nRF91 AT Commands

Command Reference Guide

v0.7.1

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Contents

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Revision history

Date	Version	Description

February 2019	0.7.1	• Added the following commands:
		  • Modem trace activation %XMODEMTRACE on page 48
		• Updated the following commands:
		  • MAGPIO configuration %XMAGPIO on page 31
		  • Internal temperature %XTEMP on page 46
		  • High level for internal temperature %XTEMPHIGHLVL on page 48
		  • PLMN selection +COPS on page 66

December 2018	0.7	• Added the following commands:
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		  • Short message memory available %XSMMA on page 96
		• Updated the following commands:
		  • Request model identification +CGMM on page 9
		  • Credential storage management %CMNG on page 43
		  • QoS dynamic params +CGEQOSRDP on page 58
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August 2018	0.5.1	• Added the following commands:
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		• Subscribe unsolicited network time notifications %XTIME on page 80 • Set release assistance information %XRAI on page 81 • Updated the following commands: • PLMN selection +COPS on page 66 • Credential storage management %CMNG on page 43 • Power saving mode setting +CPSMS on page 68 • Network registration status +CEREG on page 76 • Added Glossary
December 2017	0.5	Limited release

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1 Introduction

This document describes the AT commands used to control the modems in nRF91 Series devices. The nRF91 series AT command API enables modem control for firmware running in the application core on nRF91 series devices.

The AT command API can also be exposed on one of the nRF91 serial interfaces by programming appropriate firmware in the application core. The nRF Connect SDK contains examples of such proxy firmware that can be run stand-alone or as part of other firmware functionality in the nRF91 application core. The stand-alone example is called at_client. This way, an external MCU or computer can get access to the modem API either exclusively or in addition to application firmware running on the nRF91 itself.

2 AT command syntax

The AT Commands have standardized syntax rules.

Words enclosed in <angle brackets> are references to syntactical elements. Words enclosed in [square brackets] represent optional items which may be left out from the command line at the specified point. The brackets are not used when the words appear in the command line.

<CR>, <LF>, and terminating NUL are allowed in an AT command sent by an application, but are not mandatory when using an interface where both the command string and length of command string are provided.

All standard AT commands for controlling a phone or a modem, or managing the SMS feature begin with a plus sign (+), whereas Nordic-proprietary commands begin with a percent sign (%).

A string type parameter input should be enclosed between quotation marks ("").

For more information, see 3GPP 27.007 AT command set for User Equipment (UE) and 3GPP 27.005 Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS).

2.1 Set command <CMD>[=...]

Set commands set values or perform actions.

Example:

```
AT+CMD=1
```

where

- AT is the command line prefix
- + is the prefix for extended commands
- CMD is the body of a basic command
- 1 is a subparameter (multiple subparameters are separated by commas)

2.2 Read command <CMD>?

Read commands check the current values of subparameters.

Example:

```
AT+CMD?
```

where

- AT is the command line prefix
- + is the prefix for extended commands
- CMD is the body of a basic command
- ? represents a read command

2.3 Test command `<CMD>=?`

Test commands test the existence of the command and provide information about the type of its subparameters. Some test commands have also other functionality, which is described in the command-specific chapters.

Example:

```
AT+CMD=?
```

where

- AT is the command line prefix
- + is the prefix for extended commands
- CMD is the body of a basic command
- =? represents a test command for checking possible subparameter values

2.4 Response

AT responds to all commands with a final response.

The response is one of the following:

```
OK<CR><LF>
ERROR<CR><LF>
+CME ERROR: <cause_value><CR><LF>
+CMS ERROR: <cause_value><CR><LF>
```

"CMS ERROR:" is used as an error response for SMS related commands specified in *3GPP 27.005*.

Some commands may also produce a varying number of information response lines before the final response. An information response can be received only when a command-specific response syntax is specified. An information response line usually starts with a prefix, which is the command entered:

```
+CMD: [...]<CR><LF>
```

Some commands may also produce notifications, which do not start with the command prefix:

```
AT+CGSN
490154203237518
OK
```

3 General

The general commands are for the identification of the device.

For reference, see *3GPP 27.007 Ch. 5*.

3.1 Request manufacturer identification +CGMI

The **+CGMI** command requests manufacturer identification.

For reference, see *3GPP 27.007 Ch. 5.1*.

3.1.1 Set command

The set command requests manufacturer identification.

Syntax:

```
+CGMI
```

Response syntax:

```
<manufacturer>
```

The <manufacturer> parameter returns a string of up to 2048 characters followed by <CR><LF>.

The example command reads the manufacturer ID:

```
AT+CGMI
manufacturer name
OK
```

3.1.2 Read command

The read command is not supported.

3.1.3 Test command

The test command is not supported.

3.2 Request model identification +CGMM

For reference, see *3GPP 27.007 Ch. 5.2*.

3.2.1 Set command

The set command requests model identification.

Syntax:

```
+CGMM
```

Response syntax:

```
<model>
```

The <model> parameter returns a string of up to 2048 characters followed by `<CR><LF>OK`.

The example command reads the model ID:

```
AT+CGMM
Model identifier
OK
```

3.2.2 Read command

The read command is not supported.

3.2.3 Test command

The test command is not supported.

3.3 Request revision identification +CGMR

The **+CGMR** command requests revision identification.

For reference, see *3GPP 27.007 Ch. 5.3*.

3.3.1 Set command

The set command requests revision identification.

Syntax:

```
+CGMR
```

Response syntax:

```
<revision>
```

The <revision> parameter returns a string of up to 2048 characters followed by `<CR><LF>OK`.

The example command reads the revision ID:

```
AT+CGMR
revision identification
OK
```

3.3.2 Read command

The read command is not supported.

3.3.3 Test command

The test command is not supported.

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3.4 Request product serial number identification +CGSN

The **+CGSN** command requests product serial number identification.

For reference, see *3GPP 27.007 Ch. 5.4*.

3.4.1 Set command

The set command requests product serial number identification.

Syntax:

```
+CGSN[=<snt>]
```

The set command parameters and their defined values are the following:

<snt>

0 – Respond with <sn> (default)

1 – Respond with +CGSN: <imei>

2 – Respond with +CGSN: <imeisv>

3 – Respond with +CGSN: <svn>

<sn>

Information text determined by the manufacturer. Up to 2048 characters. *Electronic Serial Number (ESN)* returned if available. *International Mobile (Station) Equipment Identity (IMEI)* returned if ESN not available.

<imei>

A string in decimal format indicating the IMEI. Composed of *Type Allocation Code (TAC)* (8 digits), *Serial Number (SNR)* (6 digits), and *Check Digit (CD)* (1 digit).

<imeisv>

A string in decimal format indicating the *International Mobile (Station) Equipment Identity, Software Version (IMEISV)*. The 16 digits of IMEISV are composed of TAC (8 digits), SNR (6 digits), and *Software Version Number (SVN)* (2 digits).

<svn>

A string in decimal format indicating the current SVN which is part of IMEISV.

Response syntax when `<snt>`=0 (or omitted):

```
<sn>
```

Response syntax for other <snt> values:

```
+CGSN: <string>
```

where <string> can be <imei>, <imeisv>, or <svn>.

The example command reads the serial number:

```
AT+CGSN
490154203237518
OK
```

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The example command reads the IMEI:

```
AT+CGSN=1
+CGSN: "490154203237518"
OK
```

3.4.2 Read command

The read command is not supported.

3.4.3 Test command

The test command returns a list of supported <snt> values.

Response syntax:

```
+CGSN: (list of supported <snt>s)
```

The test command parameter and its defined values are the following:

<snt>

> 0 – Respond with <sn> (default)
>
> 1 – Respond with +CGSN: <imei>
>
> 2 – Respond with +CGSN: <imeisv>
>
> 3 – Respond with +CGSN: <svn>

Example:

```
AT+CGSN=?
+CGSN: (0-3)
OK
```

3.5 Request IMSI +CIMI

The **+CIMI** command reads the *International Mobile Subscriber Identity (IMSI)* from the *Universal Subscriber Identity Module (USIM)* card.

For reference, see *3GPP 27.007 Ch. 5.6*.

3.5.1 Set command

The set command reads the *IMSI* from the *Subscriber Identity Module (SIM)* card.

Syntax:

```
+CIMI
```

Response syntax:

```
<IMSI>
```

The response parameter and its defined value is the following:

<IMSI>

> IMSI, a string without double quotes

> **Note:** ERROR is returned if IMSI is not available.

The example command reads the IMSI string:

```
AT+CIMI
284011234567890
OK
```

3.5.2 Read command

The read command is not supported.

3.5.3 Test command

The test command is not supported.

4 Mobile termination control and status commands

Mobile termination control and status commands are used for mobile-terminated power and indicator handling. Two commands are listed for accessing *SIM/Universal Integrated Circuit Card (UICC)* database records.

4.1 Functional mode +CFUN

The **+CFUN** command sets and reads the modem functional mode.

For reference, see *3GPP 27.007 Ch. 8.2*.

4.1.1 Set command

The command sets the functional mode to Minimum (Power off), Normal, or Offline mode (Flight mode). There is a specific mode for Flight mode with *UICC* on.

Syntax:

```
+CFUN=<fun>
```

The set command parameters and their defined values are the following:

<fun>

> 0 – Power off
>
> 1 – Normal mode
>
> 4 – Offline mode
>
> 44 – Offline mode without shutting down UICC

Note:

- The response to changing to Normal mode could be ERROR if the *SIM* card has failed.
- Commanding the device to Power off or to Offline mode might take some time if signaling with the network is needed.
- When commanding the device to power off, a power cycle is needed and no further AT commands should be sent before that is completed.

The example command activates the modem normal mode:

```
AT+CFUN=1
OK
```

4.1.2 Read command

The command reads the current functional mode.

Response syntax:

```
+CFUN: <fun>
```

The read response parameter and its defined value is the following:

<fun>

> 1 – Normal mode
>
> 4 – Offline mode

The example command reads the current functional mode:

```
AT+CFUN?
+CFUN: 1
OK
```

4.1.3 Test command

The test command is not supported.

4.2 Pin code +CPIN

The **+CPIN** command enters and checks the required *Personal Identification Number (PIN)*.

For reference, see *3GPP 27.007 Ch. 8.3*.

4.2.1 Set command

The set command enters the *PIN*.

Syntax:

```
+CPIN=<pin>[,<newpin>]
```

The set command parameters and their defined values are the following:

<pin>

> String of digits.

<newpin>

> String of digits. Mandatory if the required code is *SIM Personal Unblocking Key (PUK)* or SIM PUK2.

> **Note:** If no PIN is required, the response code is ERROR.

The example command below will enter PIN 1234.

```
AT+CPIN="1234"
OK
```

4.2.2 Read command

The read command checks if a *PIN* is needed.

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Response syntax:

```
+CPIN: <code>
```

The read command parameters and their defined values are the following:

<code>

> READY – no PIN required
>
> SIM PIN – PIN code required
>
> SIM PUK – PUK code required
>
> SIM PIN2 – PIN2 code required
>
> SIM PUK2 – PUK2 code required

The example command shows how to check if a PIN code is needed with the response that a PIN code is required:

```
AT+CPIN?
+CPIN: "SIM PIN"
OK
```

4.2.3 Test command

The test command is not supported.

4.3 Remaining PIN retries +CPINR

The **+CPINR** command returns the number of remaining *PIN* retries for the *User Equipment (UE)* passwords.

For reference, see *3GPP 27.007 Ch. 8.65*.

4.3.1 Set command

The set command returns the number of remaining *PIN* retries for the *UE* passwords.

Command syntax:

```
+CPINR=<sel_code>
```

Response syntax for standard PINs:

```
+CPINR: <code>,<retries>
```

Manufacturer-specific PINs are not supported.

The command parameters and their defined values are the following:

<sel_code>, <code>

> SIM PIN
>
> SIM PIN2
>
> SIM PUK
>
> SIM PUK2
>
> Wildcard not supported.

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<retries>

Integer. Number of remaining retries.

The example command checks the remaining entries for PIN:

```
AT+CPINR="SIM PIN"
+CPINR: "SIM PIN",3
OK
```

4.3.2 Read command

The read command is not supported.

4.3.3 Test command

The test command is not supported.

4.4 List all available AT commands +CLAC

The **+CLAC** command returns a list of all available AT commands.

For reference, see *3GPP 27.007 Ch. 8.37*.

4.4.1 Set command

The set command returns a list of all available AT commands.

Syntax:

```
+CLAC
```

Response syntax:

```
<AT Command1>[<CR><LF><AT Command2>[...]]
```

The example command lists the supported AT commands:

```
AT+CLAC
AT+CFUN
AT+COPS
...
OK
```

4.4.2 Read command

The read command is not supported.

4.4.3 Test command

The test command is not supported.

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4.5 Extended signal quality +CESQ

The **+CESQ** command returns received signal quality parameters. This command issues a valid response only when the modem is activated.

For reference, see *3GPP 27.007 Ch. 8.69*.

4.5.1 Set command

The set command returns received signal quality parameters.

Syntax:

```
+CESQ
```

Response syntax:

```
+CESQ: <rxlev>,<ber>,<rscp>,<ecno>,<rsrq>,<rsrp>
```

The set command parameters and their defined values are the following:

<rxlev>

99 – Not known or not detectable

<ber>

99 – Not known or not detectable

<rscp>

255 – Not known or not detectable

<ecno>

255 – Not known or not detectable

<rsrq>

255 – Not known or not detectable

<rsrp>

0 – RSRP < −140 dBm

1 – When −140 dBm ≤ RSRP < −139 dBm

2 – When −139 dBm ≤ RSRP < −138 dBm

...

95 – When −46 dBm ≤ RSRP < −45 dBm

96 – When −45 dBm ≤ RSRP < −44 dBm

97 – When −44 dBm ≤ RSRP

255 – Not known or not detectable

The example command reads the current signal quality, mapped *Reference Signal Received Power (RSRP)* 62:

```
AT+CESQ
+CESQ: 99,99,255,255,255,62
OK
```

4.5.2 Read command

The read command is not supported.

4.5.3 Test command

The test command returns supported values as compound values.

Response syntax:

```
+CESQ: (list of supported <rxlev>s),(list of supported <ber>s),(list of supported <rscp>s),
(list of supported <ecno>s),(list of supported <rsrq>s),(list of supported <rsrp>s)
```

The example command returns supported values as compound values.

```
AT+CESQ=?
+CESQ: (99),(99),(255),(255),(255),(0-97,255)
OK
```

4.6 Signal quality notification %CESQ

The Nordic-proprietary `%CESQ` command subscribes or unsubscribes notifications of changes in signal quality.

4.6.1 Set command

The set command subscribes or unsubscribes notifications of changes in signal quality.

Syntax:

```
%CESQ=<n>
```

Notification syntax:

```
%CESQ: <rsrp>,<threshold_index>
```

The command parameters and their defined values are the following:

<n>

> 0 – Disable signal quality notifications
>
> 1 – Enable signal quality notifications

<rsrp>

> 0 – RSRP < −140 dBm
>
> 1 – When −140 dBm ≤ RSRP < −139 dBm
>
> 2 – When −139 dBm ≤ RSRP < −138 dBm
>
> …
>
> 95 – When −46 dBm ≤ RSRP < −45 dBm
>
> 96 – When −45 dBm ≤ RSRP < −44 dBm
>
> 97 – When −44 dBm ≤ RSRP
>
> 255 – Not known or not detectable

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<threshold_index>

Index of *RSRP* threshold which is below measured RSRP value.

0 – RSRP is below the first threshold

1 – RSRP is between the first and second threshold

2 – RSPR is between the second and third threshold

3 – RSRP is between the third and fourth threshold

4 – RSRP is above the fourth threshold

With the default thresholds 20, 40, 60, and 80, the measured value 70 leads to index 3.

The example command is subscribes E-UTRA signal quality notifications:

```
AT%CESQ=1
OK
```

The example notification indicates change in measured average *RSRP*. The average RSRP is 62 and mapped to threshold 3.

```
%CESQ: 62,3
```

4.6.2 Read command

The read command is not supported.

4.6.3 Test command

The test command is not supported.

4.7 Restricted SIM access +CRSM

The **+CRSM** command transmits restricted commands to *SIM*.

For reference, see *3GPP 27.007 Ch. 8.18*.

4.7.1 Set command

The set command transmits restricted commands to the *SIM*.

Syntax:

```
+CRSM=<command>[,<fileid>[,<P1>,<P2>,<P3>[,<data>[,<pathid>]]]]
```

Response syntax:

```
+CRSM: <sw1>,<sw2>[,<response>]
```

The set command parameters and their defined values are the following:

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<command>

Integer.

176 – READ BINARY

178 – READ RECORD

192 – GET RESPONSE

214 – UPDATE BINARY

220 – UPDATE RECORD

242 – STATUS

203 – RETRIEVE DATA

219 – SET DATA

<fileid>

Integer type. Identifier of an elementary data file on SIM. Mandatory for every command except STATUS. The range of valid file identifiers depends on the actual SIM and is defined in *3GPP TS 51.011*. Optional files may not be present at all.

<P1>, <P2>, <P3>

Integer type. Parameters passed on by the *Mobile Termination (MT)* to the SIM. These parameters are mandatory for every command, except GET RESPONSE and STATUS. The values are described in *3GPP TS 51.011*.

<data>

String in hexadecimal format. Information that shall be written to the SIM.

<pathid>

String type. Contains the path of an elementary file on the SIM/*UICC* in hexadecimal format (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*.

<sw1>, <sw2>

Integer type. Information from the SIM about command execution. These parameters are delivered to the *Terminal Equipment (TE)* in both cases, on successful or failed command execution.

<response>

String in hexadecimal format. Issued once a command is successfully completed. STATUS and GET RESPONSE return data which provides information about the current elementary data field. This information includes file type and size (see *3GPP TS 51.011*). After READ BINARY, READ RECORD, or RETRIEVE DATA command, the requested data will be returned. <response> is not returned after a successful UPDATE BINARY, UPDATE RECORD, or SET DATA command.

The example command reads the forbidden *Public Land Mobile Network (PLMN)* list:

```
AT+CRSM=176,28539,0,0,12
+CRSM: 144,0,"64F01064F040FFFFFFFFFFFF"
OK
```

4.7.2 Read command

The read command is not supported.

4.7.3 Test command

The test command is not supported.

4.8 Generic SIM access +CSIM

The **+CSIM** command transmits a command to the *SIM*.

For reference, see *3GPP 27.007 Ch. 8.17*.

4.8.1 Set command

The set command transmits a command to the *SIM*.

Syntax:

```
+CSIM=<length>,<command>
```

Response syntax:

```
+CSIM: <length>,<response>
```

The set command parameters and their defined values are the following:

<length>

> Integer. The length of hexadecimal characters.

<command>

> The command passed to the SIM in hexadecimal format. Two characters per byte.

<response>

> The response from the SIM in hexadecimal format. Two characters per byte.

The example command runs a GSM algorithm:

```
AT+CSIM=14,"A0A40000027F20"
+CSIM: 48,"000010247F20020000000000091100160800838A838A9000"
OK
```

4.8.2 Read command

The read command is not supported.

4.8.3 Test command

The test command is not supported.

4.9 Device activity status +CPAS

The **+CPAS** command returns the device activity status.

For reference, see *3GPP 27.007 Ch. 8.1*.

4.9.1 Set command

The set command returns the device activity status.

Syntax:

```
+CPAS
```

Response syntax:

```
+CPAS: <pas>
```

The command has the following parameter:

<pas>

Activity status.

0 – Ready (*MT* allows commands from *Terminal Adapter (TA)/TE*)

The example command checks the activity status:

```
AT+CPAS
+CPAS: 0
OK
```

4.9.2 Read command

The read command is not supported.

4.9.3 Test command

The test command is not supported.

4.10 Indicator control +CIND

The **+CIND** command sets indicator states.

For reference, see *3GPP 27.007 Ch. 8.9*.

4.10.1 Set command

The command sets indicator states.

Syntax:

```
+CIND=[<ind>[,<ind>[,...]]]
```

Response syntax:

```
+CIND: <descr>,<value>
```

The set command parameters and their defined values are the following:

\<ind\>

    Integer. 0 – Off.

    Other values are \<descr\>-specific.

    "service": 1 – On

    "roam": 1 - On

    "message": 1 - On

\<descr\>

    "service" – Service availability

    "roam" – Roaming indicator

    "message" – Message received

\<value\>

    Integer. Values are \<descr\>-specific.

    "service": 0 - Not registered, 1 - Registered

    "roam": 0 - Not roaming, 1 - Roaming

    "message": 1 - Message received

The example enables service and message indicators:

```
AT+CIND=1,0,1
OK
```

The example notification indicates that the device is in service:

```
+CIND: "service",1
```

4.10.2 Read command

The command returns indicator states.

Response syntax:

```
+CIND: <ind>[,<ind>[,...]]
```

The command has the following parameter:

\<ind\>

    Integer. 0 – Off.

    Other values are \<descr\>-specific.

    "service": 1 – On

    "roam": 1 - On

    "message": 1 - On

\<descr\>

    "service" – Service availability

    "roam" – Roaming indicator

    "message" – Message received

Example:

```
AT+CIND?
+CIND: 1,0,1
OK
```

4.10.3 Test command

The command returns supported indicator states.

Response syntax:

```
+CIND: (<descr>,(list of supported <ind>s))[,(<descr>,(list of supported <ind>s))[,...]]
```

The test command parameters and their defined values are the following:

<ind>

Integer. 0 – Off.

Other values are <descr>-specific.

"service": 1 – On

"roam": 1 - On

"message": 1 - On

<descr>

"service" – Service availability

"roam" – Roaming indicator

"message" – Message received

Example:

```
AT+CIND=?
+CIND: ("service",(0,1)),("roam",(0,1)),("message",(0,1))
OK
```

4.11 IP address format +CGPIAF

The **+CGPIAF** command returns information about IPv6 address format.

For reference, see *3GPP 27.007 Ch 8.62*.

4.11.1 Set command

The set command is not supported.

4.11.2 Read command

The read command returns the IPv6 address format.

Response syntax:

```
+CGPIAF:
 <IPv6_AddressFormat>,<IPv6_SubnetNotation>,<IPv6_LeadingZeros>,<IPv6_CompressZeros>
```

The read command parameters and their defined values are the following:

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<IPv6_AddressFormat>

> 1 – Use IPv6-like colon notation

<IPv6_SubnetNotation>

> 1 – Use / (forward slash) subnet prefix *Classless Inter-domain Routing (CIDR)* notation

<IPv6_LeadingZeros>

> 1 – Leading zeros are included

<IPv6_CompressZeros>

> 0 – No zero compression

The example command reads the current IPv6 address format:

```
AT+CGPIAF?
+CGPIAF: 1,1,1,0
OK
```

4.11.3 Test command

The test command returns the supported IPv6 address formats.

Response syntax:

```
+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)
```

The read command parameters and their defined values are the following:

<IPv6_AddressFormat>

> 1 – Use IPv6-like colon notation

<IPv6_SubnetNotation>

> 1 – Use / (forward slash) subnet prefix *CIDR* notation

<IPv6_LeadingZeros>

> 1 – Leading zeros are included

<IPv6_CompressZeros>

> 0 – No zero compression

The example command reads the current IPv6 address format:

```
AT+CGPIAF=?
+CGPIAF: (1),(1),(1),(0)
OK
```

4.12 Current band %XCBAND

The Nordic-proprietary **%XCBAND** command returns the current E-UTRA band.

4.12.1 Set command

The set command reads the current band. The command issues a valid response only when the modem is activated.

Syntax:

```
%XCBAND
```

Response syntax:

```
%XCBAND: <band>
```

> **Note:** %XBANDLOCK usage has an impact on the list of supported bands.

The set command parameter and its defined values are the following:

<band>

Integer, range 1–71. See *3GPP 36.101*.

0 when current band information not available

The example command reads the current band:

```
AT%XCBAND
%XCBAND: 13
OK
```

4.12.2 Read command

The read command is not supported.

4.12.3 Test command

The test command returns a list of supported bands.

Response syntax:

```
%XCBAND: (list of supported bands <band>)
```

The example command returns a list of supported bands:

```
AT%XCBAND=?
%XCBAND: (1,2,3,4,12,13)
OK
```

4.13 Read neighbor cells %NBRGRSRP

The Nordic-proprietary `%NBRGRSRP` command reads measured *RSRP* values of neighboring cells. The command issues a valid response only when the modem is activated.

4.13.1 Set command

The set command reads measured *RSRP* values of neighboring cells.

> **Note:** Neighboring cell measurements are only valid and available when neighbors are monitored, i.e. current cell quality is low enough.

Syntax:

```
%NBRGRSRP
```

Response syntax:

```
%NBRGRSRP: <phys_cellID>1,<EARFCN>1,<RSRP>1,<phys_cellID>2,
 <EARFCN>2,<RSRP>2,<phys_cellID>n, <EARFCN>n,<RSRP>n
```

The set command parameters and their defined values are the following:

<phys_cellID>

Integer. Physical cell ID, format XXX.

<EARFCN>

Integer. EARFCN for a given cell where EARFCN is according to *3GPP TS 36.101*.

<rsrp>

0 – RSRP < −140 dBm

1 – When −140 dBm ≤ RSRP < −139 dBm

2 – When −139 dBm ≤ RSRP < −138 dBm

...

95 – When −46 dBm ≤ RSRP < −45 dBm

96 – When −45 dBm ≤ RSRP < −44 dBm

97 – When −44 dBm ≤ RSRP

255 – Not known or not detectable

4.13.2 Read command

The read command is not supported.

4.13.3 Test command

The test command is not supported.

4.14 Mode of operation (CS/PS) +CEMODE

The **+CEMODE** command sets the device mode of operation.

For reference, see *3GPP 27.007 Ch. 10.1.28*.

4.14.1 Set command

The command sets the *CS/PS Mode of Operation*. The mode is stored in the non-volatile memory when the device is powered off with +CFUN=0. The command should only be used when the modem is not activated.

Syntax:

```
+CEMODE=[<mode>]
```

The set command parameter and its defined values are the following:

<mode>

> 0 – PS mode 2 of operation
>
> 2 – CS/PS mode 2 of operation

The example command sets the operating mode to PS mode 2:

```
AT+CEMODE=0
OK
```

4.14.2 Read command

The command reads the current mode of operation.

Response syntax:

```
+CEMODE: <mode>
```

The read command parameter and its defined values are the following:

<mode>

> 0 – PS mode 2 of operation
>
> 2 – CS/PS mode 2 of operation

The example command reads the current operating mode:

```
+CEMODE: 0
OK
```

4.14.3 Test command

The test command lists the supported modes of operation.

Response syntax:

```
+CEMODE: (list of supported <mode>s
```

The test command parameter and its defined values are the following:

<mode>

> 0 – PS mode 2 of operation
>
> 2 – CS/PS mode 2 of operation

Example:

```
+CEMODE: (0,2)
OK
```

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4.15 UICC state %XSIM

The Nordic-proprietary `%XSIM` command subscribes *UICC* state notifications.

4.15.1 Set command

The set command subscribes *UICC* state notifications.

Syntax:

```
%XSIM=<n>
```

Notification syntax:

```
%XSIM: <state>
```

The set command parameters and their defined values are the following:

<n>

        0 – Unsubscribe XSIM notifications

        1 – Subscribe XSIM notifications

<state>

        0 – UICC not initialized

        1 – UICC initialization OK

The example command subscribes UICC state notifications:

```
AT%XSIM=1
OK
```

The example notification indicates that UICC initialization is completed:

```
%XSIM: 1
```

4.15.2 Read command

The command reads the *UICC* state.

Response syntax:

```
%XSIM: <state>
```

The read command parameter and its defined values are the following:

<state>

        0 – UICC not initialized

        1 – UICC initialization OK

The example command reads the UICC state:

```
AT%XSIM?
%XSIM: 1
OK
```

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4.15.3 Test command

The test command is not supported.

4.16 MAGPIO configuration %XMAGPIO

The Nordic-proprietary **%XMAGPIO** command writes the MAGPIO configuration to device's RAM memory.

The MAGPIO pins can be used, for example, to control an external antenna tuner, or any other GPIO-controlled device, whose state depends on modem's RF frequency. The AT command needs to be sent before any modem activity occurs. Based on the given configuration, the modem applies the MAGPIO state corresponding to the RF frequency range automatically during run time. The configuration is stored to *Non-volatile Memory (NVM)* when the device is powered off with +CFUN=0. The stored configuration is applied when the device is powered on.

4.16.1 Set command

The set command writes the MAGPIO configuration to device's RAM memory.

This command has been updated. The command format in v0.7 of this document is still valid, but the new format described here is recommended.

Syntax:

```
%XMAGPIO=<gpio_0>,<gpio_1>,<gpio_2>,<num_ranges>,<state_0>,<flo_0>,<fhi_0><state_1>,<flo_1>,
<fhi_1>,...
```

A command without any parameters deletes the previously written values.

The set command parameters and their defined values are the following:

<gpio_x>

> 0 – MAGPIO is not used
>
> 1 – MAGPIO used

<num_ranges>

> The number of frequency ranges, maximum value 12

<state_x>

> Settings of the MAGPIO pins for the range x that follows

<flo_x>

> Frequency range low value when the setting is active, in MHz

<fhi_x>

> Frequency range high value when the setting is active, in MHz

The following table contains an example configuration for an antenna tuner:

	State	MAGPIO2	MAGPIO1	MAGPIO0	Low MHz	High MHz
Unused	0	0	0	0	-	-
LTE(746–803)	1	0	0	1	746	803
LTE(698–746)	2	0	1	0	698	746
LTE(1710–2200)	2	0	1	0	1710	2200
LTE(849–894)	3	0	1	1	849	894
LTE(894–960)	4	1	0	0	894	960
Unused	5	1	0	1	-	-
LTE(803–849)	6	1	1	0	803	849
GPS	7	1	1	1	1574	1577

Table 1: Example configuration for an antenna tuner

The example command writes seven ranges to device's RAM:

```
AT
%XMAGPIO=1,1,1,7,1,746,803,2,698,746,2,1710,2200,3,849,894,4,894,960,6,803,849,7,1574,1577
OK
```

This example command writes three ranges to device's RAM:

```
AT%XMAGPIO=1,1,1,3,0,1574,1577,1,705,747,6,748,804
OK
```

The following example command deletes the previously written values:

```
AT%XMAGPIO
OK
```

4.16.2 Read command

The read command is not supported.

4.16.3 Test command

The test command is not supported.

4.17 Authenticated access %XSUDO

The Nordic-proprietary `%XSUDO` command provides authenticated access for a restricted AT command.

> **Note:** This command is for future releases. In the current software release, the use of this command is not required.

For information on the usage of the command, see Authenticating AT command usage on page 98.

4.17.1 Set command

The set command provides authenticated access for a restricted AT command.

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The restricted command is separated with a semicolon (;). The leading AT prefix is not included in the concatenated command.

Syntax:

```
%XSUDO=<data_len>,<signature>
```

+CME ERROR codes

> 513 – Not found, public key not found
>
> 520 – Authentication failed

The set command parameters and their defined values are the following:

<data_len>

> Length of a signed command string.
>
> Only the number of characters in <data_len> from an authenticated command is processed, the rest are ignored. <data_len> shall not be greater than the given command.

<signature>

> Command signature in Base64 format

The example command provides authenticated access for the restricted %CMNG command:

```
AT%XSUDO=7,"c2lnbmF0dXJl";%CMNG=1
OK
```

4.17.2 Read command

The read command is not supported.

4.17.3 Test command

The test command is not supported.

4.18 Public key storage management %XPMNG

The Nordic-proprietary %XPMNG command writes and reads the public key. The public key can be written only if it does not exist. An existing key can be deleted with the %CMNG command.

4.18.1 Set command

The set command writes and reads the public key.

Syntax:

```
%XPMNG=<opcode>[,<content>]
```

Response syntax:

```
%XPMNG: <content>
```

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+CME ERROR codes

> 513 – For read: Not found

> 520 – For write: Already exists

The set command parameters and their defined values are the following:

<opcode>

> 0 – Write

> 2 – Read

<content>

> String. Mandatory if parameter opcode is 'Write'. An empty string is not allowed. Parameter content is enclosed in double quotes. ASN.1 DER encoding in Base64 encoded with the header and footer of begin key and end key.

The example command writes the public key:

```
AT%XPMNG=0,"-----BEGIN PUBLIC KEY-----...-----END PUBLIC KEY-----"
OK
```

The example command reads the public key:

```
AT%XPMNG=2
%XPMNG: "-----BEGIN PUBLIC KEY-----...-----END PUBLIC KEY-----"
OK
```

4.18.2 Read command

The read command is not supported.

4.18.3 Test command

The test command is not supported.

4.19 RF test execution %XRFTEST

The Nordic-proprietary `%XRFTEST` command performs RF testing.

4.19.1 Set command

The set command performs RF testing.

Syntax:

```
%XRFTEST=<test>,<operation>,<param0>,<param1>,…,<param7>
```

The set command parameters and their defined values are the following:

<test>

> 0 – RX

> 1 – TX

> 2 – GPS SNR

<operation>

> 0 – OFF
>
> 1 – ON

<paramX>

> One or more int16 values. The usage and number of parameters depends on <test> and <operation>. See the following sections.

4.19.1.1 RX testing

The command enables RF receiver with the given parameters. It also measures antenna power with a time domain power meter and returns the measurement result.

The command parameter and its value are the following:

<test>

> 0 – RX

RX ON

<operation>

> 1 – ON

RX ON has a total of four parameters:

<param0>

> 3GPP band number.

<param1>

> Frequency 100 kHz.
>
> Valid range 6000–22000 (corresponds to 600.0 MHz–2200.0 MHz). Note that if CW is used, an offset of about 45 kHz for NB1 and 300 kHz for M1 is recommended.

<param2>

> RX signal power at antenna [dBm].
>
> Valid range from −128 to −25].

<param3>

> System mode.
>
> Valid range 0–1. NB1 (0) or M1 (1).

Response syntax when <operation> is ON:

```
%XRFTEST: <antenna_power>
```

The response value is the following:

<antenna_power>

> Measured power at antenna, in q8 dBm. q8 means that dividing the result by $2^8 = 256$ gives dBm.

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The example command enables the RF receiver for Band 1, 2140.0 MHz, 65 dBm, NB1 mode:

```
%RFTEST=0,1,1,21400,-65,0
%XRFTEST: -17002
OK
```

> **Note:** −17002/256 = −66.4 dBm

RX OFF

<operation>

        0 – OFF

The example command disables the RF receiver:

```
%RFTEST=0,0
OK
```

4.19.1.2 TX testing

The command enables RF transmitter with the given parameters. It also measures TX power with an internal measurement receiver in time domain, and returns the measurement result.

The command parameter and its value are the following:

<test>

        1 – TX

TX ON

<operation>

        1 – ON

TX ON has a total of seven parameters:

<param0>

        3GPP band number.

<param1>

        Frequency [100kHz].

        Valid range 6000–22000 (corresponds to 600.0 MHz–2200.0 MHz).

<param2>

        TX signal power at antenna [dBm].

        Valid range from+23 to −50.

<param3>

        System mode.

        Valid range 0–1. NB1 (0) or M1 (1).

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<param4>

Modulation.

0 – QPSK

1 – 16QAM

2 – Reserved

3 – BPSK

4 – CW

<param5>

RB/Tone count

M1 valid range 1–6

NB1 valid range 1–12

CW modulation: N/A

<param6>

RB/Tone start position

M1 valid range 0–5

NB1 valid range 0–11

CW modulation: N/A

Response syntax when <operation> is ON:

```
%XRFTEST: <antenna_power>
```

The response value is the following:

<antenna_power>

Internally measured TX power at antenna, in q4 dBm. q4 means that dividing the result by 2^4 = 16 gives dBm.

The example command enables the RF transmitter for Band 5, 830.0 MHz, +18 dBm, NB1, BPSK, 12 tones:

```
%RFTEST=1,1,5,8300,18,0,3,12,0
%XRFTEST: 271
OK
```

> **Note:** 271/16 = 16.9 dBm

TX OFF

<operation>

0 – OFF

The example command disables the RF transmitter:

```
%RFTEST=1,0
OK
```

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4.19.1.3 GPS SNR testing

The command executes an GPS SNR test.

GPS L1 frequency is 1575.42 MHz and this test expects the CW in signal generator to be 1575.750 MHz, i.e. 330 kHz offset. The measurement duration is 1 ms.

The command parameter and its value are the following:

<test>

> 2 – GPS SNR

GPS SNR

<operation>

> 1 – ON

> **Note:** Automatic stop, i.e. no "OFF" needed.

GPS SNR ON has one parameter:

<param0>

> RX signal power at antenna [dBm]

> Valid range from −128 to −25 or 0 = default gain −105 dBm.

Response syntax when <operation> is ON:

```
%XRFTEST: <snr>
```

The response value is the following:

<snr>

> Result of the SNR measurement in q4 dB. q4 means that dividing the result by 2^4 = 16 gives dB.

The example command executes an GPS SNR test:

```
%RFTEST=2,1,0
%XRFTEST: 514
OK
```

> **Note:** 514/16 = 32.125 dB

4.19.2 Read command

The read command is not supported.

4.19.3 Test command

The test command is not supported.

4.20 Band lock %XBANDLOCK

The Nordic-proprietary **%XBANDLOCK** command sets locked bands. The band lock should be set before activating modem with **+CFUN**.

4.20.1 Set command

The command sets locked bands and bitmasks to limit supported bands.

Supported bands are masked with permanent and runtime masks. The command returns ERROR at an attempt to disable all supported bands.

> **Note:**
>
> • Set band lock before activating modem with **+CFUN**.
> • Permanent mask is written to flash when UE is powered down.

Syntax:

```
%XBANDLOCK=<operation>[,<band_mask>]
```

The set command parameters and their defined values are the following:

<operation>

        0 – Remove band locks

        1 – Set permanent band mask

        2 – Set run-time band mask

<band_mask><permanent_lock><run-time_lock>

        String. Bit string, LSB is band 1. Leading zeroes can be omitted. Maximum length 88 characters.

The example command sets permanent band 4 lock:

```
AT%XBANDLOCK=1,"1000"
OK
```

The example command sets run-time band 4 and 13 lock:

```
AT%XBANDLOCK=2,"1000000001000"
OK
```

4.20.2 Read command

The command reads locked bands.

Response syntax:

```
%XBANDLOCK: <permanent_lock>,<run-time_lock>
```

The read response parameter and its defined value is the following:

<permanent_lock>,<run-time_lock>

        Bit string, 88 bits.

An empty string is returned if bandlock is not set.

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The example command reads the locked bands. No permanent lock, run-time lock for bands 13, 4, and 1:

```
AT%XBANDLOCK?
%XBANDLOCK:
 "","00000000000000000000000000000000000000000000000000000000000000001000000001001"
OK
```

4.20.3 Test command

The test command is not supported.

4.21 Data profile %XDATAPRFL

The Nordic-proprietary **%XDATAPRFL** command sets the application data profile.

4.21.1 Set command

The set command sets the application data profile.

Syntax:

```
%XDATAPRFL=<power_level>
```

The set command parameters and their defined values are the following:

<power level>

        0 – Ultra-low power

        1 – Low power

        2 – Normal

        3 – Performance

        4 – High performance

The example command sets a low power level:

```
AT%XDATAPRFL=1
OK
```

4.21.2 Read command

The read command reads the application data profile.

Syntax:

```
%XDATAPRFL: <power_level>
```

The set command parameters and their defined values are the following:

<power level>

        0 – Ultra-low power

        1 – Low power

        2 – Normal

        3 – Performance

        4 – High performance

The example command reads the power level:

```
AT%XDATAPRFL?
AT%XDATAPRFL: 2
OK
```

4.21.3 Test command

The test command is not supported.

4.22 Data profile %XCONNSTAT

The Nordic-proprietary **%XCONNSTAT** command sets the connectivity statistics command.

4.22.1 Set command

The set command sets the connectivity statistics command.

Syntax:

```
%XCONNSTAT=<command>
```

The set command parameters and their defined values are the following:

<command>

        0 – Stop

        1 – Start

The example command makes the LwM2M application start and stop connectivity statistics:

```
AT%XCONNSTAT=1
OK
AT%XCONNSTAT=0
OK
```

4.22.2 Read command

The read command reads the connectivity statistics.

Syntax:

```
%XCONNSTAT: <SMS Tx>,<SMS Rx>,<Data Tx>,<Data Rx>,<Packet max>,<Packet average>
```

The read command parameters and their defined values are the following:

<SMS Tx>

Indicate the total number of SMSs successfully transmitted during the collection period.

<SMS Rx>

Indicate the total number of SMSs successfully received during the collection period.

<Data Tx>

Indicate the total amount of data (in kilobytes) transmitted during the collection period.

<Data Rx>

Indicate the total amount of data (in kilobytes) received during the collection period.

<Packet max>

The maximum packet size (in bytes) used during the collection period.

<Packet average>

The average packet size (in bytes) used during the collection period.

The example command makes the LwM2M application read the connectivity statistics:

```
AT%XCONNSTAT?
%XCONNSTAT=2,3,45,60,708,650
OK
```

4.22.3 Test command

The test command is not supported.

4.23 Battery voltage %XVBAT

The Nordic-proprietary **%XVBAT** command reads battery voltage.

4.23.1 Set command

The set command reads the battery voltage in mV.

Syntax:

```
%XVBAT
```

Response syntax:

```
+XVBAT: <vbat>
```

The response parameter is the following:

<vbat>

Integer. Battery voltage in mV

The example command reads the battery voltage and the response is for a successful case:

```
AT%XVBAT
%XVBAT: 3600
OK
```

4.23.2 Read command

The read command is not supported.

4.23.3 Test command

The test command is not supported.

4.24 Customer production done %XPRODDONE

The Nordic-proprietary **%XPRODDONE** command sets the customer production to done.

4.24.1 Set command

The set command sets the customer production to done.

Syntax:

```
%XPRODDONE
```

The example command sets the customer production to done:

```
AT%XPRODDONE
OK
```

4.24.2 Read command

The read command is not supported.

4.24.3 Test command

The test command is not supported.

4.25 Credential storage management %CMNG

The Nordic-proprietary **%CMNG** command is used for credential storage management. The command writes, reads, deletes, and checks the existence of keys and certificates. The credentials are stored in the non-volatile memory.

4.25.1 Set command

The set command is used for credential storage management. The command writes, reads, deletes, and checks the existence of keys and certificates.

The write and delete operations are allowed only when the modem is not activated.

Syntax:

```
%CMNG=<opcode>[,<sec_tag>[,<type>[,<content>[,<passwd>]]]]
```

Response syntax for read operation:

```
%CMNG: <sec_tag>,<type>[,<sha>[,<content>]]
```

Response syntax for list operation:

```
%CMNG: <sec_tag>,<type>[,<sha>]
```

<sec_tag> <type> shall be a unique pair, no multiple items with the same <sec_tag> and <type> values are allowed.

+CME ERROR codes

> 513 – Not found. Applies to read, write, and delete.
>
> 514 – No access. Applies to read, write, and delete.
>
> 515 – Memory full. Applies to write.
>
> 518 – Not allowed in active state

The command parameters and their defined values are the following:

<opcode>

> 0 – Write
>
> 1 – List
>
> 2 – Read
>
> 3 – Delete

<sec_tag>

> Integer, 0 – 2147483647.
>
> Mandatory for write, read, and delete operations. Optional for list operation.

<type>

> 0 – Root CA certificate (ASCII text)
>
> 1 – Client certificate (ASCII text)
>
> 2 – Client private key (ASCII text)
>
> 3 – *Pre-shared Key (PSK)* (ASCII text in hexadecimal string format)
>
> 4 – PSK identity (ASCII text)
>
> 5 – Public Key (ASCII text)
>
> Mandatory if <opcode> is write, read, or delete. Parameter <type> with the value `Public Key` can only be used when parameter <opcode> is `delete`.

<content>

> String. Mandatory if <opcode> is `write`. An empty string is not allowed. A *Privacy Enhanced Mail (PEM)* file enclosed in double quotes (X.509 PEM entities). Base64-encoded string in double quotes (PSK).

<passwd>

> String. PKCS#8 password. Mandatory for writing a type 2 encrypted private key, ignored for other types. Maximum length 32 characters.

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<sha>

String. SHA-256 digest of the entity (DER, PEM) as stored in the filesystem, 64 hexadecimal characters (representing a 256 bit vector).

> **Note:**
>
> - <content> in the read response is exactly what is written, including <CR>, <LF>, and other characters. The characters outside the double quotes are part of the AT response format.
> - Reading types 1, 2, and 3 are not supported.

The example command writes the root certificate:

```
AT%CMNG=0, 12345678, 0,"
-----BEGIN CERTIFICATE-----
MIIDSjCCA...
...bKbYK7p2CNTUQ
-----END CERTIFICATE-----"
OK
```

The example command writes the client certificate:

```
AT%CMNG=0,567890,1,"
-----BEGIN CERTIFICATE-----
MIIBc464...
...bW9aAa4
-----END CERTIFICATE-----"
OK
```

The example command writes the private key:

```
AT%CMNG=0,123,2,"
-----BEGIN ENCRYPTED PRIVATE KEY-----
MIICz...
...ukBu
-----END ENCRYPTED PRIVATE KEY-----", "abcdefg"
OK
```

The example command lists a single item by specifying tag and type:

```
AT%CMNG=1,12345678, 0
%CMNG: 12345678, 0, "978C...02C4"
OK
```

The example command lists a single tag:

```
AT%CMNG=1,12345678
%CMNG: 12345678, 0, "978C...02C4"
%CMNG: 12345678, 1, "1A8C...02BB"
OK
```

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The example command lists all stored credentials:

```
AT%CMNG=1
%CMNG: 12345678, 0, "978C...02C4"
%CMNG: 567890, 1, "C485...CF09"
%CMNG: 123, 2, "92E1...8AC8"
%CMNG: 654321, 3, "E0C9...511D"
OK
```

The example command reads the root certificate with tag 12345678:

```
AT%CMNG=2, 12345678, 0
%CMNG: 12345678, 0, "978C...02C4",
"-----BEGIN CERTIFICATE-----
MIIBc464...
...bW9aAa4
-----END CERTIFICATE-----"
OK
```

The example command deletes a client certificate with tag 123:

```
AT%CMNG=3,123,1
OK
```

The example command reads a non-existing root certificate with tag 4567. Error code 513 is returned:

```
AT%CMNG=2,4567,0
+CME ERROR: 513
```

4.25.2 Read command

The read command is not supported.

4.25.3 Test command

The test command is not supported.

4.26 Internal temperature %XTEMP

The Nordic proprietary **%XTEMP** command subscribes unsolicited internal temperature notifications.

4.26.1 Set command

The set command subscribes or unsubscribes unsolicited internal temperature notifications.

A notification is sent when the temperature is rising above a high or critical temperature level or cooling down from a critical or high temperature level.

Syntax:

```
%XTEMP=<n>
```

Notification syntax:

```
%XTEMP: <temperature_level>,<temperature>
```

The set command parameters and their defined values are the following:

<n>

> 0 – Disable unsolicited temperature indicators

> 1 – Enable unsolicited temperature indicators

The notification parameters and their defined values are the following:

<temperature_level>

> 1 – Normal temperature

> 2 – High temperature. Factory default 55. This can be changed with High level for internal temperature %XTEMPHIGHLVL on page 48.

> 3 – Critical temperature. TX/RX disabled. Factory default 90.

<temperature>

> Integer. Celcius degrees between −40 and 125.

The example command subscribes notifications:

```
AT%XTEMP=1
OK
```

The example shows an unsolicited notification for an internal temperature level:

```
%XTEMP: 1,37
%XTEMP: 2,56
%XTEMP: 3,91
```

4.26.2 Read command

The read command reads the internal temperature level and the temperature.

Syntax:

```
%XTEMP?
```

Response syntax:

```
%XTEMP: <temperature>
```

The example command reads the current modem temperature:

```
AT%XTEMP?
%XTEMP: 50
OK
```

4.26.3 Test command

The test command is not supported.

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4.27 High level for internal temperature %XTEMPHIGHLVL

The Nordic proprietary **%XTEMPHIGHLVL** command sets the high level to internal temperature in the modem.

4.27.1 Set command

The set command sets the high internal temperature level for the notification in the %XTEMP AT command.

When the high temperature level is reached, data transmission should be controlled and minimized to prevent modem overheating.

Syntax:

```
%XTEMPHIGHLVL=<temperature>
```

The set command parameters and their defined values are the following:

<temperature>

> Integer. Celcius degrees between 1 and 85. Factory default 55.

The example command sets the high temperature level:

```
AT%XTEMPHIGHLVL=60
OK
```

4.27.2 Read command

The read command reads the internal high temperature level of a modem.

When a high temperature level is reached, data transmission should be controlled and minimized to prevent modem overheating.

Syntax:

```
%XTEMPHIGHLVL?
```

The example command reads the current internal high temperature level:

```
AT%XTEMPHIGHLVL?
%XTEMPHIGHLVL: 60
OK
```

4.27.3 Test command

The test command is not supported.

4.28 Modem trace activation %XMODEMTRACE

The Nordic-proprietary **%XMODEMTRACE** command activates modem traces. The trace data is in binary format and can help the Nordic customer support to analyze and resolve issues.

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4.28.1 Set command

The set command activates and deactivates modem trace.

Syntax:

```
%XMODEMTRACE=<oper>[,<set_id>]
```

The set command parameters and their defined values are the following:

<oper>

Operation.

0 – Deactivate traces

1 – Activate predefined trace set

2 – Activate trace bitmap

<set_id>

Integer. Predefined trace set identifier.

1 – Coredump only

2 – Generic

3 – LWM2M

4 – IP only

The example command activates trace set 1:

```
AT%XMODEMTRACE=1,1
OK
```

4.28.2 Read command

The read command is not supported.

4.28.3 Test command

The test command is not supported.

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5 Packet domain commands

Commands for the packet domain include commands that control packet-switched services.

5.1 Define PDP Context +CGDCONT

The **+CGDCONT** command defines *Packet Data Protocol (PDP) Context*.

For reference, see *3GPP 27.007 Ch. 10.1.1*

5.1.1 Set command

The set command configures connection parameters.

Syntax:

```
+CGDCONT=<cid> [,<PDP_type> [,<APN> [,<PDP_addr> [,<d_comp> [,<h_comp> [,<IPv4AddrAlloc>
 [,<request_type> [,<P-CSCF_discovery> [,<IM_CN_Signalling_Flag_Ind> [,<NSLPI>
 [,<securePCO>]]]]]]]]]]]]
```

> **Note: +CGDCONT=<cid>** causes the values for context number <cid> to become undefined.

The set command parameters and their defined values are the following:

<cid>

0–11 (mandatory). Specifies a particular *Packet Data Protocol (PDP) Context* definition. The parameter is local to the device and is used in other PDP context-related commands.

<PDP_type>

String type

IP – Internet Protocol

IPV6 – Internet Protocol version 6

IPV4V6 – Virtual type of dual IP stack

<APN>

String – *Access Point Name (APN)*

<PDP_addr>

Ignored

<d_comp>

Ignored

<h_comp>

Ignored

<IPv4AdrAlloc>

0 – IPv4 address via *Non-access Stratum (NAS)* signaling (default)

1 – IPv4 address via *Dynamic Host Configuration Protocol (DHCP)*

<request type>

> Ignored

<P-CSCF_discovery>

> Ignored

<IM_CN_SignallingFlag>

> Ignored

<NSLPI>

> 0 – *Non-Access Stratum (NAS) Signalling Low Priority Indication (NSLPI)* value from configuration is used (default)
>
> 1 – Value "Not configured" for NAS signaling low priority

<securePCO>

> 0 – Protected transmission of *Protocol Configuration Options (PCO)* is not requested (default)
>
> 1 – Protected transmission of PCO is requested

The example command configures CID 1 to use IPv4 and access point "IOT_apn"

```
AT+CGDCONT=1,"IP","IOT_apn"
OK
```

5.1.2 Read command

The command reads the list of defined contexts.

Response syntax:

```
+CGDCONT: <cid>,<PDP_type>,<APN>,<PDP_addr>,<d_comp>,<h_comp>
```

The read command parameters and their defined values are the following:

<cid>

> 0–11

<PDP_type>

> String type
>
> IP – Internet Protocol
>
> IPV6 – Internet Protocol version 6
>
> IPV4V6 – Virtual type of dual IP stack

<APN>

> String – *APN*

<PDP_addr>

> String – IP address

d_comp

> 0 – Compression not supported

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h_comp

0 – Compression not supported

The example command reads configured default bearers:

```
AT+CGDCONT?
+CGDCONT: 0,"IP","internet","10.0.1.1",0,0
+CGDCONT: 1,"IP","IOT_apn","10.0.1.2",0,0
OK
```

5.1.3 Test command

The test command is not supported.

5.2 Packet domain event reporting +CGEREP

The **+CGEREP** command enables or disables the sending of packet domain events.

For reference, see *3GPP 27.007 Ch. 10.1.19*.

5.2.1 Set command

The set command enables or disables the sending of packet domain events. The unsolicited result code is **+CGEV: XXX**.

For information on **+CGEV**, see Packet domain event unsolicited result codes +CGEV on page 53.

Syntax:

```
+CGEREP=[<mode>]
```

The command parameter and its defined values are the following:

<mode>

0 – Do not forward unsolicited result codes to the *TE* (default).

1 – Discard unsolicited result codes when the *MT* TE link is reserved. Otherwise, forward them directly to the TE.

The example command subscribes CGEV notifications:

```
AT+CGEREP=1
OK
```

5.2.2 Read command

The command reads the current mode and buffering settings.

Response syntax:

```
+CGEREP: <mode>,<bfr>
```

The read command parameter and its defined values are the following:

<mode>

> 0 – Do not forward unsolicited result codes to the *TE* (default).

> 1 – Discard unsolicited result codes when the *MT* TE link is reserved. Otherwise, forward them directly to the TE.

<bfr>

> 0 – MT buffer of unsolicited result codes is cleared when <mode> 1 is entered

The example command reads the current mode:

```
AT+CGEREP?
+CGEREP: 1,0
OK
```

5.2.3 Test command

The test command reads supported modes and buffering settings.

Response syntax:

```
+CGEREP: (list of supported <mode>s),(list of supported <bfr>s)
```

The test command parameters and their defined values are the following:

<mode>

> 0 – Do not forward unsolicited result codes to the *TE* (default).

> 1 – Discard unsolicited result codes when the *MT* TE link is reserved. Otherwise, forward them directly to the TE.

<bfr>

> 0 – MT buffer of unsolicited result codes is cleared when <mode> 1 is entered

Example:

```
AT+CGEREP=?
+CGEREP: (0,1),(0)
OK
```

5.3 Packet domain event unsolicited result codes +CGEV

Unsolicited packet domain notifications are sent when the device is detached from the network or when a packet data connection is activated, deactivated, or modified.

For reference, see *3GPP 27.007 Ch. 10.1.19*.

These notifications are subscribed using the +CGEREP command.

Syntax descriptions are listed below:

Network detach:

```
+CGEV: NW DETACH
```

Mobile Equipment (ME) detach:

```
+CGEV: ME DETACH
```

The ME has activated a default bearer:

```
+CGEV: ME PDN ACT <cid>[,<reason>]
```

The network has activated a dedicated bearer:

```
+CGEV: NW ACT <p_cid>, <cid>, <event_type>
```

The network has deactivated a default bearer:

```
+CGEV: NW PDN DEACT <cid>
```

The UE has deactivated a default bearer:

```
+CGEV: ME PDN DEACT <cid>
```

The network has deactivated a dedicated bearer:

```
+CGEV: NW DEACT <p_cid>, <cid>, <event_type>
```

The UE has deactivated a dedicated bearer:

```
+CGEV: ME DEACT <p_cid>, <cid>, <event_type>
```

The network has modified a bearer:

```
+CGEV: NW MODIFY <cid>, <change_reason>, <event_type>
```

The UE has modified a bearer:

```
+CGEV: ME MODIFY <cid>, <change_reason>, <event_type>
```

IPv6 Link is up for the default bearer:

```
+CGEV: IPV6 <cid>
```

<cid>

> 0–11

<reason>

> 0 – Only IPv4 allowed
>
> 1 – Only IPv6 allowed
>
> 2 – Only single access bearers allowed
>
> 3 – Only single access bearers allowed and context activation for a second address type bearer was not successful.

<cid_other>

> 1–11: Indicates the context identifier allocated for an MT-initiated context of a second address type. This parameter is included only if <reason> parameter indicates that only single address bearers are allowed.

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<p_cid>

> 0–11: Context identifier for an associated default context.

<event_type>

> 0 – Informational event
>
> 1 – Information request. Acknowledgement is required and it can be either accept or reject.

The example notification shows that an initial *Packet Data Network (PDN)* connection is activated:

```
+CGEV: ME PDN ACT 0
```

The example notification shows that the device is detached from network:

```
+CGEV: ME DETACH
```

5.4 PDP context activate +CGACT

The **+CGACT** command activates or deactivates a *PDN* connection.

For reference, see *3GPP 27.007 Ch. 10.1.10*.

5.4.1 Set command

The set command activates or deactivates a *PDN* connection.

> **Note:** Initial PDN connection (cid 0) could not be activated or deactivated.

First, the *Packet Data Protocol (PDP) Context* needs to be defined with the +CGDCONT command, see Define PDP Context +CGDCONT on page 50.

Syntax:

```
+CGACT=<state>,<cid>
```

The set command parameters and their defined values are the following:

<state>

> 0 – Deactivate
>
> 1 – Activate

<cid>

> 1–11

The example command activates a bearer configured with CID 1:

```
AT+CGACT=1,1
OK
```

5.4.2 Read command

The command reads a list of *PDN* connections and states.

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Response syntax:

```
+CGACT: <cid>,<state>
```

The read command parameters and their defined values are the following:

<state>

> 0 – deactivate
>
> 1 – activate

<cid>

> 0–11

The example command returns a list of connections with states:

```
AT+CGACT?
+CGACT: 0,1
+CGACT: 1,1
OK
```

5.4.3 Test command

The test command returns a list of supported states.

Response syntax:

```
+CGACT: (list of supported <state>s)
```

The test command parameters and their defined values are the following:

<state>

> 0 – Deactivate
>
> 1 – Activate

Example:

```
AT+CGACT=?
+CGACT: (0,1)
OK
```

5.5 Allocate new CID %XNEWCID

The Nordic-proprietary **%XNEWCID** command allocates a new context identifier.

5.5.1 Set command

The set command is not supported.

5.5.2 Read command

The read command allocates a new context identifier.

The command allocates a unique context identifier, which can be referenced with other commands like **+CGDCONT**. The allocated identifier can be deallocated with the **CGDCONT** command by giving only the <cid> parameter.

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This command can be used instead of reading existing default and dedicated contexts with **AT +CGDCONT?** and finding an unused <cid> value before configuring new context.

Response syntax:

```
%XNEWCID: <cid>
```

The command parameter and its defined values are the following:

<cid>

       1–11

The example command requests the allocation of a new context identifier:

```
AT%XNEWCID?
%XNEWCID: 2
OK
```

5.5.3 Test command

The test command is not supported.

5.6 Map CID to PDN ID %XGETPDNID

The Nordic-proprietary **%XGETPDNID** command maps the context identifier to *PDN* ID. This command can be used only when the modem is activated.

5.6.1 Set command

The set command maps the context identifier to *PDN* ID.

PDN ID is used on a data path to select one of the existing connections for data transfer.

Syntax:

```
%XGETPDNID=<cid>
```

Response syntax:

```
%XGETPDNID: <pdn_id>
```

The command parameters and their defined values are the following:

<cid>

       0–11

<pdn_id>

       0–20

Example:

```
AT%XGETPDNID=0
%XGETPDNID: 1
OK
```

5.6.2 Read command

The read command is not supported.

5.6.3 Test command

The test command is not supported.

5.7 QoS dynamic params +CGEQOSRDP

The **+CGEQOSRDP** command reads dynamic *Evolved Packet System (EPS) Quality of Service (QoS)* parameters. This command issues a valid response only when the modem is activated.

For reference, see *3GPP 27.007 Ch. 10.1.27*.

5.7.1 Set command

The set command reads dynamic *EPS QoS* parameters.

Syntax:

```
+CGEQOSRDP[=<cid>]
```

Response syntax:

```
[+CGEQOSRDP: <cid>,<QCI>,[<DL_GBR>,<UL_GBR>],[<DL_MBR>,<UL_MBR>][,<DL_AMBR>,<UL_AMBR>]]
```

The command parameters and their defined values are the following:

<cid>

Context identifier, 0 – 11. If the parameter <cid> is omitted, the QoS parameters for all active *Packet Data Protocol (PDP) Context*s are returned.

<QCI>

Integer. Specifies a class of EPS QoS (see *3GPP TS 23.203* and *3GPP TS 24.301*).

<DL_AMBR>

Integer. Specifies downlink APN aggregate maximum bitrate. Value range 0–65280000 kbps.

<UL_AMBR>

Integer. Specifies uplink APN aggregate maximum bitrate. Value range 0–65280000 kbps.

<DL_GBR>, <UL_GBR>, <DL_MBR>, <UL_MBR>

Not supported

The example command returns a list of contexts with QoS parameters:

```
Get list of contexts with QOS parameters
AT+CGEQOSRDP
+CGEQOSRDP: 0,0,,
+CGEQOSRDP: 1,2,,
+CGEQOSRDP: 2,4,,,1,65280000
OK
```

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5.7.2 Read command

The read command is not supported.

5.7.3 Test command

The test command is not supported.

5.8 Show PDP address(es) +CGPADDR

The +CGPADDR command returns a list of *Packet Data Protocol (PDP)* addresses for the specified context identifiers.

For reference, see *3GPP 27.007 Ch. 10.1.14*.

5.8.1 Set command

The set command returns a list of *PDP* addresses for the specified context identifiers. This command issues a valid response only when the modem is activated.

Syntax:

```
+CGPADDR[=<cid>]
```

If <cid> is not present, all activated contexts are listed.

Response syntax:

```
[+CGPADDR: <cid>[,<PDP_addr_1>[,<PDP_addr_2>]]]
```

The set command parameters and their defined values are the following:

<cid>

0–11

<PDP_addr_1>

String. For IPv4 given as a dot-separated numeric (0–255) parameter. For IPv6 given as a colon-separated hexadecimal (0x0000–0xFFFF) parameter.

<PDP_addr_2>

String. Given as a colon-separated hexadecimal (0x0000–0xFFFF) parameter. Included when both IPv4 and IPv6 addresses are assigned.

The example command returns the IP address for context 1:

```
AT+CGPADDR=1
+CGPADDR: 1,"10.0.0.130","1050:0000:0000:0000:0005:0600:300c:326b"
OK
```

5.8.2 Read command

The read command is not supported.

5.8.3 Test command

The test command returns a list of defined <cid> values.

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Response syntax:

```
+CGPADDR: (list of defined <cid>s)
```

The test command parameter and its defined values are the following:

<cid>

> 0–11

Example:

```
AT+CGPADDR=?
+CGPADDR: (0,1)
OK
```

5.9 PDN connection dynamic parameters +CGCONTRDP

The **+CGCONTRDP** command returns information for an active *PDN* connection. This command issues a valid response only when the modem is activated.

For reference, see *3GPP 27.007 Ch. 10.1.23*.

5.9.1 Set command

The set command returns information for an active *PDN* connection.

Syntax:

```
+CGCONTRDP=<cid>
```

Response syntax:

```
+CGCONTRDP: <cid>,<bearer_id>,<apn>[,<local_addr and
 subnet_mask>[,<gw_addr>[,<DNS_prim_addr>[,<DNS_sec_addr>[,,,,,<IPv4_MTU]]]]]
```

The set command parameters and their defined values are the following:

<cid>

> 0–11 (mandatory)

<bearer_id>

> Integer. Not supported.

<apn>

> String, a logical name for the network

<local_addr and subnet_mask>

> String. Not supported.

<gw_addr>

> String. Not supported.

<DNS_prim_addr>, <DNS_sec_addr>

> String. DNS server IP address

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IPv4_MTU

IPv4 *Maximum Transmission Unit (MTU)* size

> **Note:** If the PDN connection has dual stack capabilities, at least one pair of lines with information is returned per <cid>: First one line with the IPv4 parameters followed by one line with the IPv6 parameters.

The example command reads dynamic parameters for an initial PDN connection:

```
AT+CGCONTRDP=0
+CGCONTRDP: 0,,"internet","","","10.0.0.1","10.0.0.2",,,,,1028
OK
```

5.9.2 Read command

The read command is not supported.

5.9.3 Test command

The test command is not supported.

5.10 PS attach or detach +CGATT

The **+CGATT** command attaches the *MT* to or detaches the MT from the Packet Domain services.

For reference, see *3GPP 27.007 Ch. 10.1.9*.

5.10.1 Set command

The set command attaches the *UE* to or detaches the UE from the Packet Domain services. The command is intended for testing purposes only.

> **Note:** The UE performs an attach automatically when activated. In normal operation there is no need to issue the **+CGATT** command.

Syntax:

```
+CGATT=<state>
```

The set command parameters and their defined values are the following:

<state>

0 – Detached

1 – Attached

The example command performs an EPS attach:

```
AT+CGATT=1
OK
```

5.10.2 Read command

The read command is not supported.

5.10.3 Test command

The test command is not supported.

5.11 Power preference indication for EPS +CEPPI

The **+CEPPI** command selects the power saving preference.

For reference, see *3GPP 27.007 Ch. 10.1.38*.

5.11.1 Set command

The set command selects if the *UE* indicates to the network during radio connection that it prefers low power configuration.

Syntax:

```
+CEPPI=<power preference>
```

The set command parameters and their defined values are the following:

<power preference>

> 0 – Normal

> 1 – Low power consumption

The example command selects the power saving preference:

```
AT+CEPPI=1
OK
```

5.11.2 Read command

The read command is not supported.

5.11.3 Test command

The test command lists the supported power preferences.

Syntax:

```
+CEPPI=(list of supported <power preference>s)
```

The set command parameters and their defined values are the following:

<power preference>

> 0 – Normal

> 1 – Low power consumption

The example command lists the supported power saving preferences:

```
AT+CEPPI=?
+CEPPI: (0,1)
```

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5.12 Protocol configuration options notification %XPCO

The Nordic-proprietary **%XPCO** command subscribes *PCO* notifications.

5.12.1 Set command

The set command subscribes *PCO* notifications.

Syntax:

```
%XPCO=<n>
```

Notification syntax:

```
%XPCO: <id>,<container data>
```

The set command parameters and their defined values are the following:

<n>

> 0 – Disable PCO notifications
>
> 1 – Enable PCO notifications

The notification parameters and their defined values are the following:

<id>

> PCO identifier

<container data>

> Content of the container, hexadecimal data encoded with IRA characters. An empty container data string indicates that PCO container has not been received.

The example command subscribes E-UTRA signal quality notifications:

```
AT%XPCO=1
OK
```

The following is an example of a PCO notification for a FF00h container:

```
%XPCO: 65280,"A1B1C1D1"
```

5.12.2 Read command

The read command is not supported.

5.12.3 Test command

The test command is not supported.

5.13 Usage of ePCO/PCO in PDN connection establishment %XEPCO

The Nordic-proprietary **%XEPCO** command selects the usage of ePCO/PCO in PDN connection establishment.

5.13.1 Set command

The set command selects ePCO/PCO usage.

Syntax:

```
%XEPCO=<epco>
```

The set command parameters and their defined values are the following:

<epco>

> 0 – Use PCO
>
> 1 – use ePCO

The example command disables ePCO and selects PCO:

```
AT%XEPCO=0
OK
```

5.13.2 Read command

The read command is not supported.

5.13.3 Test command

The test command is not supported.

5.14 APN class access %XAPNCLASS

The Nordic-proprietary **%XAPNCLASS** command reads and writes *APN* class data.

5.14.1 Set command

The set command reads and writes *APN* class data.

Syntax:

```
%XAPNCLASS=<oper>,<class>[,<apn>]
```

Read response syntax:

```
%XAPNCLASS: <class>,<apn>,<addr_type>
```

The set command and response parameters and their defined values are the following:

<oper>

> 0 – Read
>
> 1 – Write

<class>

> APN class

<apn>

> APN name string

<addr_type>

      String

      IP – Internet Protocol

      IPV6 – Internet Protocol version 6

      IPV4V6 – Virtual type of dual IP stack

The example command reads APN class 3:

```
AT%XAPNCLASS=0,3
%XAPNCLASS: 3,"VZWAPN","IPV4V6"
OK
```

The following example writes class 2 APN:

```
%XAPNCLASS=1,2,"APN2"
OK
```

5.14.2 Read command

The read command is not supported.

5.14.3 Test command

The test command is not supported.

6 Network service related commands

For reference, see *3GPP 27.007 Ch. 7*.

6.1 PLMN selection +COPS

The **+COPS** command selects a *PLMN* automatically or manually, and reads and searches the current mobile network.

For reference, see *3GPP 27.007 Ch. 7.3*

6.1.1 Set command

The set command selects a mobile network automatically or manually. The selection is stored in the non-volatile memory during power-off.

Syntax:

```
+COPS=[<mode>[,<format>[,<oper>]]]
```

The set command parameters and their defined values are the following:

<mode>

        0 – Automatic network selection

        1 – Manual network selection

        3 – Set <format> of +COPS read command response.

<format>

        0 – Long alphanumeric <oper> format. Only for <mode> 3.

        1 – Short alphanumeric <oper> format. Only for <mode> 3 .

        2 – Numeric <oper> format

<oper>

String. *Mobile Country Code (MCC)* and *Mobile Network Code (MNC)* values. Only numeric string formats supported.

For manual selection, only the numeric string format is supported and <oper> is mandatory.

The example command selects the automatic network selection:

```
AT+COPS=0
OK
```

The following command manually selects network 24407:

```
AT+COPS=1,2,"24407"
OK
```

6.1.2 Read command

The command reads the current mobile network.

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Response syntax:

```
+COPS: <mode>[,<format>,<oper>,[AcT>]]
```

The read command parameters and their defined values are the following:

<mode>

> 0 – Automatic network selection
>
> 1 – Manual network selection
>
> 2 – Deregistered. Only for the Read command.

<format>

> 0 – Long alphanumeric <oper> format
>
> 1 – Short alphanumeric <oper> format
>
> 2 – Numeric <oper> format

<oper>

> A string consisting of the operator name in the alphanumeric format or a string of *MCC* and *MNC* values.

<AcT>

> 7 – E-UTRAN
>
> 9 – E-UTRAN (NB-S1 mode)

The example command reads the current selection mode and network:

```
AT+COPS?
+COPS: 0,2,"26201",7
OK
```

The example command reads the current selection mode and network with the operator name in the alphanumeric format:

```
AT+COPS?
+COPS: 0,0,"RADIOLINJA",7
OK
```

6.1.3 Test command

The test command searches the mobile network and returns a list of operators found. If the search is interrupted, the search returns existing results and the list may be incomplete.

Response syntax:

```
+COPS: [(<stat>,long alphanumeric <oper>,short alphanumeric <oper>,numeric <oper>[,AcT>])]
```

The test command parameters and their defined values are the following:

<oper>

> String. *MCC* and *MNC* values. Only numeric string formats supported.

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<stat>

        0 – Unknown

        1 – Available

        2 – Current

        3 – Forbidden

<AcT>

        7 – E-UTRAN

        9 – E-UTRAN (NB-S1 mode)

> **Note:**
>
> - The command fails if the device has an active radio connection. It returns `ERROR` or `+CME ERROR: 516`
> - The time needed to perform a network search depends on device configuration and network conditions.

The example command is used for a manual network search:

```
AT+COPS=?
+COPS: (2,"","","26201",7),(1,"","","26202",7)
OK
```

6.2 Power saving mode setting +CPSMS

The **+CPSMS** command controls *Power Saving Mode (PSM)* settings.

For reference, see *3GPP 27.007 Ch. 7.38*.

6.2.1 Set command

The command sets the power saving mode. Sets activity timer and *PSM* period after *NAS* signaling connection release. Configured values are stored in the non-volatile memory when the device is powered off with `+CFUN=0`.

Syntax:

```
+CPSMS=[<mode>[,<Requested_Periodic-RAU>,<Requested_GPRS-READY-timer>
,<Requested_Periodic-TAU>[,<Requested_Active-Time>]]]
```

The command can be given as **+CPSMS=** (with all parameters omitted). In this form, the parameter <mode> is set to 0, the use of PSM is disabled, and data for all parameters is set to the manufacturer-specific default values.

The set command parameters and their defined values are the following:

<mode>

        0 – Disable power saving mode

        1 – Enable power saving mode

<Requested_Periodic-RAU>

        Ignored

<Requested_GPRS-READY-timer>

> Ignored

<Requested_Periodic-TAU>

> String. One byte in 8-bit format.

> Optional. Timer value updated if present. 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.

<Requested_Active-Time>

> String. One byte in 8-bit format.

> Optional. Timer value updated if present. 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.

The example command enables power saving mode and set timer values. Set Periodic-TAU timer to 10 minutes and Active-Time to 1 minute.

```
AT+CPSMS=1,"","","10101010","00100001"
OK
```

The example command disables power saving mode:

```
AT+CPSMS=0
OK
```

The example command disables power saving mode and sets timer to default values:

```
AT+CPSMS=
OK
```

6.2.2 Read command

The command reads the current *PSM* settings.

Response syntax:

```
+CPSMS: <mode>,[<Requested_Periodic-RAU>],[<Requested_GPRS-READY-timer>],
[<Requested_Periodic-TAU>],[<Requested_Active-Time>]
```

The read command parameters and their defined values are the following:

<mode>

> 0 – Disable power saving mode

> 1 – Enable power saving mode

<Requested_Periodic-RAU>

> Ignored

<Requested_GPRS-READY-timer>

> Ignored

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<Requested_Periodic-TAU>

> String. One byte in 8-bit format.

> Optional. Timer value updated if present. 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.

<Requested_Active-Time>

> String. One byte in 8-bit format.

> Optional. Timer value updated if present. 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.

The example command reads the current power saving mode settings:

```
AT+CPSMS?
+CPSMS: 1,,,"10101111","01101100"
OK
```

6.2.3 Test command

The test command is not supported.

6.3 eDRX setting +CEDRXS

The **+CEDRXS** command controls the setting of *Extended Discontinuous Reception (eDRX)* parameters.

For reference, see *3GPP 27.007 Ch. 7.40*.

6.3.1 Set command

The command sets the requested *eDRX* parameters.

Syntax:

```
+CEDRXS=[<mode>,[,<AcT-type>[,<Requested_eDRX_value>]]]
```

Unsolicited result code syntax:

```
+CEDRXP: <AcT-type>[,<Requested_eDRX_value>[,<NW-provided_eDRX_value>
 [,<Paging_time_window>]]]
```

The set command parameters and their defined values are the following:

<mode>

> 0 – Disable the use of eDRX

> 1 – Enable the use of eDRX

> 2 – Enable the use of eDRX and enable the unsolicited result code

> 3 – Disable the use of eDRX and discard all parameters for eDRX or, if available, reset to the manufacturer-specific default values

<ActT-type>

> 4 – E-UTRAN (WB-S1 mode)

> 5 – E-UTRAN (NB-S1 mode)

<Requestd_eDRX_value>

> String. Half a byte in a four-bit format. The eDRX value refers to bit 4 to 1 of octet
> 3 of the Extended DRX parameters information element (see *3GPP TS 24.008,
> subclause 10.5.5.32*). Mandatory when enabling eDRX.

<NW-Provided_eDRX_value>

> String. Half a byte in a four-bit format. The eDRX value refers to bit 4 to 1 of octet
> 3 of the Extended DRX parameters information element (see *3GPP TS 24.008,
> subclause 10.5.5.32*).

<Paging_time_window>

> String. Half a byte in a four-bit format. The paging time window referes to bit 8 to
> 5 of octet 3 of the Extended DRX parameters information element (see *3GPP TS
> 24.008, subclause 10.5.5.32*).

The example command enables eDRX and set the requested eDRX value:

```
AT+CEDRXS=1,4,"1000"
OK
```

The unsolicited notification when <mode> 2 is used:

```
+CEDRXP: 4,"1000","0101","1011"
OK
```

6.3.2 Read command

The command is used to read the requested *eDRX* parameters.

Response syntax:

```
+CEDRXS: <AcT-type>,<Requested_eDRX_value>
```

The read command parameters and their defined values are the following:

<mode>

> 0 – Disable the use of eDRX
>
> 1 – Enable the use of eDRX
>
> 2 – Enable the use of eDRX and enable the unsolicited result code
>
> 3 – Disable the use of eDRX and discard all parameters for eDRX or, if available,
> reset to the manufacturer-specific default values

<ActT-type>

> 4 – E-UTRAN (WB-S1 mode)
>
> 5 – E-UTRAN (NB-S1 mode)

<Requestd_eDRX_value>

> String. Half a byte in a four-bit format. The eDRX value refers to bit 4 to 1 of octet
> 3 of the Extended DRX parameters information element (see *3GPP TS 24.008,
> subclause 10.5.5.32*).

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The example command reads the requested eDRX value:

```
AT+CEDRXS?
+CEDRXS: 4,"0110"
OK
```

6.3.3 Test command

The test command is used to list the supported *eDRX* parameters.

Response syntax:

```
+CEDRXS: (list of supported <mode>s),(list of supported <AcT-type>s),(list of supported
 <Requested_eDRX_value>s)
```

The test command parameters and their defined values are the following:

<mode>

> 0 – Disable the use of eDRX
>
> 1 – Enable the use of eDRX
>
> 2 – Enable the use of eDRX and enable the unsolicited result code
>
> 3 – Disable the use of eDRX and discard all parameters for eDRX or, if available, reset to the manufacturer-specific default values

<ActT-type>

> 4 – E-UTRAN (WB-S1 mode)
>
> 5 – E-UTRAN (NB-S1 mode)

<Requestd_eDRX_value>

> String. Half a byte in a four-bit format. The eDRX value refers to bit 4 to 1 of octet 3 of the Extended DRX parameters information element (see *3GPP TS 24.008, subclause 10.5.5.32*).

The example command reads the supported parameter values:

```
AT+CEDRXS=?
+CEDRXS: (0-3),(4-5),("0000"-"1111")
OK
```

6.4 Read EDRX dynamic parameters +CEDRXRDP

The **+CEDRXRDP** command reads dynamic eDRX parameters.

For reference, see *3GPP 27.007 Ch. 7.41*.

6.4.1 Set command

The set command reads dynamic *eDRX* parameters.

Syntax:

```
+CEDRXRDP
```

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Response syntax:

```
+CEDRXRDP: <AcT-type>[,<Requested_eDRX_value>[,<NW-
provided_eDRX_value>[,<Paging_time_window>]]]
```

The command parameters and their defined values are the following:

\<ActT-type>

> 0 – Current cell not using eDRX
>
> 4 – E-UTRAN (WB-S1 mode)
>
> 5 – E-UTRAN (NB-S1 mode)

\<Requestd_eDRX_value>

> String. Half a byte in a four-bit format. The eDRX value refers to bit 4 to 1 of octet 3 of the Extended DRX parameters information element (see *3GPP TS 24.008, subclause 10.5.5.32*).

\<NW-Provided_eDRX_value>

> String. Half a byte in a four-bit format. The eDRX value refers to bit 4 to 1 of octet 3 of the Extended DRX parameters information element (see *3GPP TS 24.008, subclause 10.5.5.32*).

\<Paging_time_window>

> String. Half a byte in a four-bit format. The paging time window referes to bit 8 to 5 of octet 3 of the Extended DRX parameters information element (see *3GPP TS 24.008, subclause 10.5.5.32*).

The example command reads eDRX parameters:

```
AT+CEDRXRDP
+CEDRXRDP: 4,"0011","0010","1001"
OK
```

6.4.2 Read command

The read command is not supported.

6.4.3 Test command

The test command is not supported.

6.5 Subscriber number +CNUM

The **+CNUM** command returns the subscriber *Mobile Station International Subscriber Directory Number (MSISDN)*.

For reference, see *3GPP 27.007 Ch. 7.1*.

6.5.1 Set command

The **+CNUM** command returns the subscriber *MSISDN*.

Syntax:

```
+CNUM
```

Response syntax:

```
+CNUM: ,<number1>,<type1>
```

An `ERROR` response is returned if MSISDN is not available on *SIM* card or if SIM card is not initialized.

The command parameters and their defined values are the following:

<numberx>

String type phone number of format specified by <typex>

<typex>

Type of address octet in integer format (see *3GPP TS 24.008 subclause 10.5.4.7*)

The example command reads the subscriber number stored in the SIM:

```
AT+CNUM
+CNUM: ,"+1234567891234",145
OK
```

6.5.2 Read command

The read command is not supported.

6.5.3 Read command

The read command is not supported.

6.6 Facility lock +CLCK

The **+CLCK** command locks, unlocks, or interrogates a facility.

For reference, see *3GPP 27.007 Ch. 7.4*.

6.6.1 Set command

The set command locks, unlocks, or interrogates a facility.

Syntax:

```
+CLCK=<fac>,<mode>[,<passwd>]
```

<fac>

SC – SIM

<mode>

0 – Unlock

1 – Lock

<passwd>

String. Password for the facility.

The example command disables *PIN* query:

```
AT+CLCK="SC",0,"<passwd>"
OK
```

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6.6.2 Read command

The read command is not supported.

6.6.3 Test command

The test command lists supported facilities.

Response syntax:

```
+CLCK: (list of supported <fac>s)
```

Example:

```
AT+CLCK=?
+CLCK: ("SC")
OK
```

6.7 Change password +CPWD

The **+CPWD** command changes the password for the facility lock.

For reference, see *3GPP 27.007 Ch. 7.5*.

6.7.1 Set command

The set command changes the password for the facility lock.

Syntax:

```
+CPWD=<fac>,<oldpwd>,<newpwd>
```

The set command parameters and their defined values are the following:

<fac>

>   "SC" – SIM PIN
>
>   "P2" – SIM PIN2

<oldpwd>,<newpwd>

>   String. Password.

> **Note:** Currently only "SC" supported.

The example command changes the SIM *PIN*:

```
AT+CPWD="SC","1234","5678"
OK
```

6.7.2 Read command

The read command is not supported.

6.7.3 Test command

The test command returns the supported facilities and password length.

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Response syntax:

```
+CPWD: list of supported (<fac>,<pwdlength>)s
```

The test command parameters and their defined values are the following:

<fac>

"SC" – SIM PIN

"P2" – SIM PIN2

<pwdlength>

Integer. Maximum length of the password

Example:

```
AT+CPWD=?
+CPWD: ("SC",8),("P2",8)
OK
```

6.8 Network registration status +CEREG

The **+CEREG** command subscribes unsolicited network status notifications.

6.8.1 Set command

The set command subscribes or unsubscribes unsolicited network status notifications.

Syntax:

```
+CEREG=<n>
```

The set command parameters and their defined values are the following:

<n>

0 – Disable unsolicited result codes

1 – Enable unsolicited result codes +CEREG:<stat>

2 – Enable unsolicited result codes +CEREG:<stat>[,<tac>,<ci>,<AcT>]

3 – Enable unsolicited result codes
+CEREG:<stat>[,<tac>,<ci>,<AcT>[,<cause_type>,<reject_cause>]]

4 – Enable unsolicited result codes +CEREG: <stat>[,[<tac>],[<ci>],
[<AcT>][,,[,[<Active-Time>],[<Periodic-TAU>]]]]

5 – Enable unsolicited result codes +CEREG: <stat>[,[<tac>],[<ci>],
[<AcT>][,[<cause_type>],[<reject_cause>][,[<Active-
Time>],[<Periodic-TAU>]]]]

For the notification syntax parameters, see Read command on page 77.

The example command subscribes notifications with level 2:

```
AT+CEREG=2
OK
```

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Unsolicited notification level 1, trying to attach:

```
+CEREG: 2
```

Unsolicited notification level 2, registered:

```
+CEREG: 1,"002F","0012BEEF",7
```

6.8.2 Read command

The command reads current network registration status.

Response syntax:

```
+CEREG: <n>,<stat>[,[<tac>],[<ci>],[<AcT>][,<cause_type>],
[<reject_cause>][,[<Active-Time>],[<Periodic-TAU>]]]]
```

The read command parameters and their defined values are the following:

<n>

0 – Disable unsolicited result codes

1 – Enable unsolicited result codes `+CEREG:<stat>`

2 – Enable unsolicited result codes `+CEREG:<stat>[,<tac>,<ci>,<AcT>]`

3 – Enable unsolicited result codes
`+CEREG:<stat>[,<tac>,<ci>,<AcT>[,<cause_type>,<reject_cause>]]`

4 – Enable unsolicited result codes `+CEREG: <stat>[,[<tac>],[<ci>],
[<AcT>][,,[,[<Active-Time>],[<Periodic-TAU>]]]]`

5 – Enable unsolicited result codes `+CEREG: <stat>[,[<tac>],[<ci>],
[<AcT>][,[<cause_type>],[<reject_cause>][,[<Active-
Time>],[<Periodic-TAU>]]]]`

<stat>

0 – Not registered. *UE* is not currently searching an operator to register to.

1 – Registered, home network.

2 – Not registered, but UE is currently trying to attach or searching an operator to register to.

3 – Registration denied.

4 – Unknown (e.g. out of E-UTRAN coverage).

5 – Registered, roaming.

8 – Attached for emergency bearer services only.

90 – Not registered due to *UICC* failure.

<tac>

String. A two-byte *Tracking Area Code (TAC)* in hexadecimal format.

<ci>

String. A four-byte E-UTRAN cell ID in hexadecimal format.

<AcT>

7 – E-UTRAN

9 – E-UTRAN NB-S1

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<cause_type>

>   0 – <reject_cause> contains an *EPS Mobility Management (EMM)* cause value. See *3GPP TS 24.301 Annex A*.

<reject_cause>

>   EMM cause value. See *3GPP TS 24.301 Annex A*

<Active-Time>

>   String. One byte in an eight-bit format.

>   Indicates the Active Time value (T3324) allocated to the device in E-UTRAN. 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.

<Periodic-TAU>

>   String. One byte in an eight-bit format.

>   Indicates the extended periodic *Tracking Area Update (TAU)* value (T3412) allocated to the device in E-UTRAN. 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.

The example command reads the current registration status:

```
AT+CEREG?
+CEREG: 2,1,"002F","0012BEEF",7
OK
```

6.8.3 Test command

The test command returns a list of supported modes as a compound value.

Response syntax:

```
+CEREG: (supported modes)
```

The test command parameters and their defined values are the following:

<n>

>   0 – Disable unsolicited result codes

>   1 – Enable unsolicited result codes +CEREG:<stat>

>   2 – Enable unsolicited result codes +CEREG:<stat>[,<tac>,<ci>,<AcT>]

>   3 – Enable unsolicited result codes
>   +CEREG:<stat>[,<tac>,<ci>,<AcT>[,<cause_type>,<reject_cause>]]

>   4 – Enable unsolicited result codes +CEREG: <stat>[,[<tac>],[<ci>],
>   [<AcT>][,,[,[<Active-Time>],[<Periodic-TAU>]]]]

>   5 – Enable unsolicited result codes +CEREG: <stat>[,[<tac>],[<ci>],
>   [<AcT>][,[<cause_type>],[<reject_cause>][,[<Active-
>   Time>],[<Periodic-TAU>]]]]

The example shows supported unsolicited results codes:

```
AT+CEREG=?
+CEREG: (0-5)
OK
```

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6.9 Subscribe unsolicited operator name indications %XOPNAME

The Nordic proprietary `%XOPNAME` command subscribes unsolicited operator name notifications.

6.9.1 Set command

The set command subscribes or unsubscribes unsolicited operator name notifications. The notification is sent when *EMM* information *Protocol Data Unit (PDU)* with the operator name is received.

Syntax:

```
%XOPNAME=<n>
```

Notification syntax:

```
%XOPNAME: [<full_name>],[<short_name>],[<oper>]
```

The set command parameters and their defined values are the following:

<n>

        0 – Disable unsolicited operator names

        1 – Enable unsolicited operator names

<full_name>

        A string in hexadecimal format. An optional field for the full operator name as specified in *3GPP TS 24.008 Ch. 10.5.3.5a Network Name* and received from network. The first octet describes the number of spare bits in the last octet, usage of country initials, and the coding scheme of the network name. Octets 2–n specify the network name.

<short_name>

        A string in hexadecimal format. An optional field for a short operator name as specified in *3GPP TS 24.008 Ch. 10.5.3.5a Network Name* and received from network. The first octet describes the number of spare bits in the last octet, usage of country initials, and the coding scheme of the network name. Octets 2–n specify the network name.

<oper>

        A string of *MCC* and *MNC* values.

The example command subscribes notifications:

```
AT%XOPNAME=1
OK
```

An example of an unsolicited notification for a full and a short operator name:

```
%XOPNAME: "88D6B23CAD7FBB41D7B4BCCC2ECFE7","8B56FD15","556776"
```

An example of an unsolicited notification for a short operator name:

```
%XOPNAME: ,"8B56FD15","556776"
```

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6.9.2 Read command

The read command is not supported.

6.9.3 Test command

The test command is not supported.

6.10 Subscribe unsolicited network time notifications %XTIME

The Nordic proprietary **%XTIME** command subscribes unsolicited network time notifications.

6.10.1 Set command

The set command subscribes or unsubscribes unsolicited network time notifications.The notificaton is sent when *EMM* information *PDU* with time information is received.

Syntax:

```
%XTIME=<n>
```

Notification syntax:

```
%XTIME: [<local_time_zone>],[<universal_time>],[<daylight_saving_time>]
```

The set command and response parameters and their defined values are the following:

<n>

> 0 – Disable unsolicited network time
>
> 1 – Enable unsolicited network time

<local_time_zone>

> A string in hexadecimal format. A one-byte optional field for the local time zone as specified in *3GPP TS 24.008 Ch. 10.5.3.8 Time Zone* and received from network.

<universal_time>

> A string in hexadecimal format. A seven-byte optional field for universal time as specified in *3GPP TS 24.008 Ch. 10.5.3.9 Time Zone and Time* and received from network.

<daylight_saving_time>

> A string in hexadecimal format. A one-byte optional field for daylight saving time as specified in *3GPP TS 24.008 Ch. 10.5.3.12 Daylight Saving Time* and received from network.

The example command subscribes notifications:

```
AT%XTIME=1
OK
```

An example of an unsolicited notification for network time with all parameters:

```
%XTIME: "08","81109251714208","01"
```

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An example of an unsolicited notification for network time without local time zone:

```
%XTIME: ,"81109251714208","01"
```

6.10.2 Read command

The read command is not supported.

6.10.3 Test command

The test command is not supported.

6.11 Set release assistance information %XRAI

The Nordic proprietary `%XRAI` command sets release assistance information.

6.11.1 Set command

The set command sets release assistance information.

Syntax:

```
%XRAI[=<rai>]
```

The set command parameters and their defined values are the following:

<rai>

> Release assistance information sent to the network.
>
> 0 – Undefined, default
>
> 3 – Control plane one response. For more information, see *3GPP TS 24.301, subclause 9.9.4.25 Release assistance indication*.
>
> 4 – Control plane no response. For more information, see *3GPP TS 24.301, subclause 9.9.4.25 Release assistance indication*.

Note: When <rai> is set to 3 or 4, the *UE* includes release assistance information to the next control plane uplink data transmission. The network is not expecting more uplink data and will release the radio connection. Further uplink data transfer requires additional signaling for establishing a radio connection.

The example command sets release assistance information when the application has one packet to be sent and no response from the network is expected:

```
AT%XRAI=4
OK
```

6.11.2 Read command

The read command is not supported.

6.11.3 Test command

The test command is not supported.

7 Mobile termination errors

For reference, see *3GPP 27.007 Ch. 9*.

7.1 Report mobile termination errors +CMEE

The **+CMEE** command disables or enables the use of the final result code +CME ERROR.

For reference, see *3GPP 27.007 Ch. 9.1*.

7.1.1 Set command

The set command disables or enables the use of the final result code +CME ERROR.

Syntax:

```
<+CMEE=[<n>]>
```

The set command parameters and their defined values are the following:

<n>

       0 – Disable and use ERROR instead (default)

       1 – Enable +CME ERROR: <err> result code and use numeric <err> values.
       <err> values are specified in *3GPP TS 27.007 Ch. 9.2*. Vendor-specific values listed in
       the command chapters, the value range starts from 512.

The example command enables error codes in responses:

```
AT+CMEE=1
OK
```

7.1.2 Read command

The read command returns the current setting of <n>.

Response syntax:

```
+CMEE: <n>
```

The set command parameters and their defined values are the following:

<n>

       0 – Disabled. ERROR used as the final response in case of failure.

       1 – Enabled. +CME ERROR: <err> result code and numeric <err> values used.

The example command reads the current error code setting:

```
AT+CMEE?
+CMEE: 1
OK
```

7.1.3 Test command

The test command returns supported values as a compound value.

Response syntax:

```
+CMEE: (list of supported <n>s)
```

The set command parameters and their defined values are the following:

<n>

        0 – Disabled. ERROR used as the final response in case of failure.

        1 – Enabled. +CME ERROR: <err> result code and numeric <err> values used.

The example command returns the supported values:

```
AT+CMEE=?
+CMEE:(0,1)
OK
```

7.2 Report network error codes +CNEC

The **+CNEC** command activates or deactivates unsolicited reporting of error codes sent by the network.

For reference, see *3GPP 27.007 Ch. 9.1B*.

7.2.1 Set command

The set command activates or deactivates unsolicited reporting of error codes sent by the network.

Syntax:

```
+CNEC=[<n>]
```

The set command parameters and their defined values are the following:

<n>

        0 – Disable unsolicited error reporting

        8 – Enable unsolicited result code +CNEC_EMM: <error_code>[,<cid>] to report *EPS* mobility management errors

        16 – Enable unsolicited result code +CNEC_ESM: <error_code>[,<cid>] to report EPS session management errors

        24 – Enable unsolicited result codes for +CNEM_EMM: <error_code>[,<cid>] and +CNEC_ESM: <error_code>[,<cid>]

<error_code>

        3GPP TS 24.301 Table 9.9.3.9.1 for EPS mobility management errors codes

        3GPP TS 24.301 Table 9.9.4.4.1 for EPS session management errors codes

<cid>

        0 – 11. <cid> is present if <error_code> is related to a specific <cid>.

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The example command enables `CNEC_ESM` error codes.

```
AT+CNEC=16
OK
```

The example notification shows *EMM* Cause 22 (Congestion) received from the network:

```
+CNEC_EMM: 22
```

7.2.2 Read command

The read command returns the current setting of <n>.

Response syntax:

```
+CNEC: <n>
```

<n>

> 0 – Disable
>
> 8 – +CNEC_EMM enabled
>
> 16 – +CNEC_ESM enabled
>
> 24 – +CNEC_EMM and +CNEC_ESM

The example command reads **CNEC** error code setting, both `CNEC_EMM` and `CNEC_ESM` enabled.

```
AT+CNEC?
+CNEC: 24
OK
```

7.2.3 Test command

The test command returns the supported values as compound values.

Response syntax:

```
+CNEC: (list of supported <n>s)
```

<n>

> 0 – Disable
>
> 8 – **+CNEC_EMM** enabled
>
> 16 – **+CNEC_ESM** enabled
>
> 24 – **+CNEM_EMM** and **+CNEC_ESM**

The example command returns **CNEC** error code setting values.

```
AT+CNEC?
+CNEC: (0,8,16,24)
OK
```

7.3 Extended error report +CEER

The **+CEER** command returns an extended error report.

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For reference, see *3GPP 27.007 Ch. 6.10*

7.3.1 Set command

The set command returns an extended error report.

Syntax:

```
+CEER
```

Response syntax:

```
+CEER: <report>
```

The command has the following parameter:

<report>

> String. Information related to the last failure. Contains module information and the cause value. The module is one of the following values: OTHER, ESM, EMM, PDP, UICC, SMS.

The example command reads the latest failure stored by the modem:

```
AT+CEER
+CEER: "SMS 301"
OK
```

7.3.2 Read command

The read command is not supported.

7.3.3 Test command

The test command is not supported.

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8 SMS commands

For reference, see *3GPP 27.005 Ch. 3*.

8.1 Message format +CMGF

The **+CMGF** command sets message format.

For reference, see *3GPP 27.005 Ch. 3.2.3*.

8.1.1 Set command

The set command selects between *PDU* and text format

> **Note:** This command can only be issued by a client registered with **+CNMI**.

Syntax:

```
+CMGF=[<mode>]
```

The set command parameter and its defined values are the following:

<mode>

> 0 – PDU mode, default value

The example command sets the message format to PDU mode:

```
AT+CMFG=0
OK
```

8.1.2 Read command

The read command is used to query the current message format.

Response syntax:

```
+CMGF: <mode>
```

The read command parameter and its defined values are the following:

<mode>

> 0 – *PDU* mode

The example command reads the current message format:

```
AT+CMGF?
+CMGF: 0
OK
```

8.1.3 Test command

The test command lists the supported message formats.

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Response syntax:

```
+CMGF: (list of <mode>s)
```

The test command parameter and its defined values are the following:

<mode>

0 – *PDU* mode

Example:

```
AT+CMGF=?
+CMGF: (0)
OK
```

8.2 New message indications +CNMI

The **+CNMI** command selects how new messages are indicated

For reference, see *3GPP 27.005 Ch. 3.4.1*.

8.2.1 Set command

The command registers or unregisters an SMS client. Only one AT client can be registered as an SMS client. An existing registration must be released before registering a new client.

Syntax:

```
+CNMI=[<mode>[,<mt>[,<bm>[,<ds>]]]]
```

The set command parameters and their defined values are the following:

<mode>

0 – Do not forward unsolicited result codes to the *TE* (default).

3 – Forward unsolicited result codes directly to the TE.

<mt>

0 – No received message notifications, the modem acts as an SMS client. Forces also <ds> to 0.

2 – SMS-DELIVERs (except class 2 and message waiting indication group) are routed directly to the TE using unsolicited result code +CMT: [<alpha>],<length><CR><LF><pdu>. TE needs to ack with **+CNMA**.

<bm>

Ignored

<ds>

0 – No SMS-STATUS-REPORTs are routed to the TE. The only option if <mt> is set to 0.

1 – SMS-STATUS-REPORTs are routed to the TE using unsolicited result code: +CDS: <length><CR><LF><pdu>. TE needs to ack with **+CNMA**.

The TE needs to handle both SMS-DELIVER and SMS-STATUS-REPORT or neither of them, <mt> and <ds> shall both be set to 0 at the same time, equals to <mode> 0.

The example command registers as a client for mobile-terminated SMS and status reports:

```
AT+CNMI=3,2,0,1
OK
```

8.2.2 Read command

The command is used to query how new messages are indicated.

Response syntax:

```
+CNMI: <mode>,<mt>,<bm>,<ds>,<bfr>
```

The set command parameters and their defined values are the following:

<mode>

        0 – Do not forward unsolicited result codes to the *TE* (default).

        3 – Forward unsolicited result codes directly to the TE.

<mt>

        0 – No received message notifications, the modem acts as an SMS client.

        2 – SMS-DELIVERs (except class 2 and message waiting indication group) are routed directly to the TE.

<bm>

        No CBM notifications are routed to the TE.

<ds>

        0 – No SMS-STATUS-REPORTs are routed to the TE.

        1 – SMS-STATUS-REPORTs are routed to the TE using unsolicited result code: +CDS: <length><CR><LF><pdu>.

<bfr>

        1 – The buffer of unsolicited result codes is cleared when <mode> 1...3 is entered

Example:

```
AT+CNMI?
+CNMI: 3,2,0,1,1
OK
```

8.2.3 Test command

The test command is not supported.

8.3 Send message, PDU mode + CMGS

The command sends a message in *PDU* mode.

For reference, see *3GPP 27.005 Ch. 3.5.1* and *3GPP 27.005 Ch. 4.3*.

8.3.1 Set command

The command sends a message in *PDU* mode.

> **Note:** Only a client registered with **+CNMI** is allowed to send messages.

Syntax:

```
+CMGS=<length><CR><pdu><ctrl-Z>
```

Response syntax:

```
+CMGS: <mr>[,<ackpdu>]
```

The command parameters and their defined values are the following:

<length>

Number of octets coded in the transport layer data unit to be given. 1–3 ASCII digits.

<pdu>

Hexadecimal numbers containing two *International Reference Alphabet (IRA)* characters per octet.

<mr>

Message reference value.

<ackpdu>

RP-User-Data element of RP-ACK PDU.

<pdu> is expected to be received in the same command after <CR>. Interactive mode is not supported. PDU consists of hexadecimal numbers containing two IRA characters per octet.

The example command sends the message "Testing a SMS messaging over LTE" to +358401234567, Service Center Address +448888888:

```
AT+CMGS=42<CR>069144888888F811000C9153481032547600000B20D4F29C9E769F4161
        D0BC3D07B5CBF379F89C769F416F7B590E62D3CB<ctrl-z>
+CMGS: 2
OK
```

8.3.2 Read command

The read command is not supported.

8.3.3 Test command

The test command is not supported.

8.4 Received SMS notification in PDU mode +CMT

+CMT notifies of an unsolicited received message in *PDU* mode. *TE* is expected to ack received message with **AT+CNMA**.

For reference, see *3GPP 27.005 Ch. 3.4.1*

The notification is subscribed using the **+CNMI** command.

Syntax:

```
+CMT: <alpha>,<length><CR><LF><pdu>
```

The notification parameters and their defined values are the following:

<alpha>

TP-Originating-Address in string format.

<length>

Number of hexadecimal octets in <pdu>. 1–3 ASCII digits.

<pdu>

Hexadecimal numbers containing two *IRA* characters per octet.

The example returns a notification of a received message "Testing a sms messaging over lte" from +358401234567, Service Center Address +44 888 8888:

```
+CMT: "+358401234567",28<CR><LF>069144888888F8D4F29C9E769F4161D0BC3D07B5CBF379F89C
    769F416F7B590E62D3CB
```

8.5 Delivery status notification in PDU mode +CDS

+CDS notifies of an unsolicited delivery status in *PDU* mode. *TE* is expected to ack received delivery report with **AT+CNMA**.

The notification is subscribed using the **+CNMI** command.

Syntax:

```
+CDS: <length><CR><LF><pdu>
```

The notification parameters and their defined values are the following:

<length>

Number of hexadecimal octets in <pdu>. 1–3 ASCII digits.

<pdu>

Hexadecimal numbers containing two *IRA* characters per octet.

The example returns a delivery status notification with the recipient address, service center timestamp, and message delivery time:

```
+CDS: 25<CR><LF>060C915348103254761711603162550017116031521 20000
OK
```

8.6 New message ACK, PDU mode +CNMA

The **+CNMA** command sends an ACK in *PDU* mode.

> **Note:** Text mode is not supported.

For reference, see *3GPP 27.005 Ch. 4.7*.

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8.6.1 Set command

The set command sends a new message or delivery status ACK. A client receiving unsolicited notifications for new messages and delivery status is mandated to acknowledge those. This command can be used only when the modem is activated.

> **Note:**
>
> - This command can only be issued by a client registered with **+CNMI**.
> - After sending cause 22, the **%XSMMA** command needs to be used when memory is available.

.

If the *UE* does not get an acknowledgement within the required time (network timeout), the it should respond as specified in *3GPP TS 24.011*, and UE/*TA* shall automatically disable routing to the *TE* by setting both <mt> and <ds> values of **+CNMI** to zero, that is, the SMS client gets unregistered.

Syntax:

```
+CNMA[=<n>[,<length>[<CR>PDU is given<ctrl-Z/ESC>]]]
```

The set command parameters and their defined values are the following:

<n>

0 – The command operates in the same way as defined for the text mode, see New message ACK, text mode +CNMA on page 92

1 – Send RP-ACK

2 – Send RP-ERROR

<length>

Number of hexadecimal octets in <pdu>. 1–3 ASCII digits.

<pdu>

Hexadecimal numbers containing two *IRA* characters per octet.

The example command confirms the reception of a message, timestamp 06/11/2071 13:26:31:

```
AT+CNMA=1,9<CR>010017116031621300<ctrl-z>
OK
```

8.6.2 Read command

The read command is not supported.

8.6.3 Test command

The test command lists supported <n>s.

Response syntax:

```
+CNMA: (list of supported <n>s)
```

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<n>

> 0 – The command operates in the same way as defined for the text mode.

> 1 – Send RP-ACK.

> 2 – Send RP-ERROR.

Example:

```
AT+CNMA=?
+CNMA: (0-2)
OK
```

8.7 New message ACK, text mode +CNMA

The **+CNMA** command sends a new message ACK in text mode.

> **Note:** Text mode is not supported.

For reference, see *3GPP 27.005 Ch. 3.4.4.*

8.7.1 Set command

The set command sends a new message ACK in text mode. This command can be used only when the modem is activated.

This command can only be issued by a client registered with **+CNMI**.

If the *UE* does not get an acknowledgement within the required time (network timeout), it should respond as specified in *3GPP TS 24.011* and the UE/*TA* shall automatically disable routing to *TE* by setting both <mt> and <ds> values of **+CNMI** to zero, i.e. the SMS client gets unregistered.

Syntax:

```
+CNMA
```

Example:

```
AT+CNMA
OK
```

8.7.2 Read command

The read command is not supported.

8.7.3 Test command

The test command lists supported <n>s.

Response syntax:

```
+CNMA: (list of supported <n>s)
```

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<n>

> 0 – The command operates in the same way as defined for the text mode.
>
> 1 – Send RP-ACK
>
> 2 – Send RP-ERROR

Example:

```
AT+CNMA=?
+CNMA: (0-2)
OK
```

8.8 Preferred message storage +CPMS

The **+CPMS** command selects the memory storage.

For reference, see *3GPP 27.005 Ch. 3.2.2*.

8.8.1 Set command

The command sets the used memory.

> **Note:** The modem does not support SMS memory, only direct routing to *TE*.

Syntax:

```
+CPMS=<mem1>[,<mem2>[,<mem3>]]
```

Response syntax:

```
+CPMS: <used1>,<total1>,<used2>,<total2>,<used3>,<total3>
```

The set command parameters and their defined values are the following:

<mem1>

> "MT" – Refers to all message storage areas associated with the modem

<mem2>

> "MT" – Refers to all message storage areas associated with the modem

<mem3>

> "MT" – Refers to all message storage areas associated with the modem

<usedx>

> Integer. The number of messages currently in <memx>

<totalx>

> Integer. The number of messages currently in <memx>

Example:

```
AT+CPMS="MT","MT","MT"
+CPMS: 0,0,0,0,0,0
OK
```

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8.8.2 Read command

The command is used to query memory status.

Response syntax:

```
+CPMS: <mem1>,<used1>,<total1>,<mem2>,<used2>,<total2>,<mem3>,<used3>,<total3>
```

The set command parameters and their defined values are the following:

<mem1>

"MT" – Refers to all message storage areas associated with the modem

<mem2>

"MT" – Refers to all message storage areas associated with the modem

<mem3>

"MT" – Refers to all message storage areas associated with the modem

<usedx>

Integer. The number of messages currently in <memx>

<totalx>

Integer. The number of messages currently in <memx>

Example:

```
AT+CPMS?
+CPMS: "MT",0,0,"MT",0,0,"MT",0,0
OK
```

8.8.3 Test command

The test command lists supported memories.

Response syntax:

```
+CPMS: (list of supported <mem1>s),(list of supported <mem2>s),(list of supported <mem3>s)
```

The set command parameters and their defined values are the following:

<mem1>

"MT" – Refers to all message storage areas associated with the modem

<mem2>

"MT" – Refers to all message storage areas associated with the modem

<mem3>

"MT" – Refers to all message storage areas associated with the modem

Example:

```
AT+CPMS=?
+CPMS: ("MT"),("MT"),("MT")
OK
```

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8.9 Message service failure result code +CMS ERROR

Message service failure result code **+CMS** is sent as error response to SMS-related commands.

For reference, see *3GPP 27.005 Ch. 3.2.5*.

Response syntax:

```
+CMS ERROR: <err>
```

The parameter and the values used by common messaging commands are the following:

<err>

> 0...127 – 3GPP TS 24.011 clause E.2 values
>
> 128...255 – 3GPP TS 23.040 clause 9.2.3.22 values
>
> 300...511 – 3GPP TS 27.005 Ch. 3.2.5
>
> 512... – Manufacturer specific
>
> 513 – Manufacturer-specific cause: Not found
>
> 514 – Manufacturer-specific cause: Not allowed
>
> 515 – Manufacturer-specific cause: Memory full

8.10 Select SMS service +CGSMS

The **+CGSMS** command selects the SMS service.

For reference, see *3GPP 27.007 Ch. 10.1.21*.

8.10.1 Set command

The set command selects the SMS service.

Syntax:

```
+CGSMS=[<service>]
```

The set command parameter and its defined value is the following:

<service>

> 1 – Circuit-switched

> **Note:** In a failure case, the command response is ERROR or +CME ERROR.

The example command selects the circuit-switched SMS service:

```
AT+CGSMS=1
OK
```

8.10.2 Read command

The command reads the current SMS service.

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Response syntax:

```
+CGSMS: <service>
```

The read command parameter and its defined value is the following:

<service>

> 1 – Circuit-switched

The example command reads the current SMS service:

```
AT+CGSMS?
+CGSMS: 1
OK
```

8.10.3 Test command

The command lists the supported SMS services.

Response syntax:

```
+CGSMS: (list of currently available <service>s)
```

The test command parameter and its defined value is the following:

<service>

> 1 – Circuit-switched

The example command lists the supported SMS services:

```
AT+CGSMS=?
+CGSMS: (1)
OK
```

8.11 Short message memory available %XSMMA

The Nordic-proprietary **%XSMMA** command sends an *RP-SMMA* message.

8.11.1 Set command

The set command sends an *RP-SMMA* message.

The command is a trigger for the RP-SMMA message on the SMS stack to indicate to the Service Center that the *UE* has memory available and can receive mobile-terminated short messages. The client can set a memory full situation preventing incoming SMS messages by acking a mobile-terminated short message with AT+CNMA=2 (the *PDU* parameter has to contain cause code 22 "Memory capacity exceeded"). Cause 300 is returned for all failures.

Command syntax

```
%XSMMA
```

The example command triggers sending the RP-SMMA on the SMS layer to release a memory full situation and to receive a response:

A successful case:

```
AT%XSMMA
OK
```

8.11.2 Read command

The read command is not supported.

8.11.3 Test command

The test command is not supported.

9 Authenticating AT command usage

The `%XSUDO` is used to authenticate AT commands.

Before you start the authentication, perform the following two steps (only once):

1. Generate private and public keys with OpenSSL:

```
openssl ecparam -name prime256v1 -genkey -noout -out [private key PEM file]
openssl ec -in [private key PEM file] -out [public key PEM file] -pubout
```

2. Write the public key with the AT command:

```
AT%XPMNG=0,"<public key>"
OK
```

To authenticate an AT command, perform the following steps:

1. Calculate an AT command signature.
   a) Create an AT command text file for an authenticated AT command:
      Example:

```
%CMNG=0,1,0,"TEST ROOT CERTIFICATE"
```

   b) Create a digest file with OpenSSL from AT command that needs authentication:

```
openssl sha256 -binary [AT command text file] > [digest file]
```

   c) Create a signature file with OpenSSL from the digest file:

```
openssl pkeyutl -sign -in [digest file] -out [signature file] -inkey [private key PEM
 file]
```

   d) Convert the signature to Base64 format:

```
base64 < [signature file] > [signature base64 file]
```

2. Write the authenticated AT command.
   The `%XSUDO` command is used to authenticate the `%CMNG` command:
   Example:

```
AT%XSUDO=35,"<signature base64>";%CMNG=0,1,0,"TEST ROOT CERTIFICATE"
OK
```

For more information on the command, see Authenticated access %XSUDO on page 32.

Glossary

Access Point Name (APN)

The name of a gateway between a mobile network and another computer network, usually the Internet.

Check Digit (CD)

The last one-digit number of the *IMEI* code used for error detection.

Classless Inter-domain Routing (CIDR)

A method for allocating IP (Internet Protocol) addresses.

CS/PS Mode of Operation

A *UE* mode of operation. The UE may either register to packet-switched services, circuit-switched services, or both based on the mode of operation. If both are registered, the mode of operation also contains a preference for either of them.

Dynamic Host Configuration Protocol (DHCP)

A network management protocol used for automatic and centralized management of IP addresses within a network.

EPS Mobility Management (EMM)

The *EPS* Mobility Management (EMM) sublayer in the *NAS* protocol provides mobility service to the *UE*.

Evolved Packet System (EPS)

A connection-oriented transmission network in LTE (Long-term Evolution) consisting of an EPC (Evolved Packet Core) and an E-UTRAN (Evolved Terrestrial Radio Access Network).

Electronic Serial Number (ESN)

A unique number embedded on a microchip for identifying mobile devices.

Extended Discontinuous Reception (eDRX)

A method to conserve the battery of an IoT (Internet of Things) device by allowing it remain inactive for extended periods.

Firmware-Over-The-Air (FOTA)

Wireless update of the main system software.

International Mobile (Station) Equipment Identity (IMEI)

A unique code consisting of 14 digits and a check digit for identifying 3GPP-based mobile devices.

International Mobile (Station) Equipment Identity, Software Version (IMEISV)

A unique code consisting of 16 decimal digits and two software version digits for identifying 3GPP-based mobile devices.

International Mobile Subscriber Identity (IMSI)

A unique code, usually 15 digits, used for the identification of a mobile subscriber and consisting of an *MCC*, *MNC*, and MSIN (Mobile Subscription Identification Number).

International Reference Alphabet (IRA)

A seven-bit coded character set for information exchange.

Mobile Country Code (MCC)

A unique three-digit part of an IMSI code identifying the country of domicile of the mobile subscriber. MCC is used together with the Mobile Network Code (MNC).

Mobile Equipment (ME)

The physical *UE* consisting of one of more *MT* and one or more *TE*.

Mobile Network Code (MNC)

A code identifying the telecommunications network. The code is defined by ITU-T Recommendation E.212, consists of two or three decimal digits, and is used together with the Mobile Country Code (MCC).

Mobile Station International Subscriber Directory Number (MSISDN)

A number consisting of a maximum of 15 digits identifying a mobile subscriber by mapping the telephone number to the *SIM* card in a phone.

Mobile Termination (MT)

A component of the Mobile Equipment (ME) performing functions specific to management of the radio interface. The R interface between *TE* and MT uses the AT command set. The *IMEI* code is attached to the MT.

Maximum Transmission Unit (MTU)

The largest packet or frame that can be sent in a single network layer transaction.

Non-access Stratum (NAS)

In telecom protocol stacks, the highest stratum of the control plane between the core network and *UE*. The layer is used to manage the establishment of communication sessions and for maintaining communications with the UE as it moves.

Non-Access Stratum (NAS) Signalling Low Priority Indication (NSLPI)

Used by the network for NAS level mobility management congestion control and *APN* based congestion control.

Non-volatile Memory (NVM)

Memory that can retrieve stored information even after having been power-cycled.

Protocol Configuration Options (PCO)

An element of *NAS* message used for transferring parameters between the *UE* and the P-GW (Packet Data Network Gateway).

Packet Data Network (PDN)

A network that provides data services.

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Packet Data Protocol (PDP)

A packet transfer protocol in wireless GPRS (General Packet Radio Services) and HSDPA (High-speed Downlink Packet Access) networks.

Packet Data Protocol (PDP) Context

In UMTS (Universal Mobile Telecommunications System) and GPRS (General Packet Radio Service), the record that specifies *UE* access to an external packet-switched network.

Privacy Enhanced Mail (PEM)

A public key certificate defined in the X.509 cryptography standard and used to privately transmit email.

Protocol Data Unit (PDU)

Information transferred as a single unit between peer entities of a computer network and containing control and address information or data. PDU mode is one of the two ways of sending and receiving SMS messages.

Personal Identification Number (PIN)

An optional security feature in mobile devices used for identifying a user. PIN is a numeric code which must be entered each time a mobile device is started.

Personal Unblocking Key (PUK)

A digit sequence required in 3GPP mobile phones to unlock a *SIM* that has disabled itself after an in correct personal identification number has been entered multiple times.

Power Saving Mode (PSM)

A feature introduced in 3GPP Release 12 to improve battery life of IoT (Internet of Things) devices by minimizing energy consumption. The device stays dormant during the PSM window.

Pre-shared Key (PSK)

A password authentication method, a string of text, expected before a username and password to establish a secured connection. Also known as a "shared secret".

PS Mode of Operation

A *UE* mode of operation. The UE registers only to *EPS* services.

Public Land Mobile Network (PLMN)

A network that provides land mobile telecommunications services to the public. A PLMN is identified by the *MCC* and *MNC*.

Quality of Service (QoS)

The measured overall performance of a service, such as a telephony or computer network, or a cloud computing service.

RP-SMMA

A message sent by the User Equipment to relay a notification to the network that the mobile has memory available to receive one or more short messages.

Reference Signal Received Power (RSRP)

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The average power level received from a single reference signal in an LTE (Long-term Evolution) network.

Serial Number (SNR)

A unique six-digit number part of the *IMEI* code identifying each equipment within each *TAC*.

System in Package (SiP)

A number of integrated circuits, often from different technologies, enclosed in a single module that performs as a system or subsystem.

Software Version Number (SVN)

Part of the *IMEI* code identifying the revision of the software installed on a mobile device.

Subscriber Identity Module (SIM)

A card used in *UE* containing data for subscriber identification.

Terminal Adapter (TA)

A device that connects a *UE* to a communications network. In mobile networks, the terminal adapter is used by the terminal equipment to access the mobile termination using AT commands.

Type Allocation Code (TAC)

The initial eight-digit part of an *IMEI* code used for identifying the model of a mobile phone.

Tracking Area Code (TAC)

A unique code used to identify a tracking area within a particular network.

Tracking Area Update (TAU)

A procedure initiated by the *UE* when moving to a new tracking area in the LTE (Long-term Evolution) system.

Terminal Equipment (TE)

Communications equipment at either end of a communications link, used to permit the stations involved to accomplish the mission for which the link was established.

Universal Integrated Circuit Card (UICC)

A new generation *SIM* used in *UE* for ensuring the integrity and security of personal data.

Universal Subscriber Identity Module (USIM)

A card used in *UE* containing data for subscriber identification.

User Equipment (UE)

Any device used by an end-user to communicate. The UE consists of the Mobile Equipment (ME) and the Universal Integrated Circuit Card (UICC).

Acronyms and abbreviations

These acronyms and abbreviations are used in this document.

APN
Access Point Name

CD
Check Digit

CIDR
Classless Inter-Domain Routing

CS
Circuit-Switched

DER
Distinguished Encoding Rules

DHCP
Dynamic Host Configuration Protocol

DRX
Discontinuous Reception

eDRX
Extended Discontinuous Reception

EMM
EPS Mobility Management

EPS
Evolved Packet System

ESN
Electronic Serial Number

E-UTRA
Evolved Universal Terrestrial Radio Access

E-UTRAN
Evolved Terrestrial Radio Access Network

FOTA
Firmware Over The Air

GPRS
General Packet Radio Services

IMEI
International Mobile (Station) Equipment Identity

IMEISV
International Mobile (Station) Equipment Identity, Software Version

IMSI

International Mobile Subscriber Identity

IRA

International Reference Alphabet

MCC

Mobile Country Code

ME

Mobile Equipment

MNC

Mobile Network Code

MSISDN

Mobile Station International Subscriber Directory Number

MT

Mobile Termination

MTU

Maximum Transmission Unit

NAS

Non-access Stratum

NSLPI

NAS Signalling Low Priority Indication

NVM

Non-volatile Memory

PCO

Protocol Configuration Options

PDP

Packet Data Protocol

PDN

Packet Data Network

PDU

Protocol Data Unit

PEM

Privace Enhanced Mail

PIN

Personal Identification Number

PKCS

Public Key Cryptography Standards

PLMN

Public Land Mobile Network

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PS

Packet-Switched

PSK

Pre-shared Key

PSM

Power Saving Mode

PUK

Personal Unblocking Key

QoS

Quality of Service

RAU

Routing Area Update

RP-ACK

Reply Path Acknowledgement

RP-ERROR

Reply Path Error

RSRP

Reference Signal Received Power

SIM

Subscriber Identity Module

SiP

System in Package

SNR

Serial Number

SVN

Software Version Number

TA

Terminal Adapter

TAC

Tracking Area Code

Type Allocation Code

TAU

Tracking Area Update

TE

Terminal Equipment

UE

User Equipment

UICC

Universal Integrated Circuit Card

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USIM
Universal Subscriber Identity Module

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MANAGEMENT SYSTEM CERTIFICATION

DNV·GL

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