**PSM**

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Information gathered mainly from Nordic DevZone.

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**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.

You cannot receive any GPS signals when using the LTE antenna. Therefore, if you want to use LTE and GPS **together**, you need PSM.

A device can **request** PSM, specifying the requested **Periodic Tracking Area Update** (P-TAU, the interval when the antenna is off), and **Active-Time** (the interval after a transmit when the device can be reached/is receiving). It is up to the network if the request is granted. If you are using the iBasis SIM card that came with the DK, my guess is that PSM is not granted (I only know of places where that is not granted, and no places where it is granted).

I have been unable to confirm whether iBasis SIM cards are allowed PSM on Verizon networks or not. However, I do know that on Verizon networks only PSM periods of >190 minutes are allowed.

You can check if PSM got activated by using AT+CEREG=5 or AT%XMONITOR. If the first three bits of the Active-time or Periodic-TAU is 111, PSM the related timer is not activated.

The two last values of the CEREG level 5 response are the ones related to PSM, Active-Time (the time after a transmit event when the device is reachable) and Periodic-TAU (the time between regular transmit events to keep the connection alive).

One ticket about nRF91 power saving modes:
<https://devzone.nordicsemi.com/f/nordic-q-a/57959/nrf91-power-saving-modes>

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<https://devzone.nordicsemi.com/f/nordic-q-a/46774/nrf91-psm-edrx-application-operation-mode>

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1. When modem is in deep sleep mode, is the application halted too?

* The application has a dedicated CPU (Cortex M33), so it runs asynchronous to the modem.
* The state of the application depends on your running program.

2. If not, what happens when sending data to the internet?

* If the application needs to transmit data while the modem is in eDRX or PSM mode, it'll wake up and send the specific data, then go back to eDRX or PSM.
* PSM and eDRX is for receive "polling" only, you can send data at any time.

3. Does the application get an interrupt when the modem is active?

* Are you referring to the PSM or eDRX timeout? No, that is not conveyed to the application.
* The application should use functions like recv() or poll() to check if there's any received data available for the current opened socket.

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[https://devzone.nordicsemi.com/f/nordic-q-a/48200/correct-to-shutdown-modem-and-reconnect/191097#191097](https://devzone.nordicsemi.com/f/nordic-q-a/48200/correct-to-shutdown-modem-and-reconnect/191097#23191097)

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The three upper bits sets the interval, and the lower 5 bits set the timer count.

The PSM interval should match your expected "receive" window from the network. If you expect to receive/poll data every 2 hours, the PSM interval should be set to this value.

If you only send data, via UDP (thus, never receive), you can set the PSM interval even higher.

If you want to receive every 1 day (24 hours), you can set it to "00111000" (1 hour \* 24 = 24h)

When PSM is set, you can send data at any time you'd like, just push data and the modem will do the rest for you.

Note that the active time and the PSM interval use two different "GPRS timer", so the bits set for active time will differ from the bits set for PSM interval.

 /\* GPRS Timer 3 value (octet 3)

 \* Bits 5 to 1 represent the binary coded timer value.

 \* Bits 6 to 8 defines the timer value unit for the GPRS timer as follows:

 \* 8 7 6

 \* 0 0 0 value is incremented in multiples of 10 minutes

 \* 0 0 1 value is incremented in multiples of 1 hour

 \* 0 1 0 value is incremented in multiples of 10 hours

 \* 0 1 1 value is incremented in multiples of 2 seconds

 \* 1 0 0 value is incremented in multiples of 30 seconds

 \* 1 0 1 value is incremented in multiples of 1 minute

 \* 1 1 0 value is incremented in multiples of 320 hours (NOTE 1)

 \* 1 1 1 value indicates that the timer is deactivated (NOTE 2). \*/

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**Periodic Tracking Area Update**

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config LTE\_PSM\_REQ\_RPTAU // CONFIG\_LTE\_PSM\_REQ\_RPTAU="00000110"

 string "PSM setting requested periodic TAU" // Tracking Area Update (TAU)

 default "00000011"

 help

 Power saving mode setting for requested periodic TAU.

 See 3GPP 27.007 Ch. 7.38.

 And 3GPP 24.008 Ch. 10.5.7.4a for data format.



default = "00000011" | 00011 = 3 | 000 = 10min | 10min \* 3 = 30min = 0.5h

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**Active Time**

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config LTE\_PSM\_REQ\_RAT // CONFIG\_LTE\_PSM\_REQ\_RAT="00000000"

 string "PSM setting requested active time"

 default "00100001"

 help

 Power saving mode setting for requested active time.

 See 3GPP 27.007 Ch. 7.38.

 And 3GPP 24.008 Ch. 10.5.7.3 for data format.



default = "00100001" | 00001 = 1 | 001 = 1min | 1min \* 1 = 1min

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<https://github.com/Rallare/fw-nrfconnect-nrf/blob/nrf9160_samples/samples/nrf9160/udp_with_psm/src/main.c#L88>

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void setup\_psm(void)

{

 char psm\_settings[] = CONFIG\_LTE\_PSM\_REQ\_RPTAU;

 printk("PSM bits: %c%c%c\n", psm\_settings[0], psm\_settings[1],

 psm\_settings[2]);

 printk("PSM Interval: %c%c%c%c%c\n", psm\_settings[3], psm\_settings[4],

 psm\_settings[5], psm\_settings[6], psm\_settings[7]);

 int err = lte\_lc\_psm\_req(true);

 if (err < 0) {

 printk("Error setting PSM: %d Errno: %d\n", err, errno);

 }

}

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**Asset Tracker – Power optimization**

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The Asset Tracker can run in three power modes that are configured in the Kconfig file of the application.

These settings are currently only supported on the nRF9160 DK.

**Note**

Not all cellular network providers support these modes, and the granted parameters can vary between networks.

**Demo mode**

This is the default setting.
In this mode, the device maintains a continuous cellular link.
To enable this mode, set ``CONFIG\_POWER\_OPTIMIZATION\_ENABLE=n``.

**Request eDRX mode**

In this mode, the device requests the eDRX feature from the cellular network to save power.
To enable this mode, set ``CONFIG\_POWER\_OPTIMIZATION\_ENABLE=y`` and then
set Switch 2 to the N.C. position.

**Request Power Saving Mode (PSM)**

In this mode, the device requests the PSM feature from the cellular network to save power.
To enable this mode, set ``CONFIG\_POWER\_OPTIMIZATION\_ENABLE=y`` and then
set Switch 2 to the GND position.

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CONFIG\_LTE\_LEGACY\_PCO\_MODE=n

config LTE\_LEGACY\_PCO\_MODE

 bool "Enable legacy LTE Protocol Configuration Options mode"