| Project | **IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>** |
|---|---|
| Title | **The optimization for the transmission of the MOB-TRF-IND message in Sleep Mode.** |
| Date Submitted | **2004-11-04** |
| Source(s) | Kiseon Ryu, Yongho Kim, Beomjoon Kim, Yongwon Kwak, Changjae Lee LG Electronics,Inc. 533,Hogye-1dong,Dongan-gu, Anyang-shi,Kyongki-do,Korea | Voice: 82-31-450-4387 Fax:　82-31-450-7912 [mailto:ksryu, ronnykim, beom, yongwon, cjlee16@lge.com] |
| Re: | Response to Sponsor Ballot |
| Abstract | This document contains suggestions to reduce the transmission of the MOB-TRF-IND message. |
| Purpose | This document is submitted for review by 802.16e Working Group members. |
| Notice | This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein. |
| Release | The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16. |
| Patent Policy and Procedures | The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:chair@wirelessman.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>. |

# The optimization for the transmission of the MOB-TRF-IND message in Sleep Mode

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

## 1. Problem Statement

Per the sleep-window update algorithm, the MSS shall double the duration of the preceding sleep-window if it re-enters sleep-window. This procedure shall be repeated as long as the resulting sleep-window does not exceed the final-sleep-window value.

If there are a number of MSSs in Sleep Mode, the BS shall send the MOB-TRF-IND messages to each MSS's listening interval. Therefore, it can be inferred that the BS may transmit the MOB-TRF-IND messages more frequently in proportion to the number of the MSS in Sleep Mode, even considering the possibility of overlapping sleep interval between the MSSs.

The frequent transmission of the MOB-TRF-IND message may cause waste of the air resources and increase the processing load of the MSSs in Normal Operation because the MOB-TRF-IND message is transmitted on Broadcast management CID.

In this contribution, we propose the parameter with which the BS indicates the change of timing offset for listening interval to the MSS in Sleep Mode. The BS can transmit the MOB-TRF-IND message less frequently by synchronizing consequently listening interval among several MSSs, and the BS can save the air resources.

## 2. Proposed Remedy

Adjustment of timing can be achieved with either traffic indication or ranging response.

Both the MOB-TRF-IND message and RNG-RSP message can include the proposed parameter as follows:

• *Next_Listening_Interval_Start*

This parameter indicates the frame offset in which the next listening widow start. When the MSS receives this parameter, it shall adjust the sleep interval to the value of the indication. However, this adjustment of sleep interval shall not affect the sleep-window update algorithm defined in the current draft, and the next sleep-window shall be set to the value calculated through the original sleep-window update algorithm.

The following figure shows an operational example of the proposed scheme.

a) Current operations



Next Listening Interval Start

b) Operations using Next Listening Interval Start TLV
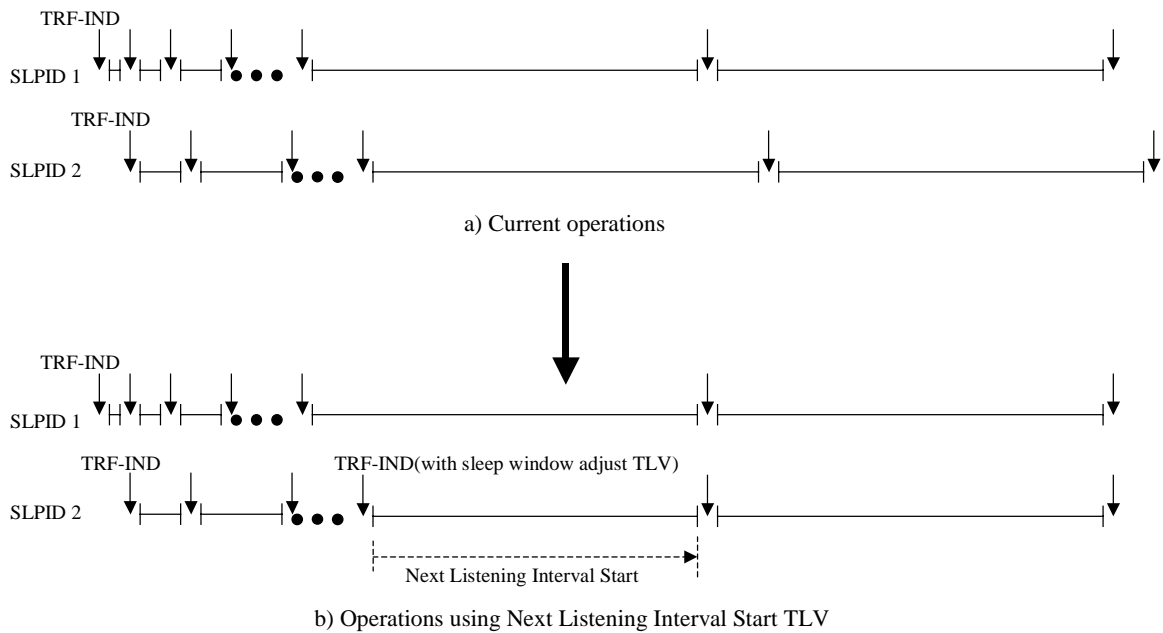
## 3. Proposed Text Changes

*[Add the following text below line 38 in page 22 of IEEE802.16e/D5]*

The following TLV parameters may be included in the RNG-RSP message if the BS needs to adjust the timing offset of the listening interval of the MSS in Sleep Mode to synchronize with other MSSs' listening interval.

**Next_Listening_Interval_Start (11.6)**
This value indicates the frame offset in which the next listening interval start. If the MSS in Sleep Mode receives this parameter, it shall adjust the timing offset of the next listening window to this value. This adjustment shall not affect the sleep-window update algorithm. After adjusting the current sleep interval to Next_Listening_Interval_Start TLV and the next sleep-window to the value calculated by the original sleep-window update algorithm.

*[Add the following parameter after Next Periodic Ranging in Table 320a on page 285, line 60]*

| Name | Type | Length | Value |
|---|---|---|---|
| Next_Listening_Interval_Start | 22 | 3 | This value indicates the frame offset in which the next listening widow start with respect to the frame where RNG-RSP is transmitted. This TLV encoding shall be included in RNG-RSP message only when its ranging status is 'success' |

*[Modify the MOB-TRF-IND message in Table 106c on page 61, line 23 as follows]*

| Syntax | Size | Notes |
|---|---|---|
| MOB_TRF-IND_Message_Format() { | | |
| Management message type = 52 | 8 bits | |
| FMT | 1 bit | 0 = SLPID based format<br>1 = CID based format |
| if (FMT == 0) { | | |
| Reserved | 7 bits | |
| SLPID Group Indication bit-map | 32 bits | Nth bit of SLPID-Group indication bit-map [MSB corresponds to N = 0] is allocated to SLPID Group that includes MSSs with SLPID values from N*32 to N*32+31 Meaning of this bit<br>0 : There is no traffic for all the 32 MSSs which belong to the SLPIDGroup<br>1 : There is traffic for at least one MSS in SLPID-Group. |
| Traffic Indication Bitmap | Variable | Traffic Indication bit map comprises the multiples of 32-bit long Traffic Indication unit. A Traffic Indication unit for 32 SLPIDs is added to MOB_TRFIND message whenever its SLPID Group is set to '1' 32 bits of Traffic Indication Unit (starting from MSB) are allocated to MSSs in the ascending order of their SLPID values<br>0 : Negative indication<br>1 : Positive indication |
| } else { | | |
| Num-pos | 7 bits | Number of CIDs on the positive indication list |
| for (i=0; i<Num-pos; i++) { | | |
| Short Basic CID | 12 bits | 12 least significant bits of the Basic CID |
| } | | |
| while (!(byte_boundary)) { | | |
| Padding bits | <= 7 bits | padding for byte alignment |
| } | | |
| } | | |
| TLV encoded information | Variable | |
| } | | |

*[Add the description of TLV parameters on page 62, line 28 as follows]*

The following TLV parameters may be included if the BS needs to adjust the timing offset of the listening interval of the MSS in Sleep Mode to synchronize with other MSSs' listening interval.

**Listening_Time_Adjust (11.17.2)**

The Listening_Time_Adjust is a compound TLV value that includes the timing offset of the listening interval to synchronize with other MSSs' listening interval. The Listening_Time_Adjust TLV shall contain SLPID and Next_Listening_Interval_Start only for the MSSs receiving negative indication. If the MSS decodes its own SLPID from the TLV values, it shall adjust the timing offset of the next listening window. This adjustment shall not affect the sleep-window update algorithm for the next sleep interval.

*[Modify the paragraph 6.3.19.1 Introduction on page 103, line 47 as follows]*

During any MOB-TRF-IND message with negative indication for the MSS, the BS may include an updated SLPID for a MSS by appending SLPID_Update TLV in the MOB-TRF-IND message. When the received MOB-TRF-IND message includes a SLPID_Update TLV, the MSS shall decode the TLV and, if addressed, update its SLPID to the new one. The MSS shall identify if the SLPID_Update TLV addresses it by searching through the SLPID_Update TLV and determining if the MSS's current SLPID matches the Old_SLPID in the SLPID_Update TLV. If they match, then the MSS shall set its SLPID to the New_SLPID provided in the SLPID_Update TLV. For an example of sleep mode operation, see Annex E.

The BS may change the timing offset of the listening interval for the MSS in order to synchronize with other MSSs' listening interval. To achieve this, the BS shall inform the MSS of frame offset to the next listening interval when it transmits either MOB-TRF-IND message negatively indicated to the MSS or RNG-RSP message. In this case, the MOB-TRF-IND message may include Listening_Time_Adjust compound TLV which consists of SLPID and Next_Listening_Interval_Start, or the RNG-RSP message may include Next_Listening_Interval_Start TLV values. When an MSS receives Next_Listening_Interval_Start TLV, it shall stay in sleep interval until the indicated frame offset. This adjustment shall not affect the sleep-window update algorithm. After adjusting the current sleep interval to Next_Listening_Interval_Start TLV, and if the MSS receives a negative indication in the next listening interval, the MSS shall set the next sleep-window to the value calculated by the original sleep-window update algorithm

The cycle of sleep-window, listening-window may be repeated according to the iterations element of the MOB-SLP-RSP message. During consecutive sleep-windows and listening-windows sleep-window shall be updated using the algorithm as defined in 6.3.19.2.

*[Add the following TLV parameters after 11.17.1 on page 308, line 60 as follows]*

**11.17.2 Listening_Time_Adjust**

The Listening_Time_Adjust TLV consists of SLPID and Next_Listening_Interval_Start. This TLV may include multiple SLPID values for the MSSs negatively indicated in MOB-TRF-IND message.

| Type | Length | Value | Scope |
|------|--------|-------|-------|
| 2 | Variable | Compound | MOB-TRF-IND |

| Name | Type | Length | Value |
|------|------|--------|-------|

| SLPID | 2.1 | 2 | Unique identifier assigned to a single MSS in Sleep Mode |
| Next_Listening_Interval_Start | 2.2 | 3 | This value indicates the frame offset in which the Next_Listening_Interval_Starts from the beginning of the following sleep-window. |