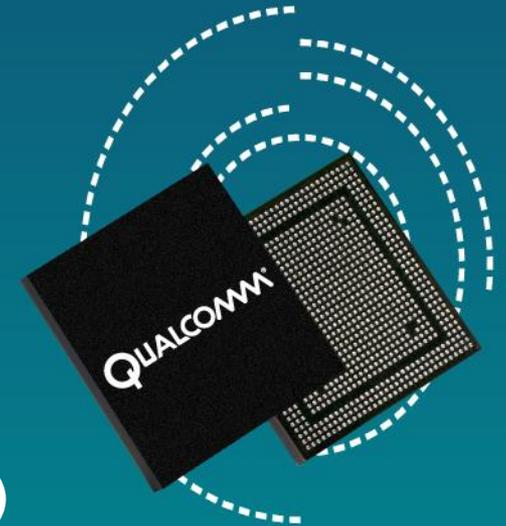




C6-150436

UICC interface in Power Saving Mode (PSM)



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Power Saving Mode (PSM)

- PSM (Power Saving Mode) was introduced in Rel.12.

- Reference TS 23.682 clause 4.5.4:

4.5.4 UE Power Saving Mode

A UE may adopt the PSM for reducing its power consumption. That mode is similar to power-off, but the UE remains registered with the network and there is no need to re-attach or re-establish PDN connections. A UE in PSM is not immediately reachable for mobile terminating services. A UE using PSM is available for mobile terminating services during the time it is in connected mode and for the period of an Active Time that is after the connected mode. The connected mode is caused by a mobile originated event like data transfer or signalling, e.g. after a periodic TAU/RAU procedure. PSM is therefore intended for UEs that are expecting only infrequent mobile originating and terminating services and that can accept a corresponding latency in the mobile terminating communication.

- The goal of PSM is to reduce power consumption for M2M devices that only requires periodic interaction with the network (water meter, tracker on container, diagnostic module on machine, ...), while reducing signaling to network.
- The duration of PSM is controlled by timer T3412, which has a maximum value of 310 hours (over 12 days).
 - A “common” use case is probably a value of T3412 set to 1 day
- During PSM mode, the UE deactivates the AS layer and enters the state EMM-REGISTERED.NO-CELL-AVAILABLE (see TS 24.301 clause 5.3.11)

UICC power in PSM

- While in PSM state, there are 3 causes of power consumption related to the UICC:
 - Presence detection polling
 - Proactive polling
 - Idle power absorbed by the UICC
- Presence detection polling
 - C6-140109 introduced the possibility to suspend the presence detection polling when data is not exchanged with the network. In this regard, presence detection polling is not required during PSM and is not a cause of power consumption.
- Proactive polling
 - Proactive polling can be disabled by the operator using the POLLING OFF proactive command. We could assume that MNO can deploy specific UICC cards that disable proactive polling for M2M devices with PSM requirements. For this reason, proactive polling does not seem to be an issue.
- Idle power absorbed by the UICC
 - This component is still present during PSM mode
 - According to ETSI 102 221 clause 5.3.1, the current consumption shall not exceed the limit of 100 μ A.
 - In practice, many UICC cards seen in the market absorb a lower current, with an average between 10 μ A and 20 μ A.
 - While this current is small, its effect becomes significant over time, especially because in practice UE consumes more than that to keep the UICC idle (as it cannot shut down the LDO).

UICC power in PSM

- Power required to initialize a UICC card:
 - Normal UICC initialization (from the cold reset to complete USIM initialization) takes about 2 seconds (ignoring unnecessary services that a M2M module might not need).
 - During active operation, the UICC can absorb up to 10mA (unless higher value is negotiated with the UE using TERMINAL CAPABILITY command).
- Let's make a quick comparison, taking a normal PSM scenario where UE is in deep sleep mode for 1 day:
 - Keeping the UICC in idle mode consumes $24\text{h} * 15\mu\text{A}$
 - Shut down of the UICC and complete power up consumes: $2\text{s} * (10\text{mA} + \text{UE power})$
- It should be clear that first option is more expensive in terms of power, which means that there is no incentive for the UE to use PSM functionality
 - It's more convenient from power perspective to shut down the entire system and re-start it
 - This implies additional signalling over the air and is against the spirit of the PSM functionality

Proposal

- UE should be able to power off the UICC during PSM and re-initialize it later, with these conditions:
 - Functionality only applicable during Power Saving Mode
 - PIN code in the USIM is disabled (to avoid storage of PIN)
 - After re-initialization, UE verifies that same UICC card is used before transmitting to the network
 - Verification of ICCID value, IMSI value and other EFs that might have changed

- Do we need additional changes on the UICC side?
 - As of today, UE has no way to know if the UICC was used in another device while in PSM other than looking at some specific EFs
 - We can standardize optional mechanism in USIM that helps UE understand if UICC was used in any other terminal during PSM

Questions?

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