Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	**Frame number synchronization between MR-BS and RS**	
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Re:	This is the response to a Call for Contributions, from IEEE802.16 Relay TG.	
Abstract	This contribution does propose the way to synchronize the offset of frame numbers between MR-BS and RS. And it proposes the mechanism for RS to know the frame number at which RS shall transmit PAG-ADV.	
Purpose	Discussion and Adoption of proposed text into baseline document by Relay TG.	
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Frame number Synchronization between MR-BS and RS

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Introduction

In IEEE802.16 TGe system, BS's shall be synchronized at TDD. But, the transmitted frame numbers among neighbor BSs may not be synchronized. Furthermore, for PRBS issue(refer to 8.4.9.4.1), it is desirable to allow different frame numbers among neighbor BSs.

In IEEE802.16 OFDMA system, it uses same pilot position for uplink among BSs. Therefore, for better channel estimation in a BS, pilot sequences need to be different from neighbor BSs. And the PRBS for generating pilot sequence in section 8.4.9.4.1 make possible for BSs to have different pilot sequences.
But, when same frame number is applied among neighbor BSs, there are only 32 different pilot sequences to be generated from PRBS generator in section 8.4.9.4.1. It is much less than the required number of pilot sequences to cover network topology of 2-tier, 19 cells, with 3 sector (3 * 19cell = 57 >> 32). Therefore, some BSs within network topology of 2-tier should have different frame number to get different pilot sequence.

The same theory will apply to the relay extension, i.e. the frame number among BS and RSs may not be same. And the difference between the frame numbers of BS and RS shall be shared between BS and RS as the BS controls the belonging RSs.

Furthermore, some MAC management message such as PAG-ADV, TRF-IND message shall be transmitted at a specific frame number per Paging Group or MS. Therefore, BS shall refer to the frame number offset of each RS in addition to processing delay when scheduling and forwarding MAC message to RSs. And the scheme that notifies the specific frame number to the RSs shall be provided.

In this contribution, the scheme enabling to share the frame number offset between BS and RS is proposed and the scheme that notifies the frame number to transmit MAC management message such as PAG-ADV and TRF-IND to RS is proposed.

Proposed Text Changes

Insert following text at the end of 6.3.2.3.7

When a RS enter network, the REG-REQ may~~shall~~ contain the following TLVs :

RS frame offset(11.7.27)

Insert following text at the end of 6.3.2.3.8

In response to REG-REQ from a RS, the REG-RSP may~~shall~~ contain the following TLVs :

RS frame offset(11.7.27)

If RS frame offset is not included in REG-RSP, RS shall use same frame number as MR-BS transmit.

Insert following text at the end of 6.39.16.2.

When a RS enters network, the RS may~~shall~~ negotiate the difference between frame numbers used by the MR-BS and the RS by transmitting REG-REQ including RS frame offset TLV. The MR-BS shall respond to the

RS by including RS frame offset TLV in REG-RSP when RS shall use different frame number offset from the number which MR-BS transmit. If RS frame offset TLV is included in REG-RSP, RS shall start frame with the frame number as indicated by RS frame offset TLV in REG-RSP. If RS frame offset TLV is not included in REG-RSP, RS shall start frame with the same frame number as MR-BS transmit.

When a RS start and transmit its frame, the RS shall keep the difference to the frame number used by MR-BS as indicated RS frame offset TLV in REG-RSP.

Insert following text at the end of 6.3.21.7 Relay support for MS sleep mode.

When MR-BS transmit TRF-IND to a RS to forward to MSs under the RS. The MR-BS shall schedule and transmit TRF-IND in consideration of RS's processing delay, D_R, and RS frame offset so that the RS has enough time to decode and transmit TRF-IND and the delay is minimized until RS forward.

Insert new subclause at the end of 6.3.24.6

6.3.24.6.1 RS Broadcast Paging message.

When a paging is need to some MS's in a Paging Group, RSs belonging to the Paging Group shall be involved to transmit MOB_PAG-ADV to the MSs. The paging information shall be transmitted by MR-BS to RSs in a relay link. When MR-BS need to transmit paging information to RSs, MR-BS shall calculate the time to transmit in consideration of RS's processing delay, D_R, and RS frame offset so that RSs have enough time to decode and transmit MOB_PAG-ADV and paging delay will be minimized. When MR-BS transmits a paging information to RSs, it may transmit MOB_PAG-ADV including RS tx frame number TLV to RSs. When a RS receive PAG-ADV including RS tx frame number TLV in a relay link, the RS shall restructure and transmit PAG-ADV by extracting the TLV and updating the length field at the frame number as specified by the TLV.

Insert new subclause at the end of 11.7.26

11.7.27 RS frame offset

RS frame offset indicates the offset value between frame number used by MR-BS and frame number used by the RS transmitting (receiving) REG-REQ(REG-RSP) with RS frame offset.

When the RS broadcast frame number in its frame, RS shall keep the offset to the frame number used by BS as indicated by this TLV.

Name	**Length**	**Value**	**Scope**
RS frame offset	1 byte	Unsigned integer for frame offset of LSB 8 bit between Relay Station and Base Station.	REG-REQ , REG-RSP

Insert new subclause at the end of 11.17.3

11.17.4 RS tx frame number

RS tx frame number indicates the frame number at which RS shall transmit the message including this TLV to MS's. When RS receive PAG-ADV including this TLV, RS shall restructure and transmit PAG-ADV by extracting this TLV and updating the length field at the frame number as specified by this TLV.

Name	Length	Value	Scope
RS tx frame number	1 byte	Unsigned integer for LSB 8 bit of frame number at which RS shall transmit.	PAG-ADV