Cat M/NB-IoT

Quick Start Guide

80529NT11661A Rev. 5 – 2021-11-10

Telit Technical Documentation

APPLICABILITY TABLE

PRODUCTS
ME910C1 Series
ME910G1 Series
ML865C1 Series
ML865G1 Series
ME310G1 Series

CONTENTS

1. INTRODUCTION

1.1. Scope

The Scope of this document is to give an overview and basic instructions on how to use the following product series: ME910C1, ME910G1, ML865C1, ML865G1, and ME310G1.

1.2. Audience

This document is intended for customers who want to use and test the ME910C1, ME910G1, ML865C1, ML865G1, and ME310G1 products.

1.3. Contact Information, Support

For technical queries, support services, and to share documentation feedback, contact Telit Technical Support at:

- *TS-EMEA@telit.com*
- *TS-AMERICAS@telit.com*
- *TS-APAC@telit.com*

Alternatively, you may visit *https://www.telit.com/contact-us*

For more information about Telit modules, visit *https://www.telit.com*

1.4. Symbol Conventions

Danger: This information MUST be followed or catastrophic equipment failure or personal injury may occur.

Warning: Alerts the user on important steps about the module integration.

Note/Tip: Provides advice and suggestions that may be useful when integrating the module.

Electrostatic Discharge: Notifies the user to take proper grounding precautions before handling the product.

All dates are in ISO 8601 format, that is YYYY-MM-DD.

1.5. Related Documents

- ME910C1 Hardware User Guide, 1VV0301351
- ME310G1 Hardware Design Guide, 1VV0301588
- ME910C1/NE910C1/ML865C1 AT Commands Reference Guide, 80529ST10815A
- ME310G1/ME910G1/ML865G1 AT Commands Reference Guide, 80617ST10991A
- ME910C1/NE910C1/ML865C1 PSM Application Note, 80529NT11643A
- ME310G1/ME910G1/ML865G1 PSM Application Note, 80617NT11830A

2. GENERAL DESCRIPTION

2.1. ME910C1 and ML865C1 Main Features

- 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 over NAS
- IPv4/IPv6 stack with TCP and UDP protocol
- OMA Lightweight M2M (LWM2M)
- Firmware Over-the-Air Update (FOTA) using delta upgrade techniques
- Telit Application Development Environment: AppZone C (for future release)
- SSL
- Optional embedded GNSS (GPS, GLONASS, Beidou, Galileo)

2.2. ME910G1, ML865G1, and ME310G1 Main Features

- LTE UE Cat M1 (1.4 MHz)/NB2 (200 KHz)
- 3GPP Rel. 14 compliant
- Half-duplex FDD
- Single Rx, single antenna
- 3GPP Rel. 12 PSM
- 3GPP Rel. 13 eDRX
- 3GPP Rel. 13 Extended Coverage
- Control via AT commands according to 3GPP TS 27.005, 27.007 and customized Telit AT commands
- SIM application tool kit 3GPP 51.01
- VoLTE (planned)
- SMS over NAS
- IPv4/IPv6 stack with TCP and UDP protocol
- Firmware Over-the-Air Update (FOTA) using delta upgrade techniques

- TLS/DTLS
- Embedded GNSS (GPS, GLONASS, Beidou, Galileo)
- OMA Lightweight M2M (LwM2M)

2.3. USB/UART Port Configuration

The ME910C1, ME910G1, ML865C1, ML865G1, and ME310G1 are equipped with 2 asynchronous serial ports (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 Modem Manager and Network Manager.

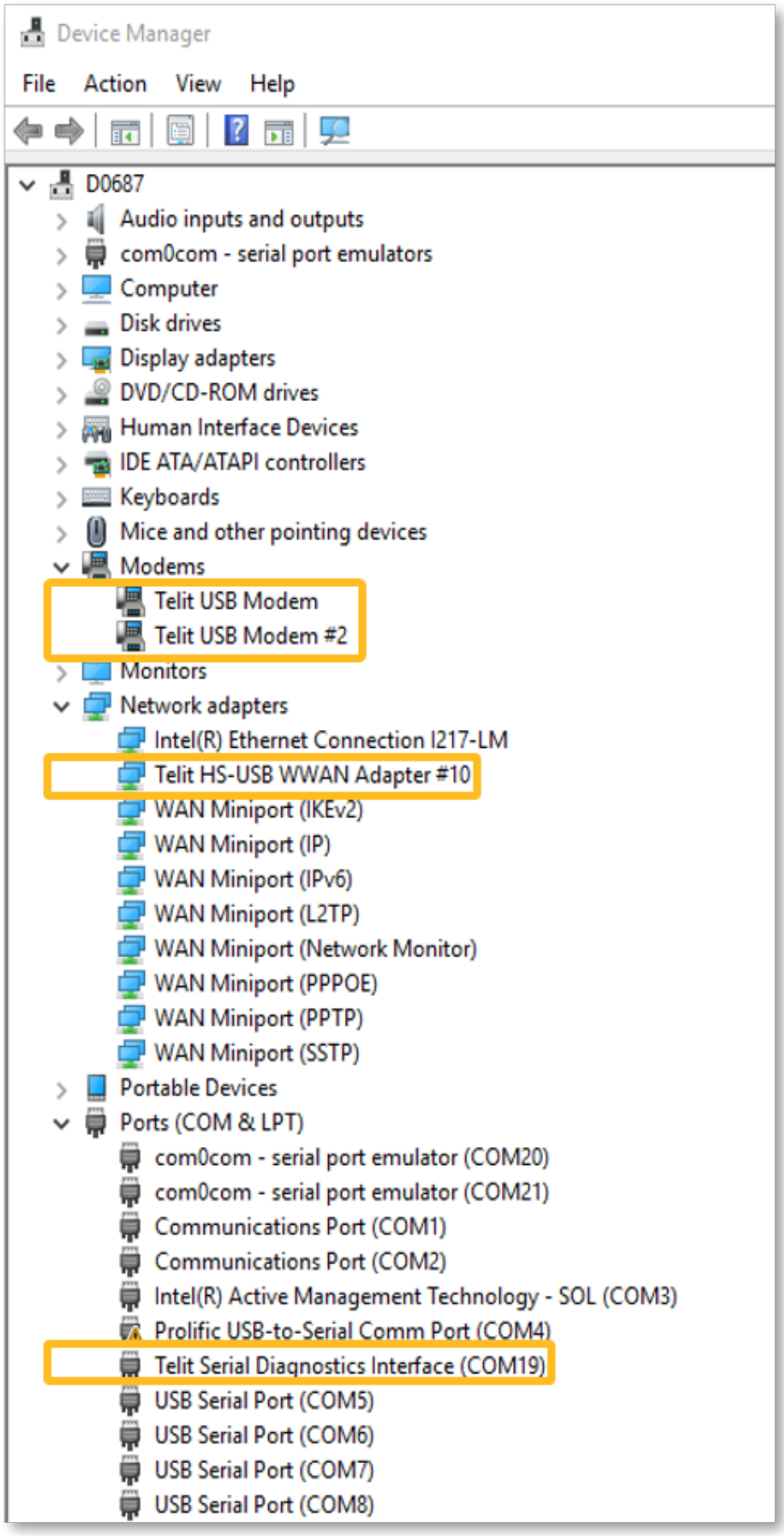

Figure 1: Port Composition

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

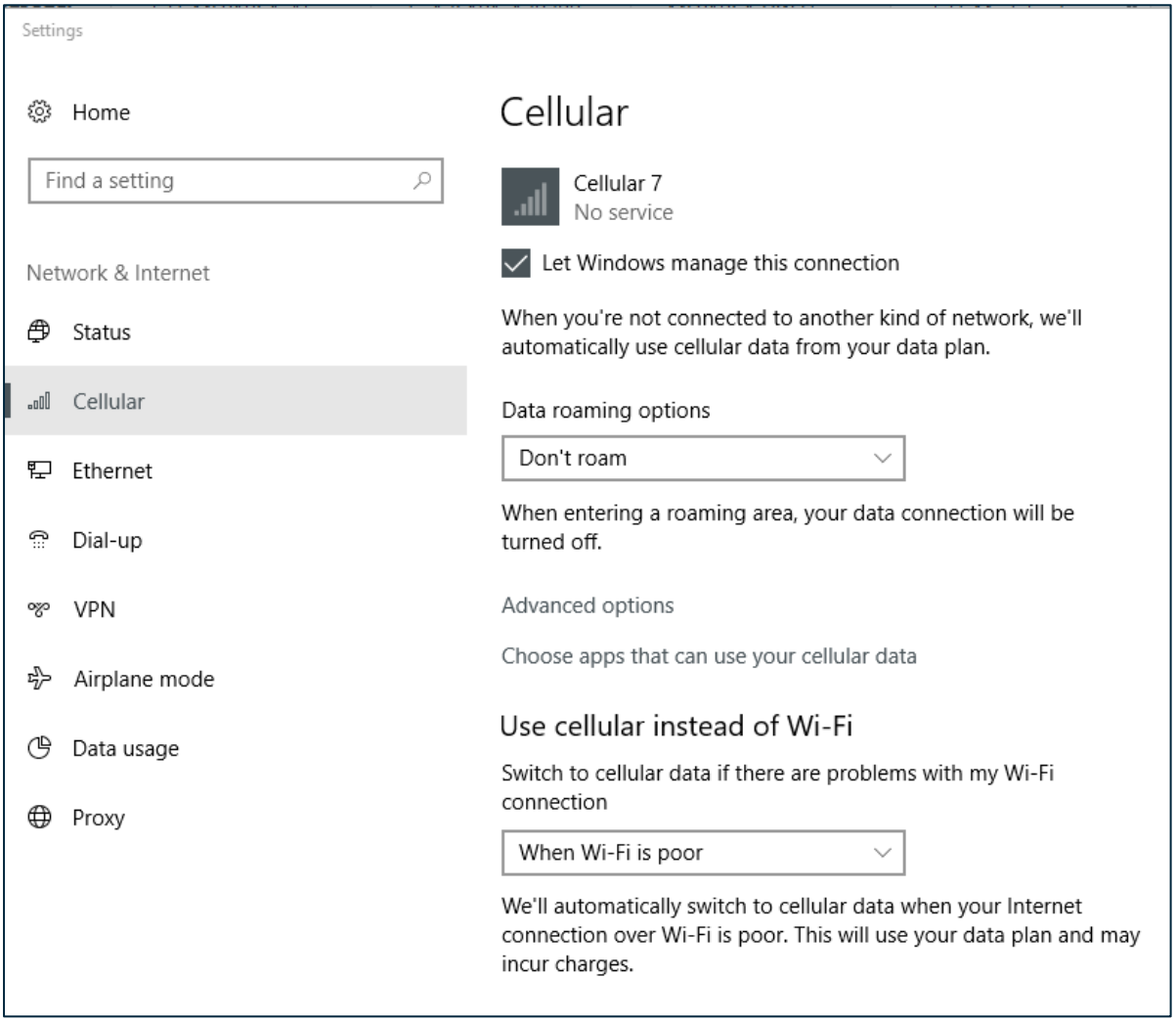

Figure 2: Network and Internet Settings

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

2.4. Warning on Windows Cellular Connection

When the module is recognized as a Cellular device, Windows uses the WWAN interface to set up an 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 the WWAN interface, we strongly suggest disabling it. Go to: Control Panel ► Network and Sharing Center ► change Adapter settings ► right-click on Cellular connection ► disable.

3. APPLICATION MAIN FLOW

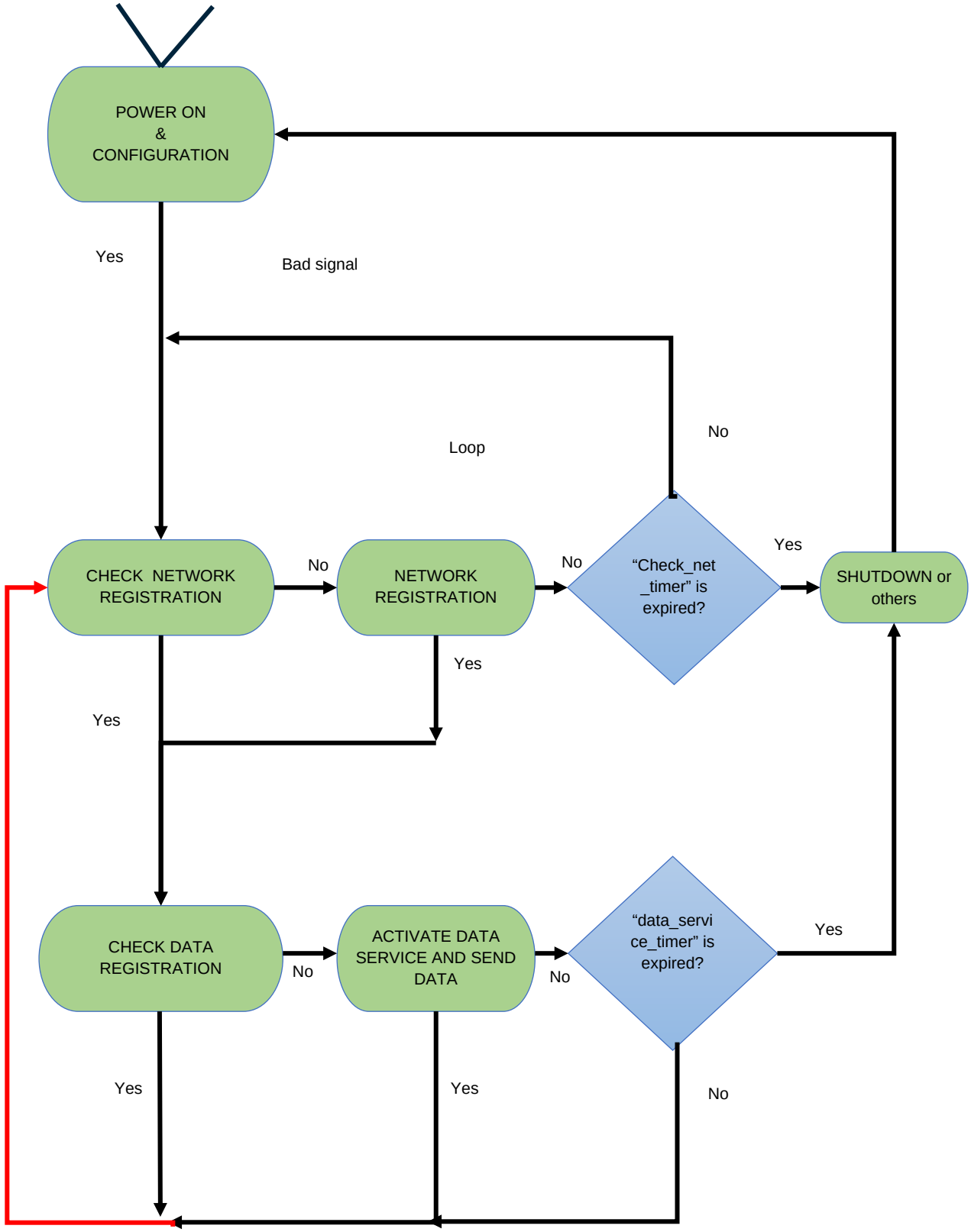

Figure 3: Application Main Flowchart

4. NETWORK REGISTRATION

Here below is a brief overview of the 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 must 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 the 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 carefully checking with the Network Provider what's the proper APN configuration to be used (context ID, APN name). APN configuration can be set through the 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
```

A 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
```

The 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, For example we can open a TCP socket.

```
AT#SD=1,0,80,"www.telit.com"
CONNECT
+++
OK
```

+++ escape sequence is sent to move in Command Mode.

```
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, the IP address has been assigned (10.34.234.204) and the 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
+++
OK
```

+++ escape sequence is sent to move in Command Mode.

```
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 network to operate with.

- 4G/2G products support <n> parameter values 12, 28, and, 30. 30 is the 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 are available at the 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 the 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; most operators provide specific SIM for IoT services and technology.
    b. An APN must be set for registration/attach and data traffic.
2. Turn on the module and set the APN if required, in most cases you'll have to set it on 1st context: For example, **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. For example, 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 (For example after the 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>]]
```

For example, if we want to activate context 1, issue **AT#SGACT=1,1**; in case we want to use the <cid> 3 (For example 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 the **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_p
rim>[,<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 is set automatically by the network. The module enables NB IoT only. A UDP socket is opened in command mode on the xxx.telit.com echo server. "echo_test_UDP" string is sent to the server and echoed back to the module. Incoming data is signaled 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 the xxx.telit.com echo server. "echo_test_TCP" is the data sent to the server and echoed back to the module. Incoming data is signaled 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 the radio off, then the 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

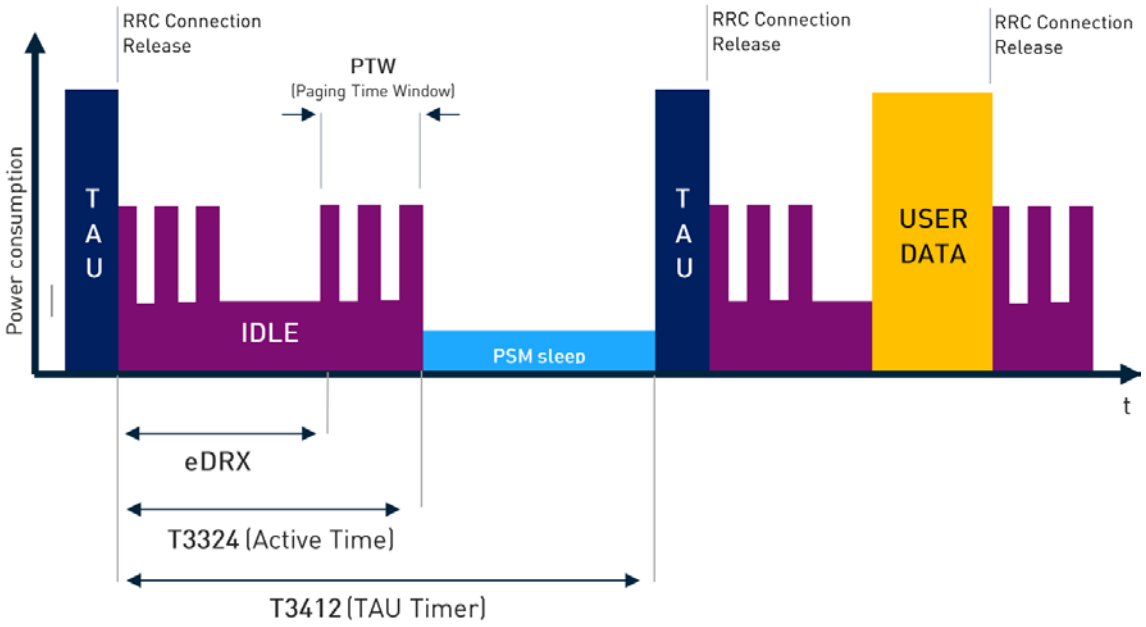

Figure 4: PSM/eDRX Overview

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 signaling between the IoT device and network. The picture above shows the two features combined. However, they can be enabled independently.

The Power Saving Mode (PSM) in 3GPP Rel12 allows the module to skip idle mode tasks for a long time 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, that is 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 the periodic TAU timer expires.

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

Note: 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

The module supports 3GPP command **AT+CPSMS** and custom Telit command **AT#CPSMS** that simplifies and improves PSM management.

On ME910C1 and ML865C1:

```
AT#CPSMS=[<mode>[,<ReqPeriodicRAU>[,<ReqGPRSreadyTimer>[,<ReqPeri
odicTAU>[,<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 seconds.

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

Read command **AT#CPSMS?** presents the current CPSMS configuration returned by the network, in the format:

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

On ME910G1, ML865G1, and ME310G1:

```
AT#CPSMS=[<mode>[,<ReqPeriodicRAU>[,<ReqGPRSreadyTimer>[,<ReqPeri
odicTAU>[,<ReqActiveTime>[,<psmVersion>[,<psmThreshold>]]]]]]]
```

The command has two additional parameters compared to the implementation on ME910C1 and ML865C1: <psmVersion> and <psmThreshold>. The other parameters have the same meaning and functionality as defined for ME910C1 and ML865C1.

<psmVersion>: Integer N/A bitmask to indicate PSM modes. Each bit is configured independently.

Default value: <psmValue>=4

Values:

- **0**: PSM without network coordination
- **1**: Rel 12 PSM without context retention
- **2**: Rel 12 PSM with context retention
- **3**: PSM in between eDRX cycles

<psmThreshold>: integer - Minimum duration threshold (in a sec) to enter PSM. Default and the minimum value are 60 seconds.

Here below a simple script shows the **AT#CPSMS** functionalities:

```
AT+COPS?
+COPS: 1,0,"Vodafone@",9
OK
```

The module is registered to Vodafone NB-IoT.

```
AT#CPSMS?
#CPSMS: 0
OK
```

PSM is off.

```
AT#CPSMS=1,0,0,120,20
OK
```

Enable PSM feature: T3412=120s, T3324=20s.

A TAU (Tracking Area Update) is triggered, timer negotiation with the network starts; the procedure is fast, we suggest waiting for about 2s before proceeding with the next step.

```
AT#CPSMS?
#CPSMS: 1,20,4200
OK
```

Values: T3412=4200s, T3324=20s.

Timers T3412 and T3324 start when the module moves 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)

For example, 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 the 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"
CONNECT
echo test message
OK
```

Module now move from IDLE to CONNECTED.

```
SRING: 1
```

The echo is received.

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

```
AT#SH=1
OK
```

New **TIMERS START POINT**: the module was in a **CONNECTED** state, after RRC Connection Release from the network it moves to an **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

The modules support 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 the Extended DRX parameters information element in 3GPP TS 24.008, Table 10.5.5.32/3GPP TS 24.008. The default value is "0000".

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

```
AT#CEDRXS?
#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 a live network.

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

```
AT+COPS?
+COPS: 0,0,"Test 001 01",8
OK
```

The module is registered to CAT M test network.

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

eDRX is disabled on all access technologies.

```
AT#CEDRXS=1,4
OK
```

eDRX enabled without specifying timings.

A TAU (Tracking Area Update) is triggered and the values negotiation with the network starts. The procedure is fast but we suggest waiting about 2s before proceeding 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 following eDRX timings for the CAT M connection:

<NW_prov_eDRX> : 0010=20,48s.

<NW_prov_PagTimeWindow> : 0000=1,28s.

```
AT#CEDRXS=0,4
OK
```

eDRX disabled, TAU is triggered.

```
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
OK
```

Module detach.

If we change the eDRX supported parameters on the test network. For example,

eDRX 40,96s.

Paging Time Window 2,56s.

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

During the attached 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.

8.4. PSM in between eDRX Script

Within the eDRX modality, the modules can activate a proprietary power save management to fully enhance eDRX power consumptions when the eDRX cycle is greater than a specific value (typically above 2-3 minutes).

This uses "PSM power state" in-between eDRX PTWs to lower current consumption to 3uA.

Since the module is practically OFF a tiny boot process is needed before being ready for the Paging Time Window, this is accomplished with an anticipated wakeup.

Note: It is noted that this modality doesn't activate standard 3GPP PSM, this solution just takes advantage of the PSM power state of 3uA in between eDRX, that is when the module is not in the active paging task window.

When PSM in between eDRX is activated the AT modem interface is not available. The module can be awakened at every time by using the ON_OFF line.

Differently from standard eDRX this proprietary modality cannot be combined with PSM (as shown in figure 8.1) and needs a specific command plus a reboot to take effect.

The feature is available on ME910G1, ML865G1, and ME310G1.

Here below is a simple script to perform PSM between eDRX. The test is performed using a network simulator but the same can be applied on a live network.

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

```
AT+COPS?
+COPS: 0,0,"Test 001 01",8
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#CPSMS=1,,,90,20,8,60
OK
```

PSM in between eDRX mode is activated with a PSM threshold of 60 sec.

Before giving this command be sure PSM is disabled (#CPSMS: 0).

When using PSM in between eDRX, <psmThreshold> has the following meaning: PSM in between eDRX will be activated if assigned (eDRX cycle – PTW) > psmThreshold. Otherwise, standard eDRX is activated.

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

eDRX is disabled on all access technologies.

```
AT#CEDRXS=1,4
OK
```

eDRX enabled without specifying timings that will be assigned by the network (Network Simulator).

A TAU (Tracking Area Update) is triggered, values negotiation with the network starts;

the procedure is fast but we suggest waiting about 2s before proceeding with the next step.

```
AT+CEDRXRDP
+CEDRXRDP: 4,"0101","0101","1111"
```

The network returns the follwing eDRX timings for the CAT M connection:

<NW_prov_eDRX> : 0101= 81,92 s.

<NW_prov_PagTimeWindow> : 1111=20,48 s.

```
AT#CEDRXS=0,4
OK
```

eDRX disabled, TAU is triggered.

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

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Make sure the use of this product is allowed in your country and the environment required. The use of this product may be dangerous and has to be avoided in areas where:

- It can interfere with other electronic devices, particularly in environments such as hospitals, airports, aircraft, etc.
- There is a risk of explosions such as gasoline stations, oil refineries, etc. It is the responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for the correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conformed to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power-saving mode.

The system integrator is responsible for the functioning of the final product. Therefore, the external components of the module, as well as any project or installation issue, have to be handled with care. Any interference may cause the risk of disturbing the GSM network or external devices or having an impact on the security system. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed carefully to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case this requirement cannot be satisfied, the system integrator must assess the final product against the SAR regulation.

The equipment is intended to be installed in a restricted area location.

The equipment must be supplied by an external specific limited power source in compliance with the standard EN 62368-1:2014.

The European Community provides some Directives for the electronic equipment introduced on the market. All of the relevant information is available on the European Community website: *https://ec.europa.eu/growth/sectors/electrical-engineering_en*

10. GLOSSARY

Acronym	Definition
CMOS	Complementary Metal – Oxide Semiconductor
CS	Chip Select
GPIO	General Purpose Input Output
HS	High Speed
PCB	Printed Circuit Board
SIM	Subscriber Identification Module
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

11. DOCUMENT HISTORY

Revision	Date	Changes
5	2021-11-10	Content and image update
4	2021-10-08	Template update
3	2020-07-22	Updated document tile Updated Applicability Table Updated section 1.4 – Related Documents Added new section 2.2 – ME910G1, ML865G1,ME310G1 Main Features Updated graph in section 8.1 – PSM/eDRX Overview Updated section 8.2 – PSM Script Added new section 8.4 – PSM in between 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
1	2018-03-01	Updated Applicability Table Document restyling Updated PSM and added a new eDRX script
0	2018-02-14	First registered issue

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