, and so on. To be sure to save suddenly the run-time configuration of the commands listed in Appendix B.2, it is advisable to use +CPWROFF or +CFUN=15 or +CFUN=16. If the +CPWROFF has been issued the module, perform a reboot of the device

## B.4 Estimated command response time

After having sent a command to a u-blox cellular module, the time to obtain a resulting result code depends on the SIM and the network. It is possible to have an immediate response if the command does not interact with either the network or the SIM.

The following table reports the maximum time to get the result code for the AT commands. The commands are grouped by categories.

| Category | Estimated maximum time to get response | Commands |
|---|---|---|
| Power off | < 40 s | +CPWROFF |
| Set module functionality | Up to 3 min | +CFUN |
| Call control | < 20 s | H |
| Dial | Up to 3 min | D |
| Data connection commands | Up to 3 min | +CGATT, +CGDATA, +UPSDA |
| Network commands | • SARA-R5 - Up to 3 min | +COPS |
| Network commands | < 10 s | +URAT |
| Operator name | Up to 1 s | +UDOPN |
| Cell information | < 5 s | +UCELLINFO |
| Security | Up to 3 min | +CLCK, +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, +CMGL, +CMSS, +CMGS |
| SIM management | < 10 s | +CMGW, +CMGR, +UCMGP, +CNUM, +CPIN, +CPOL, +CRES, +CRSM, +CSCA, +CSCB, +CSMP |
| PDP context activation | < 150 s | +CGACT |
| PDP context deactivation | < 40 s | +CGACT |
| Restore configuration | < 5 s | +UFACTORY |
| End user test (antenna dynamic tuner control) | Up to 1 s | +UTEST |
| GPIO commands | < 10 s | +UGPIOC, +UGPIOR, +UGPIOW |
| Internet suite (socket connect) | • SARA-R5 - < 20 s for IP address, < 130 s with an hostname | +USOCO |
| Internet suite (socket connect with SSL) | • SARA-R5 - < 20 s<br>• SARA-R5 - < 120 s | +USOSEC |
| Internet suite (socket write) | • SARA-R5 - < 1 s | +USOWR |
| Internet suite (UDP socket write) | • SARA-R5 - < 20 s for IP address, < 130 s with an hostname | +USOST |

| Category | Estimated maximum time to get response | Commands |
|---|---|---|
| Internet suite (socket closure) | • SARA-R5 - < 1 s | +USOCL |
| Internet suite | • SARA-R5 - < 1 s | +USODL, +USOLI, +USORD, +USORF |
| Resolve name/IP number through DNS | • SARA-R5 - < 130 s | +UDNSRN |
| Security suite | < 30 s | +USECMODE, +USECDEVINFO, +USECFW, +USECC2C, +USECDEVCERT, +USECDATAENC, +USECDATADEC, +USECFILEENC, +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 |
| Time information | < 10 s | +UTIME |
| Last gasp configuration | < 10 s | +ULGASP |
| MQTT command | • SARA-R5 - immediate | +UMQTTC |
| Firmware update | • SARA-R5 - < 10 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 30 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) |

| AT command | UART / AUX UART (where available) | Multiplexer | USB (where available) | SPI (where available) |
|---|---|---|---|---|
| \Q | Effective | When it returns OK (the configuration is allowed), it is effective | When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile) | When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile) |
| +ICF | Effective | Returns OK, but it is not effective (only change the value in the AT command profile) | Returns OK, but it is not effective (only change the value in the AT command profile) | Returns OK, but it is not effective (only change the value in the AT command profile) |
| +IFC | Effective | When it returns OK (the configuration is allowed), it is effective | When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile) | When it returns OK (the configuration is allowed), it is not effective (only change the value in the AT command profile) |
| +IPR | Effective | Returns OK, but it is not effective (only change the value in the AT command profile) | Returns OK, but it is not effective (only change the value in the AT command profile) | Returns OK, but it is not effective (only change the value in the AT command profile) |
| +UPSV | Effective | Returns OK, but it changes UART setting | Returns OK, but it changes UART setting | Returns OK, but it changes UART setting |

**Table 30: Interface comparison**

## B.6 Mobile Network Operator profiles

By means of +UMNOPROF AT command the module is able to manage different MNO profiles that configure the module according with the MNO configuration. 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.

- SARA-R5
  - o SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 Americas MNO profiles
  - o SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 EMEA MNO profiles

| SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 Americas MNO profiles | | | | |
|---|---|---|---|---|
| | **Regulatory** | **AT&T** | **Verizon** | **GCF-PTCRB** |
| **MNO profile** | | | | |
| <MNO> | 0 | 2 | 3 | 201 |
| **LwM2M feature** | | | | |
| Available | No | Yes | Yes | No |
| +UBANDMASK | | | | |
| LTE-M bands [decimal value] | 1, 2, 3, 4, 5, 8, 12, 13, 18, 19, 20, 25, 26, 28 [185473183] | 2, 4, 5, 12 [2074] | 4, 13 [4104] | 1, 2, 3, 4, 5, 8, 12, 13, 18, 19, 20, 25, 26, 28 [185473183] |
| Locked | No | No | No | No |
| +CGDCONT | | | | |
| Data profile 1 | IPV4V6,"" | IPV4V6,"" | IPV4V6,"" | IPV4V6,"" |
| Data profile 2 | empty | empty | IPV4V6, "VZWADMIN" | empty |
| Data profile 3 | empty | empty | IPV4V6, "VZWINTERNET" | empty |
| Data profile 4 | empty | empty | IPV4V6, "VZWAPP" | empty |

| SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 Americas MNO profiles | | | | |
|---|---|---|---|---|
| | **Regulatory** | **AT&T** | **Verizon** | **GCF-PTCRB** |
| Data profile 6 | empty | empty | IPV4V6, "VZWCLASS6" | empty |
| Data profile 7 | empty | empty | IPV4V6, "VZWCLASS7" | empty |
| +UFGI | | | | |
| FGI | 0xee0dd88a | 0xee0d1882 | 0xee0dd88a | 0xee0dd88a |
| FGI R9 | 0 | 0 | 0 | 0 |
| FGI R10 | 0x40020000 | 0x40000000 | 0x40020000 | 0x40020000 |
| +ULWM2MREG | | | | |
| Supported server ID | 0 | 0,3,721 | 100, 101, 102, 1000, 721 | 0 |
| Locked | No | No | No | No |
| +ULWM2MCONFIG | | | | |
| Configured server ID | 0 | 0,3,721 | 100, 101, 102, 1000, 721 | 0 |
| Locked | No | No | No | No |
| +ULWM2MCONFIGEXT | | | | |
| Connection teardown timer | 90 | 90 | 60 | 90 |
| Out of coverage timer | 20 | 20 | 20 | 20 |
| Communication retry timer | 30 | 30 | 30 | 30 |
| Communication retry count | 4 | 4 | 4 | 4 |
| General data cid | 1 | 1 | 1 | 1 |
| Locked | No | No | No | No |

**Table 31: SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 Americas MNO profiles**

| SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 EMEA MNO profiles | | |
|---|---|---|
| | **Global** | **Standard Europe** |
| **MNO profile** | | |
| <MNO> | 90 | 100 |
| **LwM2M feature** | | |
| Available | Yes | Yes |
| +UBANDMASK | | |
| LTE-M bands [decimal value] | 1, 2, 3, 4, 5, 8, 12, 13, 18, 19, 20, 25, 26, 28 [185473183] | 3, 8, 20 [524420] |
| Locked | No | No |
| +CGDCONT | | |
| Data profile 1 | IPV4V6,"" | IPV4V6,"" |
| Data profile 2 | empty | empty |
| Data profile 3 | empty | empty |
| Data profile 4 | empty | empty |
| Data profile 6 | empty | empty |
| Data profile 7 | empty | empty |
| +UFGI | | |
| FGI | 0xee0dd88a | 0xee0dd88a |
| FGI R9 | 0 | 0 |
| FGI R10 | 0x40020000 | 0x40020000 |
| +ULWM2MREG | | |

| SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 EMEA MNO profiles | | |
|---|---|---|
| | **Global** | **Standard Europe** |
| Supported server ID | 721 | 721 |
| Locked | No | No |
| +ULWM2MCONFIG | | |
| Configured server ID | 721 | 721 |
| Locked | No | No |
| +ULWM2MCONFIGEXT | | |
| Connection teardown timer | 90 | 90 |
| Out of coverage timer | 20 | 20 |
| Communication retry timer | 30 | 30 |
| Communication retry count | 4 | 4 |
| General data cid | 1 | 1 |
| Locked | No | No |

**Table 32: SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 EMEA MNO profiles**

# C Appendix: Glossary

| | |
|---|---|
| 2G | 2nd Generation |
| 3G | 3rd Generation |
| 3GPP | 3rd Generation Partnership Project |
| ADC | Analog to Digital Converter |
| AIeC | Automatically Initiated eCall |
| ADN | Abbreviated Dialing Numbers |
| AMR | Adaptive Multi Rate |
| AP | Access Point |
| APN | Access Point Name |
| ASCII | American Standard Code for Information Interchange |
| AT | AT Command Interpreter Software Subsystem, or attention |
| BL | Black List |
| BSD | Berkley Standard Distribution |
| CB | Cell Broadcast |
| CBM | Cell Broadcast Message |
| CLI | Calling Line Identification |
| CLIP | Calling Line Identification Presentation |
| CLIR | Calling Line Identification Restriction |
| COLP | Connected Line Identification Presentation |
| COLR | Connected Line Identification Restriction |
| CM | Connection Management |
| CPHS | Common PCN Handset Specification |
| CR | Carriage Return |
| CS | Circuit Switch |
| CSD | Circuit-Switched Data |
| CSG | Closed Subscriber Group |
| CTS | Clear To Send |
| CUG | Closed User Group |
| DA | Destination Address |
| DARP | Downlink Advanced Receiver Performance |
| DCD | Data Carrier Detect |
| DCE | Data Communication Equipment |
| DCM | Data Connection Management |
| DHCP | Dynamic Host Configuration Protocol |
| 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 |
| EEP | EEPROM Emulation Parameters |
| EF | Elementary File |
| $EF_{CGST}$ | Elementary File "Closed Subscriber Group Type" |
| $EF_{HNBN}$ | Elementary File "Home Node B Number" |
| $EF_{PLMNwAcT}$ | Elementary File "User controlled PLMN Selector with Access Technology" |
| eIM | eCall In-band Modem |
| EONS | Enhanced Operator Name from SIM-files $EF_{OPL}$ and $EF_{PNN}$ |
| EPD | Escape Prompt Delay |
| ETSI | European Telecommunications Standards Institute |
| E-UTRAN/EUTRAN | Evolved UTRAN |

| | |
|---|---|
| FDN | Fixed Dialling Number |
| FOAT | Firmware Over AT |
| FOTA | Firmware Over The Air |
| FS | File System |
| FTP | File Transfer Protocol |
| FW | Firmware |
| FWINSTALL | Firmware Install |
| GAS | Grouping information Alpha String |
| GERAN | GSM/EDGE Radio Access Network |
| GPIO | General Purpose Input Output |
| GPRS | General Packet Radio Service |
| GPS | Global Positioning System |
| GSM | Global System for Mobile Communications |
| HDLC | High Level Data Link Control |
| HNB | Home Node B |
| HPLMN | Home PLMN |
| HTTP | HyperText Transfer Protocol |
| I | Information |
| $I^2C$ | Inter-Integrated Circuit |
| $I^2S$ | Inter IC Sound or Integrated Interchip Sound |
| ICCID | Integrated Circuit Card ID |
| ICMP | Internet Control Message Protocol |
| ICP | Inter Processor Communication |
| IMEI | International Mobile Equipment Identity |
| IMSI | International Mobile Station Identity |
| InBM | In-Band Modem (generic) |
| IP | Internet Protocol |
| IRA | International Reference Alphabet |
| IRC | Intermediate Result Code |
| ISDN | Integrated Services Digital Network |
| ISP | Internet Service Provider |
| IVS | In-Vehicle System (eCall related) |
| L3 | Layer 3 |
| LCP | Link Control Protocol |
| LF | Line Feed |
| LNS | Linux Network Subsystem |
| 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 |
| MSISDN | Mobile Systems International Subscriber Identity Number |
| MSPR | Multi-Slot Power Reduction |
| MT | Mobile Terminated |
| MWI | Message Waiting Indication |
| NAA | Network Access Application |
| NAS | Non Access Stratum |

| | |
|---|---|
| NITZ | Network Identity and Time Zone |
| NVM | Non-Volatile Memory |
| ODIS | OMA-DM IMEI Sync |
| OLCM | On Line Commands Mode |
| PAD | Packet Assembler/Disassembler |
| P-CID | Physical Cell Id |
| PCN | Personal Communication Network |
| PDP | Packet Data Protocol |
| PDU | Protocol Data Unit |
| PIN | Personal Identification Number |
| PLMN | Public Land Mobile Network |
| PPP | Point-to-Point Protocol |
| PSAP | Public Safety Answering Point (eCall related) |
| PSD | Packet-Switched Data |
| PUK | Personal Unblocking Key |
| QoS | Quality of Service |
| RAM | Random Access Memory |
| RDI | Restricted Digital Information |
| RFU | Reserved for Future Use |
| RNDIS | Remote Network Driver Interface Specification |
| RI | Ring Indicator |
| RTC | Real Time Clock |
| RTP | Real-time Transport Protocol |
| RTS | Request To Send |
| Rx | Receiver |
| SAP | SIM Access Profile |
| SC | Service Centre |
| SI | SIM Application Part Software Subsystem |
| SIP | Session Initiation Protocol |
| SIM | Subscriber Identity Module |
| SMS | Short Message Service |
| SMSC | Short Message Service Center |
| SMTP | Simple Mail Transfer Protocol |
| SoR | Steering of Roaming |
| SDIO | Secure Digital Input Output |
| SES | Speech Enhancement System |
| STA | station |
| SSID | Service Set Identifier |
| TA | Terminal Adaptor |
| TCP | Transfer Control Protocol |
| TE | Terminal Equipment |
| TFT | Traffic Flow Template |
| TP | Transfer layer Protocol |
| Tx | Transmitter |
| TZ | Time Zone |
| UCS2 | Universal Character Set |
| UDI | Unrestricted Digital Information |
| UDP | User Datagram Protocol |
| UI | Unnumbered Information |
| UICC | Universal Integrated Circuit Card |
| UIH | Unnumbered Information with header Check |
| URC | Unsolicited Result Code |
| USIM | UMTS Subscriber Identity Module |
| UTRAN | Universal Terrestrial Radio Access Network |
| UUS1 | User-to-User Signalling Supplementary Service 1 |
| WLAN | Wireless Local Area Network |

# Related documents


1. Stevens. TCP/IP Illustrated Volume1 & 2 Addison-Wesley, 1994.
2. 3GPP TS 27.007 - Technical Specification Group Core Network and Terminals; AT command set for User Equipment (UE)
3. 3GPP TS 22.004 - General on supplementary services
4. GSM 02.04 - Digital cellular telecommunication system (Phase 2+); Mobile Stations (MS) features
5. 3GPP TS 22.030 - Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Man-Machine Interface (MMI) of the User Equipment (UE)
6. 3GPP TS 22.090 - Unstructured Supplementary Service Data (USSD); Stage 1
7. 3GPP TS 23.038 - Alphabets and language-specific information
8. 3GPP TS 23.040 - Technical realization of Short Message Service (SMS)
9. 3GPP TS 23.041 - Technical realization of Cell Broadcast Service (CBS)
10. 3GPP TS 23.060 - Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description
11. 3GPP TS 24.007 - Mobile radio interface signalling layer 3; General aspects
12. 3GPP TS 24.008 - Mobile radio interface layer 3 specification
13. 3GPP TS 24.011 - Point-to-point (PP) Short Message Service (SMS) support on mobile radio interface
14. GSM 04.12 - Digital cellular telecommunications system (Phase 2+); Short Message Service Cell Broadcast (SMSCB) Support on Mobile Radio Interface.
15. 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)
16. 3GPP TS 27.060 - Technical Specification Group Core Network; Packet Domain; Mobile Station (MS) supporting Packet Switched Services
17. 3GPP TS 51.011 - Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface
18. 3GPP TS 31.102 - Characteristics of the Universal Subscriber Identity Module (USIM) application
19. ITU-T Recommendation V250, 05-99.
20. ITU-T V.25ter - ITU-T V.25 ter Recommendation: Data Communications over the Telephone Network; Serial asynchronous automatic Dialling and control.
21. ITU-T T.32 - ITU-T Recommendation T.32 Asynchronous Facsimile DCE Control - Service Class 2
22. ISO 639 (1988) Code for the representation of names of languages
23. ITU-T Recommendation V24, 02-2000. List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Connection Equipment (DCE).
24. RFC 791 - Internet Protocol - http://www.ietf.org/rfc/rfc791.txt
25. RFC 2460 - Internet Protocol, Version 6 (IPv6) - http://www.ietf.org/rfc/rfc2460.txt
26. 3GPP TS 05.08 - Radio subsystem link control
27. 3GPP TS 22.087 - User-to-User Signalling (UUS)
28. 3GPP TS 22.022 - Personalisation of Mobile Equipment (ME)
29. 3GPP TS 22.082 - Call Forwarding (CF) supplementary services
30. 3GPP TS 22.083 - Call Waiting (CW) and Call Holding (HOLD)
31. 3GPP TS 22.081 - Line identification Supplementary Services- Stage 1
32. 3GPP TS 23.081 - Line identification supplementary services- Stage 2
33. 3GPP TS 22.086 - Advice of Charge (AoC) Supplementary Services
34. 3GPP TS 22.024 - Description of Charge Advice Information (CAI)
35. 3GPP TS 22.085 - Closed User Group (CUG) Supplementary Services
36. 3GPP TS 22.096 - Name identification supplementary services
37. 3GPP TS 04.18 - Mobile radio interface layer 3 specification; Radio Resource Control (RRC) protocol
38. 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
39. 3GPP TS 05.02 - Multiplexing and Multiple Access on the Radio Path
40. 3GPP TS 51.014 - Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface

41. 3GPP TS 27.010 V3.4.0 - Terminal Equipment to User Equipment (TE-UE) multiplexer protocol (Release 1999)
42. 3GPP TS 22.060 - General Packet Radio Service (GPRS); Service description; Stage 1
43. ETSI TS 102 223 - Smart cards; Card Application Toolkit (CAT)
44. 3GPP TS 25.306 - UE Radio Access capabilities
45. RFC3267 - 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
46. RFC 792 Internet Control Message Protocol (http://tools.ietf.org/html/rfc0792)
47. 3GPP TS 22.002 - Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN)
48. 3GPP TS 22.067 - enhanced Multi Level Precedence and Pre-emption service (eMLPP); Stage 1
49. AT&T: Device Requirements -- Requirements Document -- Document Number 13340 -- Revision 4.6 -- Revision Date 9/2/11
50. 3GPP TS 23.972 - Circuit switched multimedia telephony
51. 3GPP TS 24.615 Communication Waiting (CW) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol Specification
52. 3GPP TS 25.101 - User Equipment (UE) radio transmission and reception (FDD)
53. 3GPP TS 45.005 - Radio transmission and reception
54. Common PCN Handset Specification v4.2
55. SIM Access Profile - Interoperability Specification - Bluetooth Specification V11r00
56. 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)
57. 3GPP TS 23.122 - NAS Functions related to Mobile Station (MS) in idle mode
58. ETSI TS 122 101 V8.7.0 (2008-01) Service aspects; Service principles (3GPP TS 22.101 version 8.7.0 Release 8)
59. BS EN 16062:2015 Intelligent transport systems - ESafety - eCall high level application requirements (HLAP) using GSM/UMTS circuit switched networks, April 2015
60. 3GPP TS 26.267 V12.0.0 (2012-12) eCall Data Transfer; In-band modem solution; General description (Release 12)
61. 3GPP TS 51.010-1 Mobile Station (MS) conformance specification; Part 1: Conformance specification
62. RFC 959 File Transfer Protocol (http://tools.ietf.org/html/rfc959)
63. RFC 2428 FTP Extensions for IPv6 and NATs (https://tools.ietf.org/html/rfc2428)
64. 3GPP TS 23.014 Support of Dual Tone Multi-Frequency (DTMF) signalling V11.0.0 (2012-09)
65. 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)
66. 3GPP TS 51.010-2 Mobile Station (MS) conformance specification; Part 2: Protocol Implementation Conformance Statement (PICS) proforma specification
67. 3GPP TS 34.121-2 User Equipment (UE) conformance specification; Radio transmission and reception (FDD); Part 2: Implementation Conformance Statement (ICS)
68. PCCA standard - Command set extensions for CDPD modems, Revision 2.0, March, 1998
69. 3GPP TS 24.301 Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3
70. 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
71. 3GPP TS 23.221 Architectural requirements
72. 3GPP TS 23.203 Policy and charging control architecture
73. 3GPP TS 31.101 UICC-terminal interface; Physical and logical characteristics
74. ETSI TS 102 221 V8.2.0 (2009-06) Smart Cards; UICC-Terminal interface; Physical and logical characteristics (Release 8)
75. RFC 4291 - IP Version 6 Addressing Architecture (http://tools.ietf.org/html/rfc4291)
76. 3GPP TS 25.305 User Equipment (UE) positioning in Universal Terrestrial Radio Access Network (UTRAN); Stage 2
77. 3GPP TS 23.032: Universal Geographical Area Description (GAD)
78. 3GPP TS 25.331 Radio Resource Control (RRC); Protocol specification
79. 3GPP TS 36.101 Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception
80. 3GPP TS 24.173 IMS Multimedia telephony communication service and supplementary services; Stage 3

**81.** 3GPP TS 24.341 Support of SMS over IP networks; Stage 3
**82.** 3GPP TS 24.229 IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); Stage 3
**83.** 3GPP TS 36.306 Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities
**84.** 3GPP TS 36.133 Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management
**85.** 3GPP TS 25.133 Requirements for support of radio resource management (FDD)
**86.** 3GPP TS 22.071 Location Services (LCS); Service description
**87.** IEC 61162 Digital interfaces for navigational equipment within a ship
**88.** 3GPP TS 36.331 Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (Release 10)
**89.** 3GPP TS 24.167 3GPP IMS Management Object (MO); Stage 3
**90.** ITU-T E.212 - Series E: Overall network operation, telephone service, service operation and human factors
**91.** RFC 793 - Transmission Control Protocol (TCP) Protocol Specification (https://www.rfc-editor.org/rfc/rfc793.txt)
**92.** 3GPP TS 26.201 Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; Frame structure
**93.** 3GPP TS 24.216 Communication Continuity Management Object (MO)
**94.** 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)
**95.** 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)
**96.** 3GPP TS 23.003 Numbering, addressing and identification
**97.** 3GPP TS 31.111 Universal Subscriber Identity Module (USIM) Application Toolkit (USAT)
**98.** RFC 3969 - The Internet Assigned Number Authority (IANA) Uniform Resource Identifier (URI) Parameter Registry for the Session Initiation Protocol (SIP)
**99.** RFC 3261 - SIP: Session Initiation Protocol
**100.** RFC 5341 - The Internet Assigned Number Authority (IANA) tel Uniform Resource Identifier (URI) Parameter Registry
**101.** RFC 3966 - The tel URI for Telephone Numbers
**102.** RFC 2141 - URN Syntax
**103.** RFC 3406 - Uniform Resource Names (URN) Namespace Definition Mechanisms
**104.** RFC 5031 - A Uniform Resource Name (URN) for Emergency and Other Well-Known Services
**105.** 3GPP TS 22.084 MultiParty (MPTY) supplementary service; Stage 1
**106.** 3GPP TS 24.607 Originating Identification Presentation (OIP) and Originating Identification Restriction (OIR) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification
**107.** 3GPP TS 24.608 Terminating Identification Presentation (TIP) and Terminating Identification Restriction (TIR) using IP Multimedia (IM) Core Network (CN) subsystem; Protocol specification
**108.** 3GPP TS 36.213 Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures
**109.** 3GPP TS 36.212 Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding
**110.** RFC 4715 - The Integrated Services Digital Network (ISDN) Subaddress Encoding Type for tel URI
**111.** OMA Device Management V1.2.1 (http://technical.openmobilealliance.org/Technical/technical-information/release-program/current-releases/dm-v1-2-1)
**112.** RFC 5626 - Managing Client-Initiated Connections in the Session Initiation Protocol (SIP)
**113.** 3GPP TS 24.166 - 3GPP IP Multimedia Subsystem (IMS) conferencing Management Object (MO)
**114.** 3GPP TS 29.061 - Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)
**115.** 3GPP TS 24.303 - Mobility management based on Dual-Stack Mobile IPv6; Stage 3
**116.** 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
**117.** 3GPP TS 25.367 - Mobility procedures for Home Node B (HNB); Overall description; Stage 2
**118.** 3GPP TS 25.304 - User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode

**119.** 3GPP TS 36.304 - Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode
**120.** RFC 4867 - RTP Payload Format and File Storage Format for the Adaptive Multi-Rate (AMR) and Adaptive Multi-Rate Wideband (AMR-WB) Audio Codecs
**121.** RFC 4733 - RTP Payload for DTMF Digits, Telephony Tones, and Telephony Signals
**122.** 3GPP2 C.S0015-0 - Short Message Service
**123.** RFC 1518 - An Architecture for IP Address Allocation with CIDR (https://tools.ietf.org/html/rfc1518)
**124.** RFC 1519 - Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy (https://tools.ietf.org/html/rfc1519)
**125.** 3GPP TS 45.008 - GSM/EDGE Radio Access Network; Radio subsystem link control
**126.** 3GPP TS 25.401 - Universal Mobile Telecommunications System (UMTS); UTRAN Overall Description
**127.** 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
**128.** 3GPP TS 36.211 - Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation
**129.** 3GPP TS 23.682 - Architecture enhancements to facilitate communications with packet data networks and applications
**130.** 3GPP TS 23.401 - General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access
**131.** GSMA TS.34 - IoT Device Connection Efficiency Guidelines
**132.** RFC 7252 - Constrained Application Protocol (CoAP)
**133.** Open Mobile Alliance (OMA) SyncML Common Specification, Version 1.2.2 (http://www.openmobilealliance.org/release/Common)
**134.** Open Mobile Alliance (OMA) - Lightweight Machine to Machine Technical Specification, Version 1.0
**135.** MQTT Version 3.1.1 - OASIS Standard
**136.** MQTT-SN Protocol Specification Version 1.2
**137.** 3GPP TS 44.018 - Mobile radio interface layer 3 specification; GSM/EDGE Radio Resource Control (RRC) protocol
**138.** 3GPP TS 43.064 - General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2
**139.** 3GPP TS 36.321 - Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification
**140.** 3GPP TS 22.011 - Service accessibility
**141.** Device terminal access protocol-EDP technical specification, version 1.6
**142.** TOBY-L4 series data sheet, UBX-16009856
**143.** TOBY-L4 series system integration manual, UBX-16024839
**144.** TOBY-L2 series data sheet, UBX-13004573
**145.** MPCI-L2 series data sheet, UBX-13004749
**146.** TOBY-L2 / MPCI-L2 series system integration manual, UBX-13004618
**147.** LARA-R2 series data sheet, UBX-16005783
**148.** LARA-R2 series system integration manual, UBX-16010573
**149.** TOBY-R2 series data sheet, UBX-16005785
**150.** TOBY-R2 series system integration manual, UBX-16010572
**151.** SARA-R5 series data sheet, UBX-19016638
**152.** SARA-R5 series system integration manual, UBX-19041356
**153.** SARA-R4 series data sheet, UBX-16024152
**154.** SARA-R4 series system integration manual, UBX-16029218
**155.** SARA-U2 series data sheet, UBX-13005287
**156.** LISA-U2 series data sheet, UBX-13001734
**157.** LISA-U1 series data sheet, UBX-13002048
**158.** LISA-U1 / LISA-U2 series system integration manual, UBX-13001118
**159.** SARA-G450 data sheet, UBX-18006165
**160.** SARA-G450 system integration manual, UBX-18046432
**161.** SARA-G3 series data sheet, UBX-13000993

**162.** SARA-G3 / SARA-U2 series system integration manual, UBX-13000995
**163.** LEON-G1 series data sheet, UBX-13004887
**164.** LEON-G1 series system integration manual, UBX-13004888
**165.** SARA-N2 series data sheet, UBX-15025564
**166.** SARA-N3 series data sheet, UBX-18066692
**167.** SARA-N2 / SARA-N3 series system integration manual, UBX-17005143
**168.** Wi-Fi / cellular integration application note, UBX-14003264
**169.** u-blox multiplexer implementation application note, UBX-13001887
**170.** u-blox firmware update application note, UBX-13001845
**171.** SARA-R5 series firmware update with uFOTA, FOAT and EasyFlash application note, UBX-20033314
**172.** SARA-R4 series firmware update with uFOTA, FOAT and EasyFlash application note, UBX-17049154
**173.** GNSS implementation application note, UBX-13001849
**174.** SARA-R5 series positioning implementation application note, UBX-20012413
**175.** End user test application note, UBX-13001922
**176.** AT commands examples application note, UBX-13001820
**177.** SARA-R5 series application development guide, UBX-20009652
**178.** SARA-R4 series application development guide, UBX-18019856
**179.** SARA-N3 series application development guide, UBX-19026709
**180.** LwM2M objects and commands application note, UBX-18068860
**181.** NB-IoT application development guide, UBX-16017368
**182.** TOBY-L4 series eCall implementation in u-blox cellular modules application note, UBX-18019819
**183.** TOBY-L2 series audio application note, UBX-15015834
**184.** TOBY-L2 series networking modes application note, UBX-14000479
**185.** LISA-U1 / LISA-U2 audio application note, UBX-13001835
**186.** SARA-U2 audio application note, UBX-14002981
**187.** SARA-U2 series audio extended tuning application note, UBX-17012797
**188.** SARA-G3 audio application note, UBX-13001793
**189.** LEON-G1 audio application note, UBX-13001890
**190.** TOBY-L4 series extended audio application note, UBX-17065359
**191.** TOBY-L4 uCPU series Audio CSD API application note, UBX-18067601
**192.** RFC 8323 - CoAP (Constrained Application Protocol) over TCP, TLS, and WebSockets - https://www.ietf.org/rfc/rfc8323.txt
**193.** RFC 5280 - Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile - http://www.ietf.org/rfc/rfc5280.txt
**194.** RFC 7925 - TLS/DTLS IoT Profiles - https://www.ietf.org/rfc/rfc7925.txt
**195.** RFC 7959 - Block-Wise Transfers in the Constrained Application Protocol (CoAP) - https://www.ietf.org/rfc/rfc7959.txt


For regular updates to u-blox documentation and to receive product change notifications, register on our homepage.

# Revision history

| Revision | Date | Name | Comments |
|---|---|---|---|
| R01 | 17-Oct-2019 | lpah | Initial release |
| R02 | 14-Nov-2019 | lpah | Updated the document applicability to SARA-R510S-00B and SARA-R510M8S-00B<br><br>Modified commands: +COPS, +UDOPN, +UBIP, +CGDCONT, +CGACT, +CGTFTRDP, +CGEQOS, +CGEQOSRDP, +CGCONTRDP, +CGTFT, +UFACTORY, +ULGASP. |
| R03 | 20-Dec-2019 | lpah | Modified commands: Network services parameter description, +UCGED, +UCELLINFO, +UMETRIC, +VZWRSRQ, +CEDRXS, +CEDRXRDP, +CSCON, +UPCO, +CEREG, +UFWINSTALL, +UFWUPD, +CPSMS, +UCPSMS, GPIO Introduction, File System Introduction, +UDWNFILE, +USECMNG, +USECPRF, AT+USECMNG command example, FTP introduction, +UFTP, +UFTPC, +UFTPER, HTTP introduction, +UHTTP, +UHTTPAC, +UHTTPC, +UIFCONF, MQTT introduction, +UMQTT, +UMQTTWMSG, +UMQTTWTOPIC, +UMQTTC, MQTT-SN introduction, +UMQTTSN, +UMQTTSNC, +UMQTTSNER, Mobile termination error result codes +CME ERROR. |
| R04 | 06-Mar-2020 | lpah | Extended the document applicability to SARA-R500S-00B.<br><br>New commands: +CEINFO, +UDCONF=66, +CGAPNRC, +USECCONN, +USECFW, +USECC2C, +USECZTP, +UTIMECFG.<br><br>Modified commands: AT command settings, General Operations, +CSCS, +CFUN, S0, <MCC>, <MNC>, <LAC>, <CI>, <RxLev>, <RAC>, <scrambling_code>, <dl_frequency>, <ul_frequency>, <arfcn>, <rscp_lev>, <ecn0_lev>, <PhysCellID>, <TAC>, <LcellId>, <dl_EARFCN>, <ul_EARFCN>, <RSRP>, <RSRQ>, <BSIC>, +COPS, +URAT, +CRCES, +UCGED, +UMETRIC, +VZWAPNE, +CSCON, +CEDRXS, +CEDRXRDP, +UMNOPROF, +UBANDMASK, +CSMS, +CMGL, +CMGS, &D, +ICF, +IPR, S2, S3, S4, S5, S7, S12, +CLAN, <cid>, PPP LCP handshake behaviour, +CGDCONT, +UPSD, +UPSND, +CGACT, +CGEREP, +CGREG, +CGDSCONT, +CEMODE, +CEREG, +CGDEL, +UAUTHREQ, +CGEQOS, +CEUS, +CGCONTRDP, +UGCNTSET, +USIO, +UTEMP, +UFOTASTAT, +CPSMS, GPIO introduction, +UGPIOC, File System Introduction, Device and data security introduction, +UHTTP, +UHTTPC, +UGPRF, +UTIME, +UTIMEIND, +UPORTFWD, +UMQTT, +UMQTTNV, +UMQTTC, +UMQTTSN, +UMQTTSNNV, +ULWM2MSTAT, +CEER error result codes, File system class error codes, Multiple AT command interfaces, SARA-R5 Americas MNO profiles, SARA-R5 EMEA MNO profiles.<br><br>Updated estimated response time information for these commands: +USOSEC.<br><br>Review the command applicability for these commands: +CFGCIOT, +CCIOTOPT, +CSODCP, +CRTDCP, +CIPCA, +UFWSINSTALL, +UTI, +UTEMP, +UIFCONF. |
| R05 | 10-Jul-2020 | lpah | New commands: +URATCONF, +USECROTUID, +USECMODE, +USECDEVCERT, Cipher suite applicability, +ODIS.<br><br>Modified commands: AT command settings, Switch from data mode to online command mode, +CMUX, +CGSN, +CIND, +CALA, +CEER, D, H, +CNUM, +CSQ, +COPS, +UDOPN, +CRCES, +CPLS, +CREG, +CPOL, +PACSP, +UJAD, +UMETRIC, +VZWAPNE, +CEDRXS, +UMNOPROF, +UBANDMASK, +CPIN, +UPINCNT, +CPBR, +CPBW, &C, &D, &S, +CRSM, +UUICC, +UDCONF=50, +CGLA, +CRLA, +UCATPROF, <cid>, <PDP_Type>, +CGDCONT, +UDCONF=66, H, +CGEQOS, +CGEQOSRDP, +CGCONTRDP, +CABTRDP, +UFWINSTALL, +UFWUPD, +UTEST, +URING, +USIO, +UPSV, +CPSMS, +UCPSMS, +UPSMR, GPIO introduction, Module status indication, Module operating mode indication, +UGPIOC, File Tags Introduction, +UDWNFILE, +ULSTFILE, +URDBLOCK, File System limits, +USECFW, Data security introduction, +USECMNG, +USECPRF, +USECDATAENC, +USECDATADEC, +USECFILEENC, +USECFILEDEC, +USECE2EDATAENC, +USECE2EFILEENC, Positioning introduction, +UGPS, +UGPRF, +UGSRV, +ULOC, +UI2CO, +UI2CR, CoAP introduction, +UCOAP, +UCOAPC, +UMQTT, +UMQTTSN, +ULWM2MREAD, |

| Revision | Date | Name | Comments |
|---|---|---|---|
| | | | +ULWM2MSTAT, +ULWM2M, Mobile termination error result codes +CME ERROR, SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 Americas MNO profiles, SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 EMEA MNO profiles.<br><br>Review the command applicability for these commands: +UDCONF=55, +UDCONF=57, +UPCO, +CGAPNRC, +URCATR, +URCATE, +URCATCC, +CUSATE, +CUSATT, +UTEMP, +UDCONF=200, +USECOFF. |
| R06 | 28-Sep-2020 | lpah | New commands: +ULWM2MCONFIG, +ULWM2MCONFIGEXT.<br><br>Modified commands: +CMUX, +CIND, H, +URAT, +UJAD, +UCELLINFO, +UMETRIC, +VZWAPNE, +CEDRXS, +UMNOPROF, <index> parameter range, +CNMI, &D, +ICF, S3, S4, S5, S7, +UDCONF=50, +CGPIAF, +UPSD, +CGREG, +CEMODE, +UAUTHREQ, +UGCNTSET, +UDCONF=9, +UDCONF=75, +UFWINSTALL, +UFWUPD, +UANTR, +USTS, +URING, +USIO, +UFACTORY, +ULGASP, +CPSMS, +UCPSMS, +UPSMR, GPIO introduction, +UGPIOC, +UGPIOR, +UGPIOW, File System Introduction, File System limits, +USOCR, +USOSEC, +USOCL, +USOWR, +USOST, +USECCHIP, +USECROTUID, +USECDEVINFO, +USECCONN, +USECMNG, +USECPRF, +USECPSK, +USECC2C, +UFTP, +UFTPC, +UHTTP, +UGIND, +UGUBX, +ULOCIND, +ULOCGNSS, +UTIME, +UCOAP, +UCOAPC, +UMQTT, +UMQTTC, +UMQTTSN, +UMQTTSNC, LwM2M objects management, +ULWM2MLIST, +ULWM2MCREATE, +ULWM2MWRITE, +ULWM2MREAD, +ULWM2MSTAT, +ULWM2M, +ULWM2MREG, +ULWM2MCONFIG, Mobile termination error result codes +CME ERROR, MQTT class error codes, SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 Americas MNO profiles, SARA-R500S-00B-00, SARA-R510S-00B-00, SARA-R510M8S-00B-00 EMEA MNO profiles.<br><br>Updated estimated response time information for these commands: +UFWUPD, +USOSEC, +USOST, +USOWR, +USOCO, +USOCL, +UDNSRN, +UMQTTC.<br><br>Review the command applicability for these commands: UMQTTWTOPIC, UMQTTWMSG. |

# 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
E-mail: info_us@u-blox.com

**Regional Office West Coast:**
Phone: +1 408 573 3640
E-mail: info_us@u-blox.com

**Technical Support:**
Phone: +1 703 483 3185
E-mail: support_us@u-blox.com

**Headquarters**

**Europe, Middle East, Africa**

**u-blox AG**
Phone: +41 44 722 74 44
E-mail: info@u-blox.com
Support: support@u-blox.com

**Asia, Australia, Pacific**

**u-blox Singapore Pte. Ltd.**
Phone: +65 6734 3811
E-mail: info_ap@u-blox.com
Support: support_ap@u-blox.com

**Regional Office Australia:**
Phone: +61 2 8448 2016
E-mail: info_anz@u-blox.com
Support: support_ap@u-blox.com

**Regional Office China (Beijing):**
Phone: +86 10 68 133 545
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

**Regional Office China (Chongqing):**
Phone: +86 23 6815 1588
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

**Regional Office China (Shanghai):**
Phone: +86 21 6090 4832
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

**Regional Office China (Shenzhen):**
Phone: +86 755 8627 1083
E-mail: info_cn@u-blox.com
Support: support_cn@u-blox.com

**Regional Office India:**
Phone: +91 80 4050 9200
E-mail: info_in@u-blox.com
Support: support_in@u-blox.com

**Regional Office Japan (Osaka):**
Phone: +81 6 6941 3660
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com

**Regional Office Japan (Tokyo):**
Phone: +81 3 5775 3850
E-mail: info_jp@u-blox.com
Support: support_jp@u-blox.com

**Regional Office Korea:**
Phone: +82 2 542 0861
E-mail: info_kr@u-blox.com
Support: support_kr@u-blox.com

**Regional Office Taiwan:**
Phone: +886 2 2657 1090
E-mail: info_tw@u-blox.com
Support: support_tw@u-blox.com