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Re:	IEEE802.16j-06/027: “Call for Technical Proposals regarding IEEEP802.16j”
Abstract	This contribution proposes the method of timing compensation for idle mode.
Purpose	Text proposal for 802.16j Baseline Document
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A proposal for timing compensation of idle mode in MR

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Introduction

This contribution proposes a method of timing compensation for timing-related control function, such idle mode. In 802.16e specification, several messages such as PAG-ADV are received at the pre-notified timing. However, in a non-transparent RS system[1], the message processing delay in RS makes it hard to fulfill that reception timing requirement. In order for MS to receive messages at the pre-notified timing, MR-BS compensates the timing when MS can receive messages with taking account of RS processing delay.

Details

In this proposed method, based on the following assumptions:

- The MR system is a non-transparent RS system[1].

- The RS can not relay message and data within the current frame. The message is delayed for fixed duration on account of relay processing in the RS.

- Each frame sent by MR-BS and RS are synchronized and has same frame number.

Timing compensation for idle mode

As shown in Fig. 1, MS enters idle mode by receiving DREG-CMD message involving “PAGING_OFFSET” parameter from MR-BS. F_B, the beginning frame of Paging Listening Interval (PLI), is decided by condition defined in section 6.3.24.5.

According to the above assumption, the frame number in MR-BS and RS are same, both F_B decided by MR-BS and MS indicate same frame. So, timing of PLI managed in both MR-BS and MS are synchronized absolutely.

However, MOB_PAG-ADV message sent from MR-BS will delay of “D_R” in RS, it is received at MS D_R frame later. Therefore, it depends on the length of PLI and the timing of that MOB_PAG-ADV message is sent from MR-BS, MOB_PAG-ADV message does not reach within PLI of MS and MS fails to receive the message.

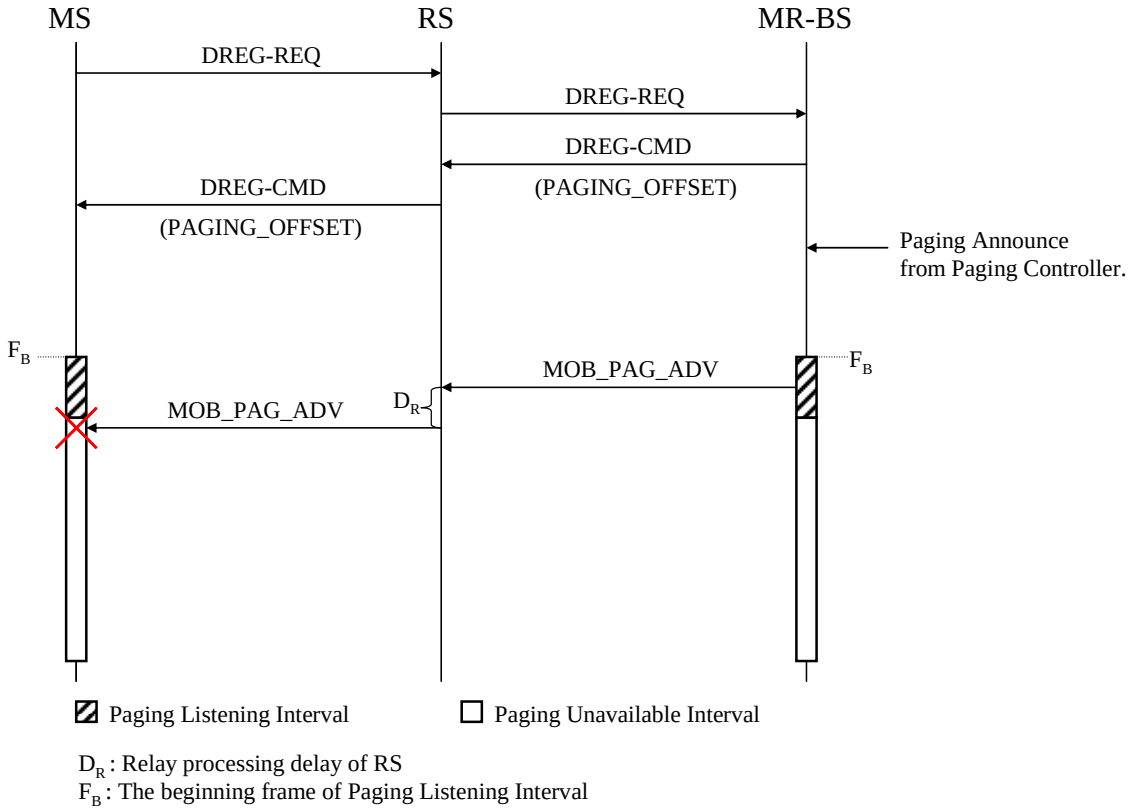

Fig. 1 PLI slipping problem of idle mode in MR

To avoid this problem, the timing of PLI managed in MR-BS and MS should be compensated. Proposed method is shown in Fig. 2.

When MR-BS receives DREG-REQ message and decides PAGING_OFFSET, MR-BS decides normal PAGING_OFFSET value using regular condition at first. MR-BS notifies MS of the beginning timing of PLI with this normal value. Then, MR-BS also decides modified PAGING_OFFSET value for itself. Modified value will be decided that the PLI managed internally in MR-BS is just shifted D_R earlier from the PLI of MS.

With this compensation method, MOB_PAG-ADV sent over the R-DL at any frame within PLI managed in MR-BS is received successfully within MS's PLI via RS relaying.

In order to decide the modified PAGING_OFFSET value in MR-BS, MR-BS needs to know D_R of RS. The value of D_R will be given to the MR-BS as a capability parameter of SBC-REQ message.

Note that modification for capability parameter of SBC-REQ message will be proposed in other contribution [2].

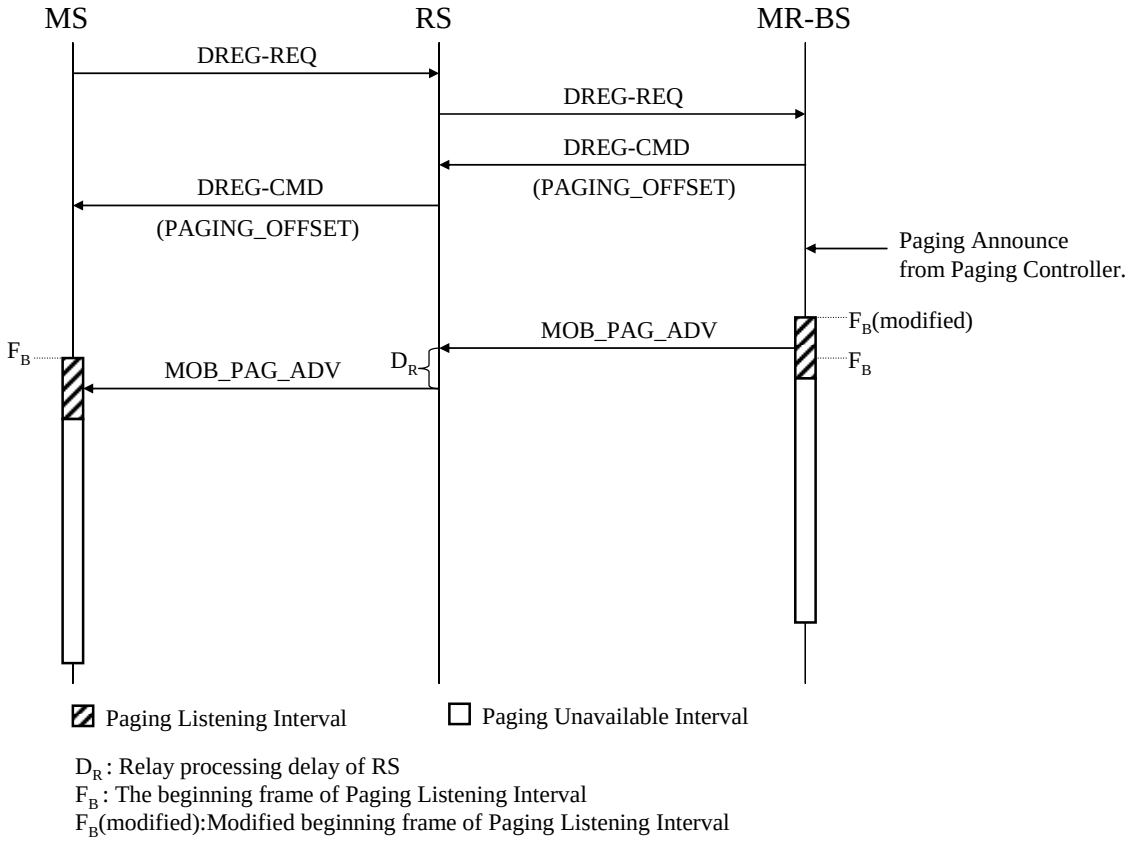

Fig. 2 Compensation for timing of PLI

Consider the case the MS moves across the areas of MR-BS and RS during the idle mode.

As shown in Fig. 3, MS1 entered idle mode under MR-BS and MS2 entered idle mode under RS. MR-BS can't recognize the location of each MS1 and MS2 because of idle mode. Both MS1 and MS2 are managing normal PLI timing, and MR-BS are managing normal PLI timing for MS1 and modified PLI timing for MS2.

In order for both MSs to receive MOB_PAG-ADV, MR-BS shall send both MOB_PAG-ADV#1 for normal PLI over the access link and MOB_PAG-ADV#2 for modified PLI over the relay link.

If there are multiple RS exist and each delay of RS are not same, MR-BS shall examine the maximum delay of RS and notify all RS of it. The MR-BS send MOB_PAG-ADV#2 earlier the maximum delay of RS than MOB_PAG-ADV#1. In each RS, after the duration notified by MR-BS, all RS transmit MOB_PAG-ADV#2 synchronously to MS over the access link data with the slowest RS. Such the maximum delay will be notified in SBC-RSP message.

If the MR-BS detects that the maximum delay of RS is replaced with the greater value, MR-BS may send unsolicited SBC-RSP message and notifies all RS of it.

Note that RS doesn't receive MOB_PAG-ADV#1 because it is sent over the access link. RS relays only MOB_PAG-ADV#2.

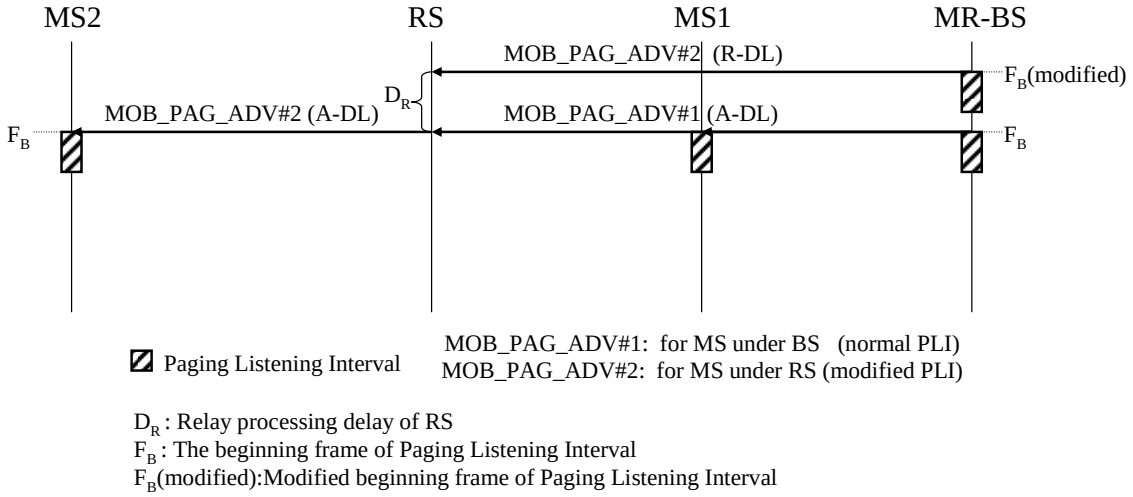

Fig. 3 MS under the MR-BS and RS

Conclusion

According to this compensation method, the MOB_PAG-ADV messages are surely delivered from MR-BS to MS through RS relaying.

Specific text changes

Insert the following text at the end of 6.3.24.5:

For MR, PLI of MS is shall be compensated for relaying delay of RS. MR-BS determines PAGING_OFFSET for MS, and compensates PAGING_OFFSET for itself taking account of RS's delay. The beginning frame of PLI in MR-BS is shifted earlier from the beginning frame of PLI in MS.
The value of RS's delay is given to MR-BS as a capability parameter of SBC-REQ message.

In order for both MS under MR-BS and RS to receive MOB_PAG-ADV, MR-BS shall send both MOB_PAG-ADV for normal PLI over the access link and MOB_PAG-ADV for modified PLI over the relay link.

In the case that there are multiple RS exist and each delay of RS are not same, MR-BS shall examine the maximum delay of RS and notify all RS of it. After the notified duration, all RS and MR-BS transmit MOB_PAG-ADV over access link to MS synchronously. Such the maximum delay is notified in SBC-RSP message. If the MR-BS detects that the maximum delay of RS is replaced with the greater value, MR-BS sends unsolicited SBC-RSP message and notifies all RS of it.

Insert new subclause 11.8.3.7:

11.8.3.7.X Maximum RS Downlink Delay for Paging Group

Type	Length	Value	Scope
TBA	1	Maximum RS Downlink Delay for Paging Group (unit: frame)	SBC-RSP

References

[1] IEEE C802.16j-06/132, “Relaying methods proposal for 802.16j”
[2] IEEE C802.16j-06/143, “Network entry procedure for non-transparent relay station”