

# Skywire<sup>®</sup> LTE CAT-M1 Power Save Mode Application Note NL-SW-LTE-SVZM20

NimbeLink Corp

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# 1. Introduction

## 1.1 Orderable Part Numbers

Orderable Device	Description	Firmware	Carrier	Network Type
NL-M1DK	Skywire M1 Development Kit	n/a	Any	Any
NL-SW-LTE-SVZM20	LTE CAT M1	35554	Verizon	LTE
NL-SW-LTE-SVZM20-B	LTE CAT M1	37120	Verizon	LTE

## 1.2 Prerequisites



This document assumes you have completed the initial setup of your modem and development kit using the Skywire® M1 Development Kit User Manual:

<http://nimbelink.com/skywire-m1dk/user-manual/>

If you have not completed those steps, refer to the link above and complete the modem setup before proceeding.

If you wish to enable Low Power Mode on a Skywire® M1 Development Kit, additional UART setup may be required.

## 2. Low Power Mode

### 2.1 Overview

LTE CAT-M1 brings additional power-save features to cellular modems not previously possible. Power Save Mode (PSM) allows a Skywire to stay powered on constantly but allows the modem to use very low amounts of power.

To enter PSM, you need to do the following:

1. Request timers from the network
2. Register on the network
3. Pull the RTS pin logic-level HIGH

To exit PSM, you need to do the following:

1. Pull the RTS pin logic-level LOW

On the NL-SW-LTE-SVZM20, there is a power mode that the modem will stay in for about 100 seconds before it enters PSM. During that 100 seconds, AT commands can be issued immediately once you pull the RTS pin LOW.

However, if the modem is allowed to enter PSM (either after 100 seconds or the proper timer expires, whichever is longer), the modem will restart once the RTS pin is pulled LOW. It will return a +SYSSTART response when it is ready after leaving PSM as described in Section 2.3 of this application note. It is important to note that it will take at least 100 seconds to enter PSM, even if the PSM timers are set to a value below 100 seconds.

### 2.2 Firmware Check

PSM functionality is available on firmware 37120 and newer. To check your firmware, type the command:

```
ATI1
```

followed by the Enter key, and the modem should respond with something similar to:

```
UE5.0.0.0
```

```
LR5.0.0.0-xxxxx
```

```
OK
```

Where xxxxx is the firmware version number. If your Skywire returns a firmware version older than 37120, please consult the firmware update application note here:

[https://nimbelink.com/Documentation/Skywire/4G\\_LTE\\_Cat\\_M1/1001541\\_NL-SW-LTE-SVZM20\\_Firmware-Upgrade.pdf](https://nimbelink.com/Documentation/Skywire/4G_LTE_Cat_M1/1001541_NL-SW-LTE-SVZM20_Firmware-Upgrade.pdf)

## 2.3 UART Configuration

In order to enable Low Power Mode, the UART RTS on the Skywire must be pulled logic-level HIGH. When the RTS pin is pulled HIGH, the modem is allowed to enter PSM. Pulling the RTS pin logic-level LOW prevents the modem from entering PSM, as well as wakes up the modem if it was previously in PSM.

## 2.4 Configure PSM Timers

The NL-SW-LTE-SVZM20 has two internal timers that control the period to activate PSM after entering IDLE mode and how often to perform a Tracking Area Update (TAU). The timer values are expressed as strings of 8-bit binary numbers. The first 3 bits represent the unit, and the next 5 bits represent the value. The values are shown in the table below for each respective timer:

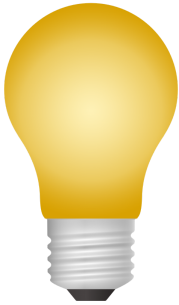
### T3412-Extended Timer - Time in between Tracking Area Updates

xxx.....	000: 10 minutes 001: 1 hour 010: 10 hours 011: 2 seconds 100: 30 seconds 101: 1 minute 111: Timer disabled
...xxxxx	Timer value, from 0 to 31

### T3324 Timer - Time to enter PSM after entering IDLE mode

xxx.....	000: 2 seconds 001: 1 minute 010: 6 minutes 111: Timer disabled
...xxxxx	Timer value, from 0 to 31

The T3324 Timer determines how quickly the modem will go into PSM. The T3412-Extended timer determines how often the modem must wake up and check in with the tower while in PSM.



### **Important note:**

The network has the final say in what the timer values are regardless of what you request with the AT+CPSMS command below. In the next section, we will set the timer values that we would like to request. However, the network may return different values that cannot be changed.

## **2.5 Set Timer Values and Enable PSM**

Before setting the timer values, the modem must be deregistered from the network. Issue the following AT commands to deregister from the network and activate Low Power Mode.

```
AT+CFUN=0
```

Once the desired timer values have been selected using the tables above, use the following AT command to enable PSM and set the two timer values.

```
AT+CPSMS=1,,,<T3412-Extended>,<T3324>
```

Be sure to replace <T3412-Extended> and <T3324> with your desired timer values.

For example, to request that the modem go into PSM after 10 seconds and check in every 20 hours, issue:

```
AT+CPSMS=1,,,"01000010","00000101"
```

After issuing this command enabling PSM, use the following AT command to register on the network and request the timer values:

```
AT+CFUN=1
```

## **2.6 View PSM Timer Values from the Network**

After resetting the Skywire modem, the actual PSM timer values that were received back from the network can be seen by issuing the following two commands.

```
AT+CEREG=4
```

```
AT+CEREG?
```

The first command sets the +CEREG output format to include the timer values in the response. After issuing the +CEREG? command, you should see a response similar to the following:

```
+CEREG: 4,1,"BE43","02E7BA01",7,,,"00001000","01011111"
```

The last two entries in the response are the T3324 and T3412-Extended, respectively, timer values assigned by the network.

In the example from Section 2.5, the network returned the following:

```
+CEREG: 4,1,"BE43","02E7BA01",7,,,"00001000","00110101"
```

In this example, the device will go into PSM after 16 seconds and check in every 21 hours.

## 2.7 Begin PSM Timer Countdown

Now that you have received the PSM timers from the network, start the T3324 timer or 100 second timer (whichever is longer) by toggling the RTS pin HIGH. Once the T3324 or 100 second timer elapses, the modem should enter PSM mode.

## 2.8 Disable PSM

To disable PSM, either continuously pull the RTS UART pin LOW or enter the following AT command:

```
AT+CPSMS=0
```

After that command has been issued, the Skywire should not go into Low Power Mode.

# 3. Troubleshooting

## 3.1 Low Power Mode Not Enabled

Check to ensure that the network has sent timer values, specifically the T3324 value. If this is not sent, PSM will not be enabled. You can check this by issuing the commands in Section 2.6. If either of the timer values are not present, PSM will not be enabled. If they are not present, restart the modem and check again.