ME910C1 Quick Start Guide

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APPLICABILITY TABLE

PRODUCTS

- ME910 SERIES

CONTENTS

1 Introduction

1.1 Scope

Scope of this document is to give an overview and basic instructions of how to start using the ME910C1 module.

1.2 Audience

This document is intended for customers who want to use and test the NE866 product.

1.3 Contact Information, Support

For general contact, technical support services, technical questions and report documentation errors contact Telit Technical Support at:
TS-EMEA@telit.com

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:
http://www.telit.com

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.
Telit appreciates feedback from the users of our information.

1.4 Related Documents

- 1VV0301351 ME910C1 HW User Guide Rev.12
- 80529ST10815A ME910C1/NE910C1/ML865C1 AT Commands Reference Guide Rev. 10
- 80529NT11643A ME910C1/NE910C1/ML865C1 PSM Application Note Rev. 1

2 General Description

2.1 ME910C1 Main Features

The ME910C1 is the Category M1/NB1 evolution of the Telit LE910 Series of LTE modules. Specified in the approved Release 13 of the 3GPP standard, Cat M1/NB1 devices are specifically tailored for IoT applications, offering optimized power consumption and enhanced coverage. This model further enriches the widely deployed Telit xE910 family of 28 x 28 mm LGA modulesBasic Set Up

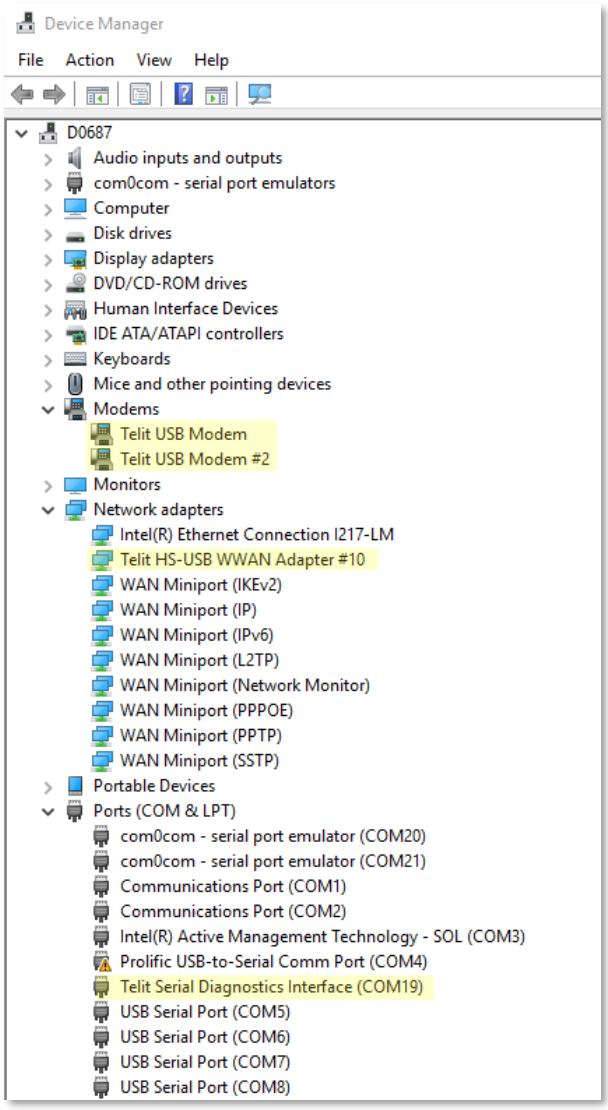
- LTE UE Category M1/NB1 3GPP release 13 compliant
- Half Duplex FDD
- Single Rx, single antenna
- 3GPP Rel. 12 Power Saving Mode (PSM)
- 3GPP Rel. 13 Extended Discontinuous Reception (eDRX)
- 3GPP Rel. 13 Extended coverage
- Control via AT commands according to 3GPP TS27.005, 27.007 and customized AT commands
- SIM application Tool Kit 3GPP TS 51.01
- SMS
- IPv4/IPv6 stack with TCP and UDP protocol
- OMA Lightweight M2M (LWM2M)
- Over-the-Air firmware update (for future release)
- Telit Application Development Environment: AppZone C (for future release)
- SSL
- Optional embedded GNSS (GPS, GLONASS, Beidou, Galileo)

2.2 USB/UART port configuration

The ME910C1 is equipped with 2 asynchronous serial port (CMOS 1.8) and one integrated universal serial bus (USB 2.0 HS) transceiver with the following composition:

- 2 Telit USB Modem ports
- 1 Telit HS-USB WWAN
- 1 Telit Serial Diagnostic Interface

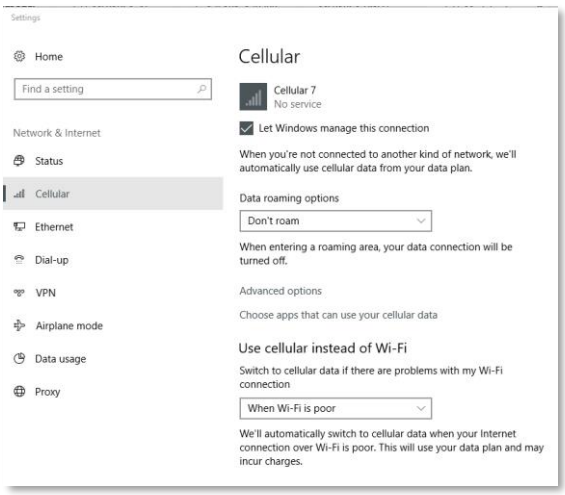
The screenshot below reports an example of the port composition listed on Windows 10 Device Manager.



USB Modem ports are ACM devices and can be used as AT Command interface.

Telit HS-USB WWAN is an RMNET adapter that can be used with Linux ModemManager and NetworkManager.

On Windows 10 WWAN Adapter should be automatically loaded as Cellular Connection in Network & Internet settings (see image below).



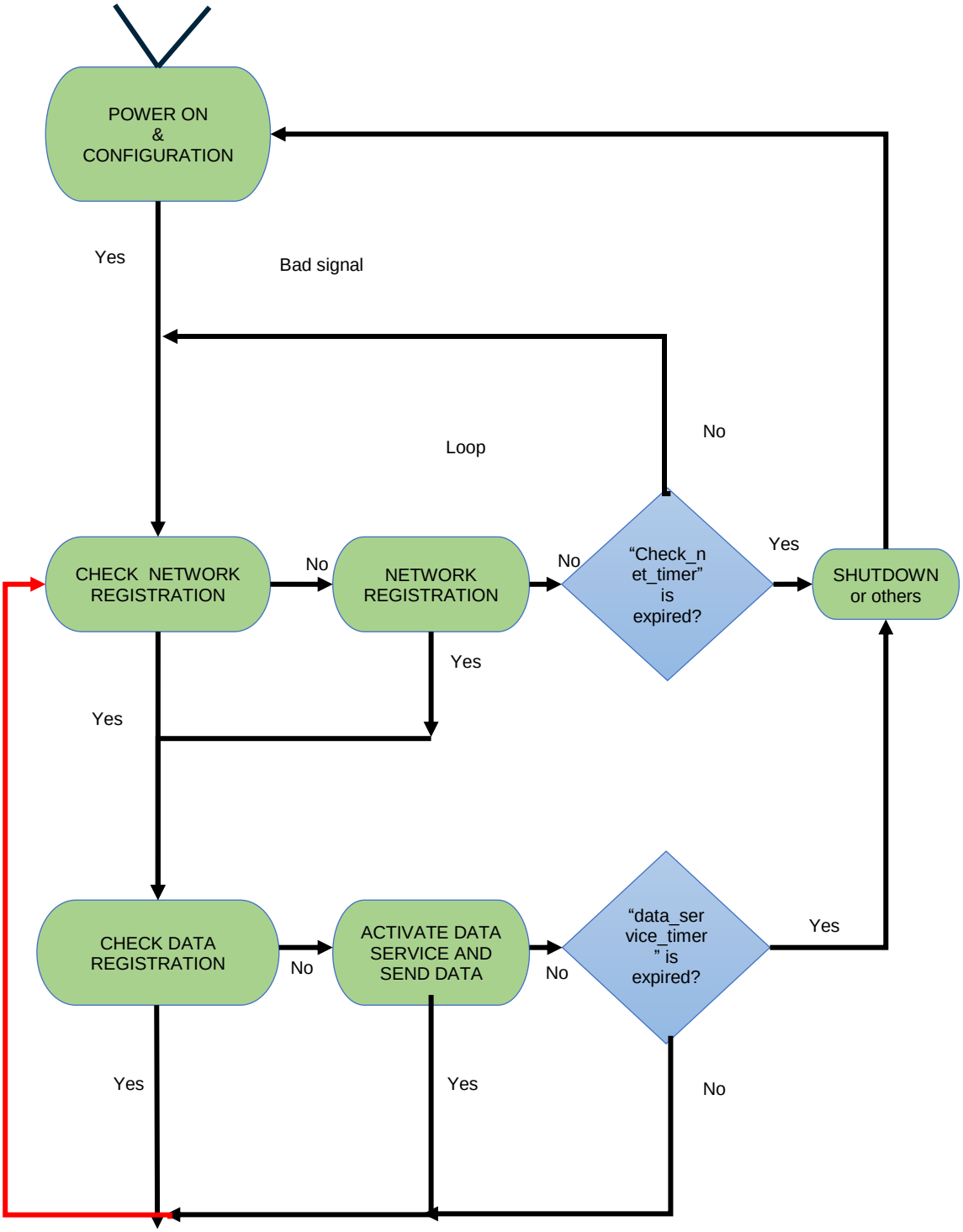
Telit Serial Diagnostic Interface is used for debugging purposes and for firmware upgrade.

2.3 Warning on Windows Cellular connection

When the module is recognized as a Cellular device, Windows uses the WWAN interface to set up internet connection (NCSI). This could lead to connectivity issues using the module AT interface: registration to the network, APN management, socket creation and data exchange, PSM and eDRX functionalities can be affected.

If you do not need your PC is connected via WWAN interface, we strongly suggest to disable it. Go to:
Control Panel ► Network and Sharing Center ► change Adapter settings ► right-click on Cellular connection ► disable.

3 Application Main Flow



4 Network Registration

Here below a brief overview of 4G (CAT M1, NB IoT) and 2G (GPRS) registration process, IP stack setup and related commands.

4G registration (CAT-M1, NB-IoT) and IP stack setup: the module performs Attach and EPS Bearer activation automatically. When the procedure ends an IP address is assigned by the network to the module. AT+CEREG can be used to check the EPS network registration status. AT+CGCONTRDP can be used to check the EPS bearer parameters. AT#SGACT command has to be used to enable the internal IP stack and IPEasy command set.

2G registration and IP stack setup: the module performs GPRS Attach automatically. You can check the status of registration using AT+CREG and AT+CGREG commands. To get IP connectivity the user has to activate a PDP context. In this scenario, AT#SGACT command performs PDP context activation and IP internal stack enabling. After this step, the module has an IP address and IPEasy command set can be used. AT+CGCONTRDP can be used to check the PDP context parameters.

To get IP connectivity, for all access technology, a specific APN configuration is required. We suggest to carefully check with the Network Provider what's the proper APN configuration to be used (context ID, APN name). APN configuration can be set through AT+CGDCONT command.

4.1 CAT-M1 / NB-IoT Registration AT script example

The module is turned on, APN on context 1 is required by MNO for registration and data traffic

AT+CEREG?
+CEREG: 0,2
OK

AT+CGDCONT=1,"IP","nbiot.tids.tim.it"
OK

New attach is needed to use the new APN. A way to do this is to turn the radio off and on using AT+CFUN

AT+CFUN=4
OK

AT+CEREG?
+CEREG: 0,0
OK

AT+CFUN=1
OK

AT+CEREG?
+CEREG: 0,0
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,1
OK

AT+COPS?
+COPS: 0,1,"I TIM",9
OK

AT+CGCONTRDP
+CGCONTRDP: 1,5,"nbiot.tids.tim.it","10.16.13.162",,"192.168.200.43","192.168.200.42"
OK

Module is registered and has an IP address (10.16.13.162).

AT#SGACT=1,1
#SGACT: 10.16.13.162
OK

Module IP stack is on, IPEasy commands can be used, e.g. we can open a TCP socket

AT#SD=1,0,80,"www.telit.com"

CONNECT

+++ escape sequence sent here to move on Command Mode

OK

AT#SS
#SS: 1,2,10.16.13.162,36862,35.202.235.194,80
…
OK

4.2 2G Registration AT script example

The module is turned on and attached, APN on context 1 is required by MNO for data traffic

AT+CREG?
+CREG: 0,1
OK

AT+CGREG?
+CGREG: 0,1
OK

AT+CGDCONT=1,"IP","internet.wind.biz"
OK

There's no need to trigger new registration since the APN will be used in the next step: the PDP context activation request

AT#SGACT=1,1
#SGACT: 10.34.234.204
OK

The PDP context is active, IP address has been assigned (10.34.234.204) and IP stack is enabled; now it is possible to perform a socket connection

AT+CGCONTRDP
+CGCONTRDP: 1,5,"internet.wind.biz","10.34.234.204",,"193.70.152.25","212.52.97.25"
OK

AT#SD=1,0,80,"www.telit.com"

CONNECT

+++ escape sequence sent here to move on Command Mode

OK

AT#SS
#SS: 1,3,10.34.234.204,35911,35.202.235.194,80
…
OK

In all scenarios (2G, CAT-M1, NB-IoT) the command AT+CGDCONT stores APN in NVM, so the APN setting is needed only once.

4.3 Access technology selection

AT+WS46=[<n>] command selects the cellular netwrok to operate with.

• 4G/2G products support <n> parameter values 12, 28 and 30. 30 is factory default
• 4G only products support <n> parameter value 28

Values [<n>]:
12 : GSM Digital Cellular Systems, GERAN only
28 : E-UTRAN only
30 : GERAN and E-UTRAN

AT#WS46=[<n>] command selects the IoT E-UTRAN technology to operate with.

Values [<n>]:
0 : CAT-M1
1 : NB-IoT
2 : CAT-M1 (preferred) and NB-IoT
3 : CAT-M1 and NB-IoT (preferred)

The parameter is stored in NVM and the settings is available at next reboot.

4.4 Speed up registration

The registration process in CAT-M1 and NB-IoT technologies could require some minutes to complete. This happens especially in the case of very first registration: new SIM, new location, new module. This is due to the IoT technology itself and cellular network deployment factors.

To speed up the process you can reduce the set of supported technologies and bands. This will reduce the radio scanning time of the module. The example below refers to NB-IoT, the same can be applied to CAT-M1.

1. Check with operator if:
    a. the SIM you have is enabled for NB-IoT or CAT-M1; the majority of operators provides specific SIM for IoT services and technology

    b. an APN has to be set for registration/attach and data traffic

2. Turn on the module and set the APN if required, in the majority of cases you'll have to set it on 1st context: e.g. AT+CGDCONT=1,"IP","NB IoT APN"

3. Set the module for NB IoT only support: AT+WS46=28 , AT#WS46=1

4. Use AT#BND to reduce the set of supported bands. E.g. set support for band 3 and 8 only: AT#BND=0,0,132 (132 decimal ► 1000 0100 binary)

5. Reboot the module to apply the changes above

6. When the module is back on, wait some seconds and run manual registration through AT+COPS=1,2,"MCCMNC"

7. Poll AT+CEREG? to check the registration status or enable unsolicited indication through AT+CEREG=2

The same will apply for CAT-M1 using AT#WS46=0.

The reboot is required only once to apply the AT#WS46 setting. Subsequent registrations are usually faster (e.g. after power cycle): the module store radio link information about previous registration and use this information to start a new registration.

5 Check/Set data service

When registration is completed you can activate data services and set up the internal IP stack with the AT#SGACT command:

AT#SGACT=<cid>,<stat>[,<userId>[,<pwd>]]

E.g. if we want to activate context 1, issue AT#SGACT=1,1; in case we want to use the <cid> 3 (e.g. Verizon in US) issue AT#SGACT=3,1.

The command returns IP address provided by the network:

AT#SGACT=1,1
#SGACT: xxx.xxx.xxx.xxx

You can get useful information about the active context using AT+CGCONTRDP command.

AT+CGCONTRDP=[<cid>]

The execution command returns the relevant information on a PDP Context – EPS Bearer established by the network with the context identifier <cid>. If the parameter <cid> is omitted, the information for all established contexts is returned. The response message has the following format.

+CGCONTRDP:<cid>,<bearerId>,<apn>[,<ip&subnet>[,<gw_addr>[,<DNS_prim>[,<DNS_sec>[, <P_CSCF_prim>[,<P_CSCF_sec>]]]]]][<CR><LF>

6 UDP script

An example of UDP communication over NB-IoT is reported below; in this scenario, APN is not required and it set automatically by the network. The module enables NB IoT only. A UDP socket is opened in command mode on xxx.telit.com echo server. “echo_test_UDP” string is sent to the server and echoed back to the module. Incoming data is signalled through SRING unsolicited. AT#SI (Socket Info) command is used to check the data buffered and not yet read. AT#SRECV command is used to read the data. AT#SS command is used to check remote server IP address and socket status.

AT+WS46?
+WS46: 28
OK

AT#WS46?
#WS46: 1
OK

AT+CGDCONT?
+CGDCONT: 1,"IPV4V6","","0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0",0,0,0,0
+CGDCONT: 2,"IPV4V6","","0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0",0,0,0,0
…
+CGDCONT: 6,"IPV4V6","","0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0",0,0,0,0
OK

AT+CEREG?
+CEREG: 0,1
OK

AT+COPS?
+COPS: 0,1,"I TIM",9
OK

AT#MONI
#MONI: I TIM RSRP:-72 RSRQ:-3 TAC:9091 Id:AAFC4A1 EARFCN:6290 PWR:-67dbm DRX:1024 pci:0 QRxLevMin:0
OK

AT+CGCONTRDP
+CGCONTRDP: 1,5,"nbiot.tids.tim.it","10.18.13.162",,"192.168.200.43","192.168.200.42"
OK

AT#SGACT?
#SGACT: 1,0
#SGACT: 2,0
…
#SGACT: 6,0
OK

AT#SGACT=1,1
#SGACT: 10.18.13.162,
OK

AT+CGPADDR=1
+CGPADDR: 1,"10.18.13.162"
OK

AT#SGACT?
#SGACT: 1,1
#SGACT: 2,0
…
#SGACT: 6,0
OK

AT#SD=1,1,10510,”xxx.telit.com”,0,1234,1
OK

AT#SS
#SS: 1,2,10.18.13.162,1234,185.xxx.xxx.218,10510
#SS: 2,0
#SS: 3,0
…
#SS: 10,0
OK

AT#SSEND=1
> echo_test_UDP<CTRL-Z>
OK

SRING: 1

AT#SI
#SI: 1,13,0,13,0
#SI: 2,0,0,0,0
…
#SI: 10,0,0,0,0
OK

AT#SRECV=1,1500
#SRECV: 1,13
echo_test_UDP
OK

AT#SH=1
OK

AT#SS
#SS: 1,0
#SS: 2,0
…
#SS: 10,0
OK

7 TCP script

An example of TCP communication over NB-IoT is reported below; in this scenario, APN is not required and it is set automatically by the network. The module enables NB IoT only. A TCP socket is opened in command mode on xxx.telit.com echo server. “echo_test_TCP” is the data sent to the server and echoed back to the module. Incoming data is signalled through SRING unsolicited. AT#SI (Socket Info) command is used to check the data sent and received. AT#SRECV command is used to read the data. AT#SS command is used to check remote server IP address and socket status. The module starts with radio off, then radio is switched on and attach is performed.

AT+CFUN=4
OK

AT+CFUN=1
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,2
OK

AT+CEREG?
+CEREG: 0,1
OK

AT#RFSTS
#RFSTS: "222 01",6290,-69,-66,-3.0,9091,00,-40,1024,3,1,AAFC4A1,"222013200124051","I TIM",3,20,720,3240,166
OK

AT+COPS?
+COPS: 0,1,"I TIM",9
OK

AT+CGCONTRDP
+CGCONTRDP: 1,5,"nbiot.tids.tim.it","10.18.15.165",,"192.168.200.43","192.168.200.42"
OK

AT#SGACT=1,1
#SGACT: 10.18.15.165,
OK

AT#SD=1,0,10510,”xxx.telit.com”,0,0,1
OK

AT#SS
#SS: 1,2,10.18.15.165,36410,185.xxx.xxx.218,10510
#SS: 2,0
…
#SS: 10,0

OK

AT#SSEND=1
> echo_test_TCP<CTRL-Z>
OK

SRING: 1

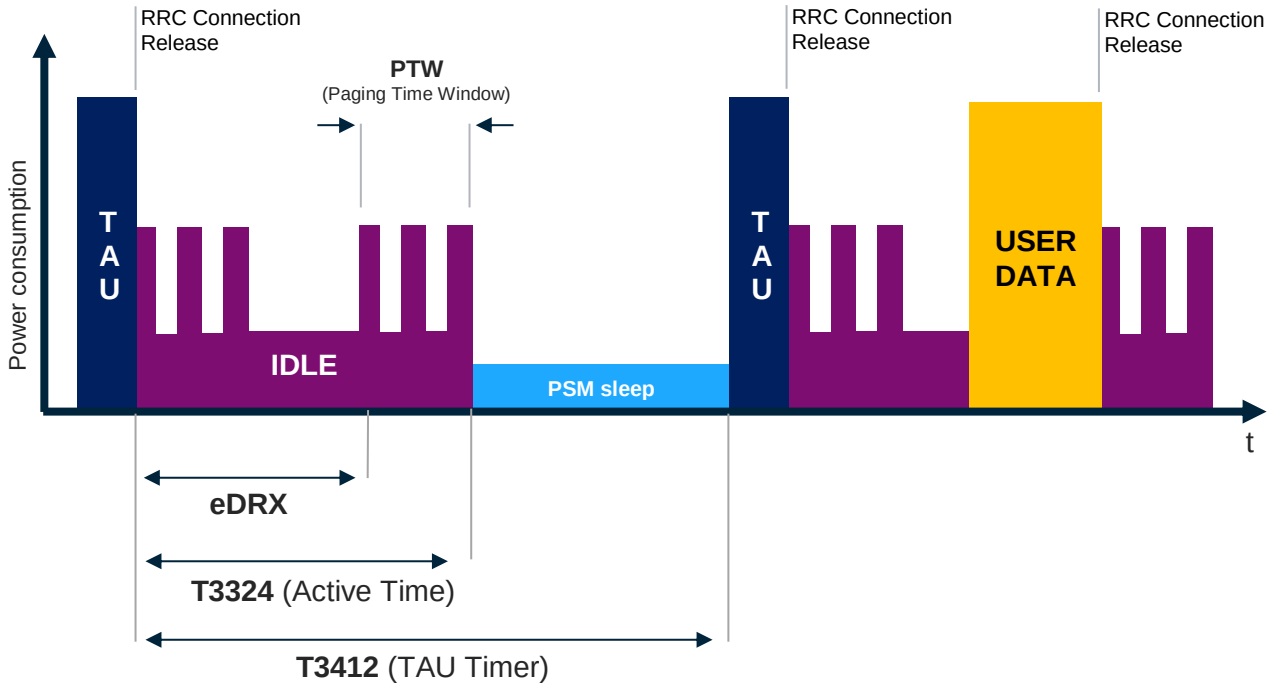
AT#SRECV=1,1500
#SRECV: 1,13
echo_test_TCP
OK

AT#SI
#SI: 1,13,13,0,0
#SI: 2,0,0,0,0
…
#SI: 10,0,0,0,0
OK

AT#SH=1
OK

8 PSM and eDRX

8.1 PSM/eDRX overview



PSM and eDRX are two different features defined in the latest 3GPP releases. The goal of these features is to reduce the power consumption of IoT devices. To achieve this, PSM and eDRX enable different mechanisms to reduce the signalling between the IoT device and network.

The Power Saving Mode (PSM) in 3GPP Rel12 allows the Module to skip idle mode tasks for a longer time period while still maintaining the NAS context. This feature permits to reduce the overall power consumption when there is no required data activity with the network for a long time. This saves the power also related to the Paging activity. During the “PSM sleep” period the module is NOT reachable by the network, i.e. it cannot be paged and stops access stratum activities. The Module can leave the PSM mode at any point in time when there is MO data or when periodic TAU timer expires.

The extended DRX (eDRX) allows the module to extend the paging period. This feature permits to reduce the overall power consumption increasing radio inactivity time in between paging occasions. The feature is suitable for applications that support high latency communication.

Both features require a negotiation with the network to be enabled. The negotiation happens during the Attach procedure and the Tracking Area Update (TAU).

8.2 PSM script

Module supports 3GPP command AT+CPSMS and custom Telit command AT#CPSMS that simplifies and improve PSM management.

AT#CPSMS=[<mode>[,<ReqPeriodicRAU>[,<ReqGPRSreadyTimer>[,<ReqPeriodicTAU>[,<ReqActiveTime>]]]]]

The set command controls the setting of the UEs power saving mode (PSM) parameters. The command controls whether the UE wants to apply PSM or not, as well as the requested extended periodic RAU value and the requested GPRS READY timer value in GERAN, the requested extended periodic TAU value in E-UTRAN and the requested Active Time value. Find the relevant parameters below.

<ReqPeriodicTAU> : requested extended periodic TAU value (T3412) to be allocated to the UE in E-UTRAN. Parameter expressed in secconds.

<ReqActiveTime> : requested Active Time value (T3324) to be allocated to the UE. Parameter expressed in seconds.

AT#CPSMS?

Read command presents the current CPSMS configuration returned by the network, in the format:

#CPSMS: <status>[,<T3324>,<T3412 or T3412EXT>]

Here below a simple script shows the AT#CPSMS functionalities.

AT+COPS?
+COPS: 1,0,"Vodafone@",9 Module is NB-IoT registered
OK

AT#CPSMS? PSM feature is OFF
#CPSMS: 0
OK

AT#CPSMS=1,0,0,120,20 Enable PSM feature: T3412=120s, T3324=20s
OK

A TAU (Tracking Area Update) is triggered, timer negotiation with the network starts; the procedure is fast, unsolicited are disabled we suggest to wait about 2s before proceeding with the next step

AT#CPSMS?
#CPSMS: 1,20,4200 Values that will apply: T3412=4200s, T3324=20s
OK

Timers T3412 and T3324 start when module move from CONNECTED state to IDLE state (RRC Connection Release).

TIMERS START POINT (RRC Connection release)
. . .

20s

. . .

Active Time T3324 EXPIRE

The module enters automatically in PSM sleep (module turns off)

E.g. let's assume that at a certain point in time the user wants to use the module to send data; it is possible even if the module is in PSM; the user can wake module up with ON_OFF pin (see turn on procedure defined in HW user guide)

+CEREG: 0

+CEREG: 2

+CEREG: 5,"FFFE","99EE71",9

The module is just turned on and it does not interact with the network, the T3412 timer is still running from TIMERS START POINT

AT#SGACT=1,1
#SGACT: 10.21.115.40
OK

AT#SD=1,0,20510,"2xx.xxx.xxx.xx3" Module now move from IDLE to CONNECTED

CONNECT
echo test message

OK

SRING: 1 Echo is received

AT#SS
#SS: 1,3,10.21.115.40,32468,2xx.xxx.xxx.xx3,20510
…

OK

AT#SH=1 Socket shut down
OK

New TIMERS START POINT: the module was in CONNECTED state, after RRC Connection Release from the network it moves to IDLE state, this reset the two timers

TIMERS START POINT (RRC Connection release)
. . .

20s

. . .

Active Time T3324 EXPIRE

The module enters automatically in PSM sleep (module turns off)

. . .

4180s (T3412-T3324)

. . .

Tracking Area Update period T3412 EXPIRE

The module exits automatically from PSM sleep (module turns on); Tracking Area Update is triggered

+CEREG: 0

+CEREG: 2

+CEREG: 5,"FFFE","99EE71",9

8.3 eDRX script

Module supports 3GPP commands AT+CEDRXS, AT+CEDRXRDP and custom Telit command AT#CEDRXS that simplifies and improve eDRX management.

AT#CEDRXS=[<mode>[,<AcTtype>[,<Req_eDRX>[,<ReqPagTimeWindow>]]]]

Set command controls the setting of the UEs eDRX parameters. The command controls whether the UE wants to apply eDRX or not, as well as the requested eDRX value for each specified type of access technology. Find the relevant parameters below.

<AcTtype> : integer N/A type of access technology.

Values:
0 : Access technology is not using eDRX
2 : GSM (A/Gb mode)
4 : E-UTRAN (CAT M1 mode)
5 : E-UTRAN (NB1 mode)

<Req_eDRX> : half a byte in a 4 bit format. The eDRX value refers to bit-4 to 1 of octet 3 of the Extended DRX parameters information element (see subclause 10.5.5.32 of 3GPP TS 24.008). For the coding and the value range, see Extended DRX parameters information element in 3GPP TS 24.008, Table 10.5.5.32/3GPP TS 24.008. Default value is "0000".

AT#CEDRXS?
Read command returns the current settings for each defined value of <AcTtype> in the format:

#CEDRXS:<AcTtype>,<eDRX_act_state>,<Req_eDRX>,<ReqPagTimeWindow>
[,<NW_prov_eDRX>[,<NW_prov_PagTimeWindow>]]

Here below a simple script shows the AT#CEDRXS functionalities. The test is performed using a network simulator but the same can be applied on live network.

AT+CEREG?
+CEREG: 0,1
OK

AT+COPS?
+COPS: 0,0,"Test 001 01",8 The module is registered to CAT M test network
OK

AT#RFSTS
#RFSTS: "001 01",1575,-85,-65,-3.0,0001,00,,256,3,0,0000100,"001012345678901","Test 001 01",3,3,720,3240,249
OK

AT#CEDRXS? eDRX is disabled on all access technologies
#CEDRXS: 2,0,"0000","0000"
#CEDRXS: 4,0,"0000","0000"
#CEDRXS: 5,0,"0000","0000"
OK

AT#CEDRXS=1,4 eDRX enabled without specifying timings
OK

A TAU (Tracking Area Update) is triggered, values negotiation with the network starts; the procedure is fast but we suggest to wait about 2s before proceed with next step

AT#CEDRXS?
#CEDRXS: 2,0,"0000","0000"
#CEDRXS: 4,1,"0000","0000",1,"0010","0000"
#CEDRXS: 5,0,"0000","0000"
OK

The network returns the follwing eDRX timings for the CAT M connection:
<NW_prov_eDRX> : 0010=20,48s
<NW_prov_PagTimeWindow> : 0000=1,28s

AT#CEDRXS=0,4 eDRX disabled, TAU is triggered
OK

AT#CEDRXS?
#CEDRXS: 2,0,"0000","0000"
#CEDRXS: 4,0,"0000","0000"
#CEDRXS: 5,0,"0000","0000"
OK

AT#CEDRXS=1,4,"0001","0001"
OK

eDRX enabled with some specific values, but test network is setup to support only:
eDRX 20,48s
Paging Time Window 1,28s
TAU is triggered and values are exchanged with the network

AT#CEDRXS?
#CEDRXS: 2,0,"0000","0000"
#CEDRXS: 4,1,"0001","0001",1,"0010","0000"
#CEDRXS: 5,0,"0000","0000"
OK

The network applies the supported values
<NW_prov_eDRX> : 0010=20,48s
<NW_prov_PagTimeWindow> : 0000=1,28s

AT+CFUN=4 Module detach
OK

If we change the eDRX supported parameters on test network, e.g.:
eDRX 40,96s
Paging Time Window 2,56s

AT+CFUN=1
OK

During the attach procedure module asks the network to enable eDRX using the previous settings

AT#CEDRXS?
#CEDRXS: 2,0,"0000","0000"
#CEDRXS: 4,1,"0001","0001",1,"0011","0001"
#CEDRXS: 5,0,"0000","0000"
OK

The network applies the new supported values
<NW_prov_eDRX> : 0011=40,96s
<NW_prov_PagTimeWindow> : 0001=2,56s

9 Document History

Revision	Date	Changes
0	2018-02-14	First registered issue
1	2018-03-01	Updated Applicability Table Document restyling Updated PSM and added new eDRX script
2	2019-12-06	Document restyling Added section 2.3 – Warning on Windows Cellular connection Modified and updated chapter 4 – Network registration Updated chapter 5 – Check/Set data service Modified and updated chapter 6 – UDP script Modified and updated chapter 7 – TCP script Modified and updated chapter 8 – PSM and eDRX

SUPPORT INQUIRIES

Link to **www.telit.com** and contact our technical support team for any questions related to technical issues.

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