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Re:	IEEE 802.16m-08/040 Call for Comments and Contributions on Project 802.16m SDD TGm SDD: Femtocells
Abstract	This contribution proposes femtocell idle mode and sleep mode to achieve energy saving and interference reduction.
Purpose	Discussion and approval by TGm.
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Femtocell BS Idle Mode and Sleep Mode

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1. Introduction

While power saving mode is considered for MSs in the legacy system, there is no consideration on the power saving mode for BSs. Nevertheless, with emergence of Femtocell BS (FBS), energy efficiency becomes an important issue for FBS owners since FBSs are considered as consumer devices and the utility bill is paid by the end users. In this contribution, we propose femtocell BS idle mode and sleep mode, just similar to MS idle and sleep mode in the legacy system. The basic idea is that an FBS should stop transmission and enter idle/sleep mode when it is not serving active MSs. Therefore, both energy saving at FBSs and reduction of interferences to neighbor cells can be achieved.

2. Scenarios in FBS Idle Mode and Sleep Mode

Two scenarios which benefit from fBS idle mode and sleep mode are considered:

Scenario I: All closed-user-group MSs (CUG-MSs) are not in the service range of their FBS and the FBS may enter FBS idle mode.

Scenario II: Those CUG-MSs in the service range of their FBS are either in idle mode and sleep mode. Then the FBS can enter either idle mode or sleep mode.

The difference between FBS idle mode and FBS sleep mode is on the length of FBS sleeping period. The state transition diagram of FBS idle mode and sleep mode is described in Figure 1. The state transitions from Active mode to Idle/Sleep Mode are summarized by the two scenarios mentioned above. On the opposite direction of the state transitions, there are three cases. First, same as idle/sleep modes in the legacy system, an FBS in idle/sleep mode periodically wakes up but now it “serves” MSs. Second, an FBS, which entered idle mode due to none of its CUG-MSs in its service range, needs to be activated when anyone of its CUG-MSs returns to its service range. Third, to avoid long service interruption time, we propose that FBSs can be activated by a wakeup signal sent by MSs or the network if there are data to transmit on the UL and DL connections, respectively, during FBS idle/sleep interval.

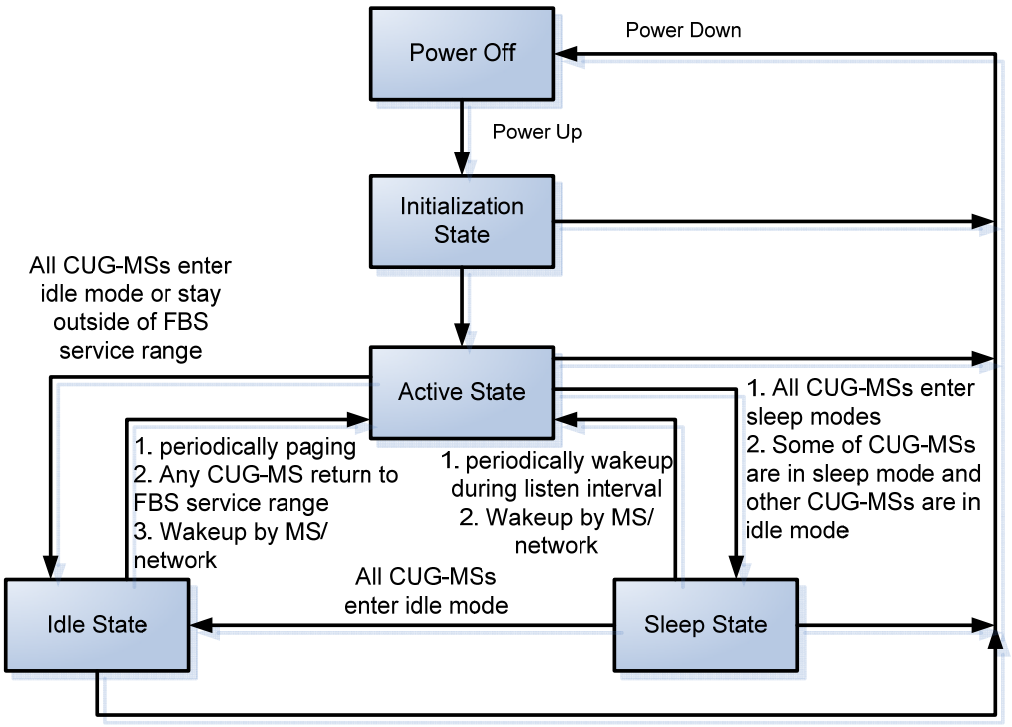

Figure 1 State transition diagram of FBS idle and sleep mode

3. Proposed SDD Text

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17 Support for Femtocells

17.Y Femtocell BS Idle Mode and Sleep Mode

In order to reduce energy consumption and interferences, FBSs should stop transmission when they are not serving any active MSs. In particular, an FBS may enter idle mode either when all of its closed-user-group MSs (CUG-MSs) are not in its service range, or when those CUG-MSs in its service range are in idle mode. Also, an FBS may enter sleep mode when all of its CUG-MSs in its service range are either in sleep mode or in idle mode. On the other hand, FBSs in idle/sleep mode periodically wakeup to serve MSs. In addition, the FBS in idle mode due to none of CUG-MSs in the service range needs to be activated when anyone of its CUG-MSs returns to its service range. Finally, MSs and the core network can send a wakeup signal to activate FBSs during FBS idle/sleep interval if there are data to transmit on the UL and DL connections, respectively.