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Title	**On the use of amble for the relay link**
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Re:	Response to call for technical contributions on 80216j-07_007r2,"Call for Technical Comments and Contributions regarding IEEE Project P802.16j", Feb..19,2007
Abstract	This contribution proposes the use of amble for the relay link.
Purpose	Propose the text regarding the location of amble for the relay link in the multi-hop frame structure.
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On the use of amble for the relay link

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1. Introduction

The proposed text concerning the location of the amble for the relay link, which was discussed during the January meeting, can be found in [1]: "The relay link amble, when present, shall be located at the end of the last DL relay zone in which MR-BS/RS is in transmit mode." It covers 2 possible options for placing the amble for the relay link. One option covered by the text is that it allows the amble to be placed at the end of the DL subframe. The other option covered by the proposed text is that allows the amble to be placed at the end of the last DL relay zone. In this contribution, we first discuss the pros and cons for each of the option that is enabled by the proposed text in [1]. On the basis of the foregoing analysis we argue that it is beneficial to enable both the options. Accordingly, we resubmit the proposed text from [1] for consideration for inclusion in the baseline draft.

2. Amble Location

Amble can be used for several purposes on the relay link. Figure 1 shows an example of a multi-hop relay topology to explain the multi-hop relay frame with amble. For instance, an amble can be used to obtain synchronization between an RS and MR-BS or between an RS and superordinated RS. Another example of amble usage is for the purposes of interference measurement. Yet another example of amble usage is in the case of mobile RS case, where the amble can be used for handover cell search.

2.1 Option 1: Amble at the end of the DL subframe

According to this option, amble is placed at a single OFDMA symbol location, i.e., at the end of DL subframe. Figure 2 shows an example implementing this option. More specifically, Figure 2 shows the case where one RS group transmit amble at the end of the relay zone which is in Rx mode and another RS group receive amble at the end of the relay zone which is in Tx mode. Accordingly, RS needs transition gap for amble transmission and reception.

The main benefit in using this option is the robustness of fixed amble location. The main disadvantages are (i) the need for signaling to indicate who transmits and who listens, and (ii) the additional transition gap.

Signaling is needed for synchronization purposes. To synchronize with superordinated RS, signaling to group the RSs in to even/odd hop group is required, i.e., signaling is needed which hop group should transmit amble and which hop group receive amble at the amble location. The role of amble transmission/reception should be rotated between even/odd hop groups.

Another disadvantage is the need of an additional transition gap to transmit amble, if the RS happens to be relay zone which is in Rx mode and to receive the amble if the RS happens to be relay zone which is in Tx

mode, as depicted in Figure 2. Finally, other signaling than even/odd hop grouping is required for indicating one RS to measure the interference and all other RSs to transmit amble.

2.2 Option 2: Amble at the end of the relay zone

Figure 3 shows an example of frame structure where amble for the relay link is transmitted at the end of last DL relay zone which is in Tx mode.

The main benefit of placing amble at the end of DL relay zone which is in Tx mode is that there is no need of signaling for even/odd hop grouping and there is no need for the additional transition gap. The disadvantage is the difficulty in measuring the amble from same hop group RSs due to the nature of even/odd hop grouping.

By placing the amble at two different OFDMA symbol locations, it becomes possible to construct even-hop and odd-hop groups specifically for amble transmission/reception purposes. According to this grouping, an RS, which belongs to an even-hop group, can synchronize with superordinated access station, which belong to odd-hop group by receiving the amble at a prescribed OFDMA symbol location. On the other hand, the very same RS in the even-hop group can transmit amble for the subordinate RS at another prescribed OFDMA symbol location. Both these locations are at the end of the DL relay zone that is in transmit mode so that there is no further need for signaling to transmit amble. Furthermore, there is no need of transition gap, because RS receives amble in Rx mode and transmits amble in Tx mode.

While locating the amble at the end of the DL relay zone using this even/odd nature in hop group is beneficial for synchronization purposes, it needs additional signaling mechanism to support interference measurement. This is because an even/odd hop group RS cannot receive amble which is transmitted by same even/odd hop group RSs. To resolve the interference measurement between RSs, signaling is required such that the RS receives the amble transmitted by same hop group, i.e., RS measures the amble at the end of DL relay zone which is in Tx mode. However, signaling for measurement is also required in option 1 where signaling is needed such that one RS receives amble for measurement purpose and all other RSs and MR-BS transmit the amble.

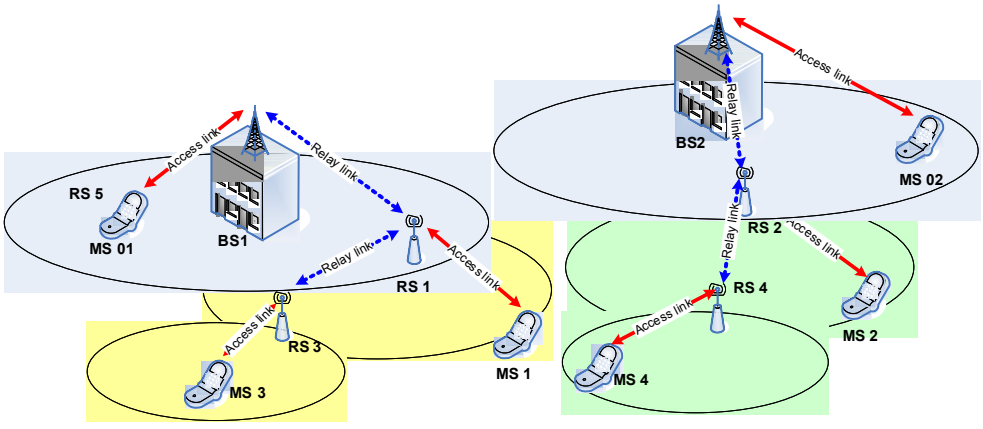


Figure 1. An example topology using Multi-hop Relay

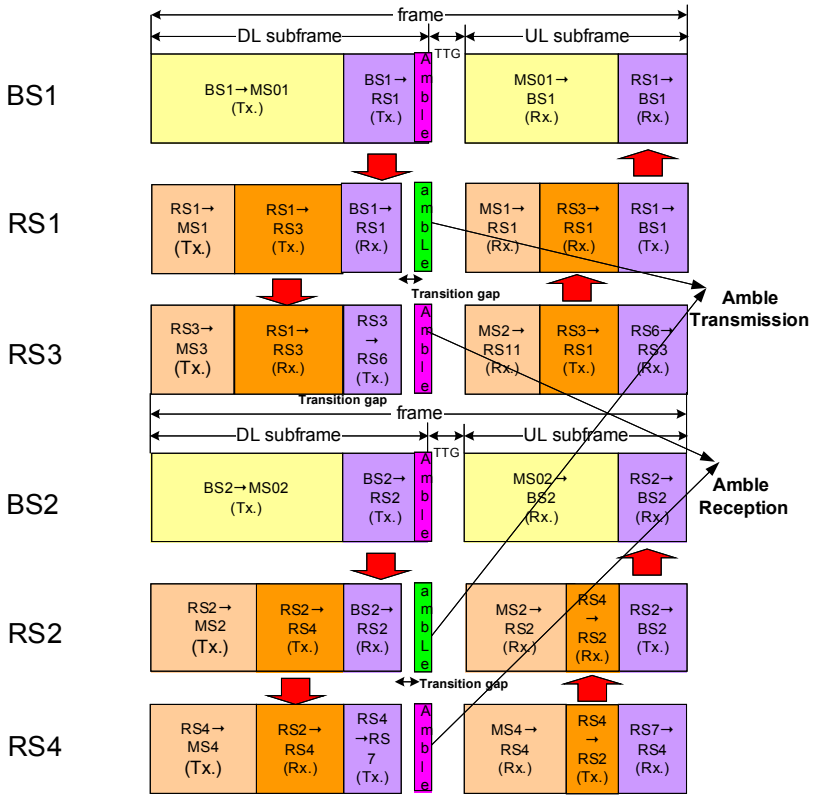
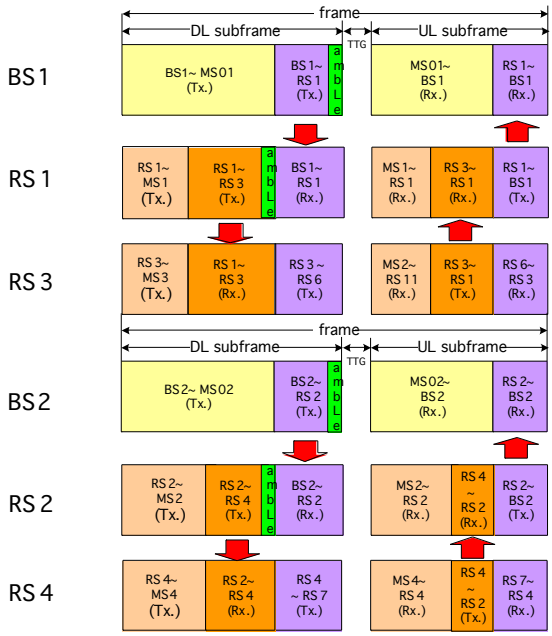


Figure 2 An example of frame structure with amble at the end of DL subframe.


frame
DL subframe
TTG
UL subframe
BS 1
BS1~ MS01 (Tx.)
BS 1~ RS 1 (Tx.)
amble
MS01~ BS 1 (Rx.)
RS 1~ BS1 (Rx.)
RS 1
RS 1~ MS 1 (Tx.)
RS 1~ RS 3 (Tx.)
BS1~ RS 1 (Rx.)
MS 1~ RS 1 (Rx.)
RS 3~ RS 1 (Rx.)
RS 1~ BS1 (Tx.)
RS 3
RS 3~ MS 3 (Tx.)
RS 1~ RS 3 (Rx.)
RS 3 ~ RS 6 (Tx.)
MS 2~ RS 11 (Rx.)
RS 3~ RS 1 (Tx.)
RS 6~ RS 3 (Rx.)
BS 2
BS2~ MS02 (Tx.)
BS2~ RS 2 (Tx.)
MS02~ BS 2 (Rx.)
RS 2~ BS2 (Rx.)
RS 2
RS 2~ MS2 (Tx.)
RS 2~ RS 4 (Tx.)
BS2~ RS 2 (Rx.)
MS 2~ RS 2 (Rx.)
RS 4 ~ RS 2 (Rx.)
RS 2~ BS2 (Tx.)
RS 4
RS 4~ MS4 (Tx.)
RS 2~ RS 4 (Rx.)
RS 4 ~ RS 7 (Tx.)
MS 4~ RS 4 (Rx.)
RS 4 ~ RS 2 (Tx.)
RS 7~ RS 4 (Rx.)

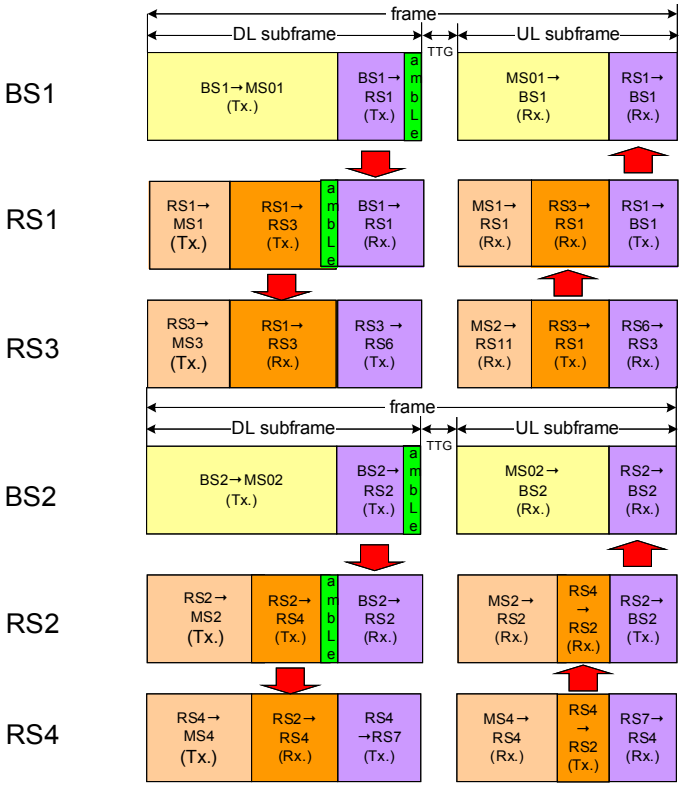

frame
DL subframe
TTG
UL subframe
BS1
BS1→MS01 (Tx.)
BS1→ RS1 (Tx.)
amble
MS01→ BS1 (Rx.)
RS1→ BS1 (Rx.)
RS1
RS1→ MS1 (Tx.)
RS1→ RS3 (Tx.)
BS1→ RS1 (Rx.)
MS1→ RS1 (Rx.)
RS3→ RS1 (Rx.)
RS1→ BS1 (Tx.)
RS3
RS3→ MS3 (Tx.)
RS1→ RS3 (Rx.)
RS3 → RS6 (Tx.)
MS2→ RS11 (Rx.)
RS3→ RS1 (Tx.)
RS6→ RS3 (Rx.)
BS2
BS2→MS02 (Tx.)
BS2→ RS2 (Tx.)
MS02→ BS2 (Rx.)
RS2→ BS2 (Rx.)
RS2
RS2→ MS2 (Tx.)
RS2→ RS4 (Tx.)
BS2→ RS2 (Rx.)
MS2→ RS2 (Rx.)
RS4 → RS2 (Rx.)
RS2→ BS2 (Tx.)
RS4
RS4→ MS4 (Tx.)
RS2→ RS4 (Rx.)
RS4 →RS7 (Tx.)
MS4→ RS4 (Rx.)
RS4 → RS2 (Tx.)
RS7→ RS4 (Rx.)

Figure 3 An example of frame structure with amble at the end of DL relay zone.

2.3 Suggested Remedy

There is tradeoff between two options. By placing the amble at the end of relay zones, there is no signaling for even/odd hop grouping and transition gap overhead required. However, due to even/odd hop structure, for interference measurement, it requires signaling to receive amble transmitted by same hop group RSs. Placing the amble at the end of DL subframe could allow the robustness in fixed amble location. However, it requires explicit signaling for even hop odd hop grouping for synchronization and transition gap overhead. Thus, two options are proposed as amble location for the relay link.

3. Proposed Text

++++++++++++ start text proposal ++++++++++++++++++++++++++++++++++

[Insert a new sentence at the end of subclause 8.4.4.7.2.2:]

For synchronization purpose, ~~T~~the relay ~~link~~ amble, when present, shall be located either at the end of the last DL relay zone in which MR-BS/RS is in transmit mode or at the end of the DL subframe. For monitoring purpose, the relay link amble, when present, shall be located at the end of the DL subframe. An R-TTG or R-RTG may be inserted before relay amble.

++++++++++++++++++++ *End of text proposal* ++++++++++++++++++++++

References

[1] IEEE 802.16j-07/136r4, “On the use of postamble for relay link”, Jan. 2007