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Title	<b>Sleep-Window Optimization for Handover</b>	
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Source(s)	Kiseon Ryu, Yongwon Kwak, Yongho (Ronny) Kim, Kihyoung Cho, Beomjoon Kim, and Changjae Lee, LG Electronics Inc., 533, Hogye-1dong, Dongan-gu, Anyang-shi, Kyongki-do, Korea	Voice: 82-31-450-7188 Fax: 82-31-450-7912 <a href="mailto:{ksryu, yongwon, ronnykim, kihyoung, beom, cjlee16}@lge.com">[mailto:{ksryu, yongwon, ronnykim, kihyoung, beom, cjlee16}@lge.com]</a>
Re:	Response to Sponsor Ballot	
Abstract	This document contains suggestions to optimize sleep window size after HO procedures.	
Purpose	This document is submitted for review by 802.16e Working Group members	
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# Sleep-Window Optimization for Handover

*Kiseon Ryu, Yongwon Kwak, Ronny (Yongho) Kim, Kihyoung Cho, Beomjoon Kim, and Changjae Lee*  
**LG Electronics**

## 1. Introduction

The current IEEE 802.16e document states that an MSS may perform handover procedures in sleep mode after terminating Sleep Mode. If the MSS still wants to continue in Sleep Mode after the handover, it shall send another MOB-SLP-REQ message to new BS. In this case, the MSS shall start to increase sleep-window from its default initial value that can be indicated by 6-bit initial-sleep window field in SLP-REQ message.

Obviously, there is no relation between an MSS's mobility pattern and traffic generation, so that it is very highly probable that the MSS that has been in Sleep Mode before handover would request to enter Sleep Mode after handover. If it is true, it may be a wasteful of wireless resources for the MSS to transmit a new SLP-REQ message after handover. In addition, it may be unreasonable to force the MSS that wants to enter Sleep Mode after handover to start with the default initial value of sleep-window only for the reason that it moves into another BS's coverage. In other words, if the MSS stays as it was, it does not have to decrease its sleep-window to the default initial value. As mentioned above, the existing field of initial-sleep window is of 6 bits, but sleep window can be increased up to about  $2^{17}$  frames, which means that the existing initial-sleep window in SLP-REQ message cannot be applied to this purpose.

In this contribution, therefore, we propose that an MSS that has been in Sleep Mode before handover would indicate its preference to enter Sleep Mode after handover to Target BS. Our proposal may be realized by adding a two TLV items to existing messages, RNG-REQ and MOB-SLP-RSP message, respectively. An operational example is shown in fig. 1.

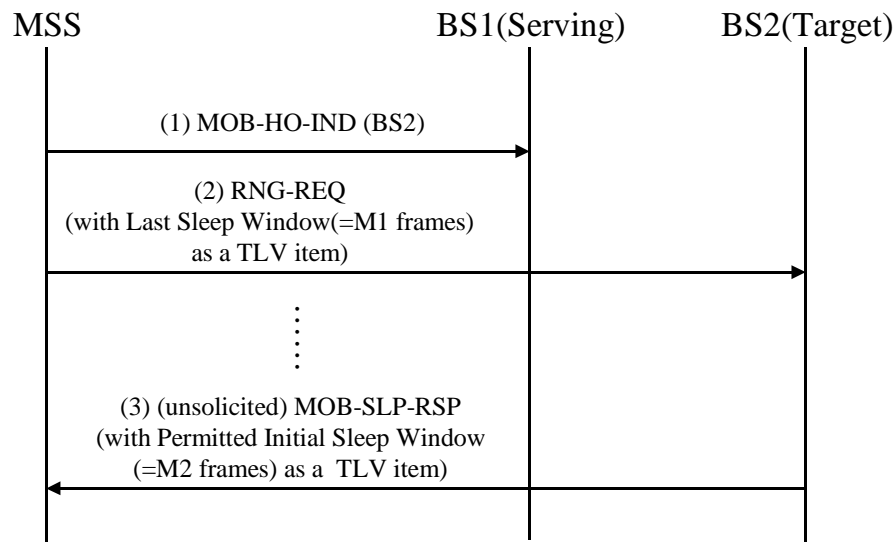


Fig. 1. Message flow for the proposed optimization

- (1) MSS transmits MOB-HO-IND message to Serving BS (BS1).
- (2) If the MSS wants to enter Sleep Mode at Target BS (BS2) after handover, the MSS may include Last Sleep Window to RNG-REQ message as a TLV item. Last Sleep Window indicates the former value of sleep-window before the MSS determines to perform handover.

- (3) After handover procedures are completed, the BS that receives RNG-REQ message with Last Sleep Window may transmit unsolicited MOB-SLP-RSP message to the MSS. In MOB-SLP-RSP message, the BS may include Permitted Initial Sleep Window as a TLV item. Permitted Initial Window may not be necessarily equal to Last Sleep Window.

By adopting this proposal, the MSS needs not transmit MOB-SLP-REQ message to the Target BS and wait for MOB-SLP-RSP under the assumption that the MSS would request to enter Sleep Mode after handover. Also, in some cases, we can reduce the number of MOB-TRF-IND messages that, otherwise, would be transmitted to the MSS on the broadcast CID.

## 2. Proposed Text Change

*[In 6.3.2.3.5 Ranging Request (RNG\_REQ) message, page 20, line 50, add the following sentence as]:*

The following parameter may be included in RNG\_REQ message when the MSS is attempting to perform handover and needs to inform Target BS of its preference to continue in Sleep Mode after handover to Target BS.

### Last Sleep Window

Indicates the former value of sleep-window before the MSS performs handover. Since the maximum length of Last Sleep Window is limited to 2 bytes, even if the former value of sleep-window is greater than  $2^{16}-1$ , Last Sleep Window shall be set to  $2^{16}-1$ .

*[In 6.3.2.3.45 Sleep Response Message (MOB-SLP-RSP), page 57, line 7, add the following sentence as]:*

In the case where sleep is denied (After-REQ-action=1), it is recommended that the BS provide unsolicited MOB-SLP-RSP message.

Also, in the case where the BS receives an RNG-REQ message including Last Sleep Window, the BS shall provide unsolicited MOB-SLP-RSP message including Permitted Initial Sleep Window as a TLV parameter. If the BS transmits the unsolicited MOB-SLP-RSP message with Permitted Initial Sleep Window, it shall set initial-sleep window to zero, and the MSS shall enter Sleep Mode with a sleep interval that is equal to Permitted Initial Sleep Window. The length of Permitted Sleep Window is limited to 2 bytes.

*[In 6.3.2.3.45 Sleep Response Message (MOB-SLP-RSP), page 59, line 10, add the following sentence as]:*

### Permitted Initial Sleep Window

This value indicates the initial value of sleep-window that is permitted for the MSS to use when it enters Sleep Mode after handover. This value shall be included only when Last Sleep Window is included in RNG-REQ message by the MSS, and may not necessarily be equal to Last Sleep Window. Its length is limited to 2 bytes.

*[In 6.3.19.2 Sleep-window update algorithm, page 111, line 47, add the following sentence as]:*

When the MSS in Sleep Mode determines to perform handover, the MSS may store the value of sleep-window at that time. If the MSS needs to enter Sleep Mode at Target BS after handover, the MSS may include Last Sleep Window in RNG-REQ message that is transmitted for handover as a TLV item. After handover, Target BS that receives RNG-REQ message including Last Sleep Window shall transmit an unsolicited SLP-RSP message. When the BS transmits the unsolicited SLP-RSP message, it may consider the value of Last Sleep Window TLV item when it determines the value of initial-sleep window, but it may not be necessarily equal to Last Sleep Window. If

the BS permits an initial sleep window that is greater than  $2^6-1$ , it shall include Permitted Initial Sleep Window in the unsolicited SLP-RSP message. MSS receiving the unsolicited SLP-RSP message shall enter Sleep Mode with initial-sleep-window that is equal to Permitted Initial Sleep Window. The length of Permitted Initial Sleep Window shall be 1 or 2 bytes.

*[In 11.5 RNG-REQ message encodings, add the following rows to Table 362a]:*

Name	Type (1 byte)	Length	Value (Variable-length)
<u>Last Sleep Window</u>	<u>TBD</u>	<u>variable</u>	<u>This value indicates the former value of sleep-window before the MSS performs handover. Presence of item in message indicates MSS's preference to enter Sleep Mode after handover. The length of this value shall be 1 or 2 bytes.</u>

*[In 11.17 Sleep mode management encodings, page 308, line 60, add the following row as]:*

Name	Type (1 byte)	Length	Value (Variable-length)
<u>Permitted Initial Sleep Window</u>	<u>TBD</u>	<u>variable</u>	<u>This value indicates the initial value of sleep-window that is permitted for the MSS when it enters Sleep Mode after handover. This value shall be included only when the BS received an RNG-REQ message including Last Sleep Window, and may not necessarily be equal to Last Sleep Window. The length of this value shall be 1 or 2 bytes.</u>