Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Relay amble position**
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Re:	Call for technical proposals 802.16j-06/034
Abstract	This contribution provides a text proposal that defines the position of an optional relay amble in the DL subframe. This builds on the current frame structure text accepted in meeting #46 that introduces the concept of a relay zone within a subframe, but did not define any support for an optional amble that can be transmitted by an MR-BS or RS on the relay link to provide support to the functions that require such a signal in the absence of being able to receive frame start preamble, due to the fact the device is transmitting its own frame start preamble.
Purpose	For discussion and approval of inclusion of the proposed text into the P802.16j baseline document.
Notice	
Release	
Patent Policy and Procedures	

Relay amble position

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Introduction

The two-hop in-band TDD frame structure proposal for non-transparent relay [1] accepted into the baseline document [2] in meeting #46 introduces the concept of a relay zone in both the downlink and uplink subframe. It also specifies that an RS shall transmit a frame start preamble at the same time as the MR-BS is transmitting its frame start preamble. Therefore, once the RS is operational (i.e. it has completed its network entry procedure) it is no longer possible for it to receive the frame start preambles of MR-BSs or RSs.

Consequently no mechanism exists for the RS to build and maintain an active set of neighbouring transmitters to which it could potentially handover to if the current connection is found to degrade in performance or a better server should appear due to either a change in the location of the devices or a change in the radio propagation environment.

Therefore this contribution proposes that an MR-BS or RS may optionally be configured to transmit a relay amble signal on the relay link. This amble signal can then be received by other RSs in order to build and maintain an active set of transmitters in its neighbourhood. It is possible to envisage a number of different locations for the amble signal within the DL subframe, as discussed in the next section. Whilst the actual signature of the signal is out-of-scope of this contribution, a proposal is made in another contribution [3].

Proposed relay amble position

In general there are two approaches proposed for positioning the amble sequence. The first is to place it at the beginning of the first relay zone in the downlink subframe, as proposed in [4][5] and this type of amble is referred to as a "Relay zone preamble". The alternative is to place it at the end of the DL subframe, as proposed in [6], and this type of amble is referred to as a "Relay postamble". Note that while both approaches are proposed in this contribution it is envisaged that only one approach would be utilized across a cellular-like network.

In general, the MR-BS will periodically transmit the amble sequence to allow operational RSs to learn the quality of the signal received from the MR-BSs in the vicinity of the RS. RSs supporting the connection of other RSs may also periodically transmit the amble sequence, when they are not transmitting it themselves to also learn the quality of the signal received from the other RSs as well as the MR-BS in the vicinity of the RS.

Relay postamble

The advantage of the postamble approach is that its location is deterministic in the case that the DL to UL subframe ratio is constant throughout the network, which is a fair assumption to make in a cellular-like deployment as it maintains some degree of continuity in levels of interference (i.e. no potential DL to UL interference). The disadvantage is that it could potentially preclude the use of the optional common sync symbol as this is defined to be transmitted at the end of every fourth subframe [7]. Also in the case of an RS, if the zone preceding the postamble was a relay zone configured in receive mode [8] then an extra R-RTG will be required to be provided for the RS to turn-around. This issue is illustrated in Figure 1.

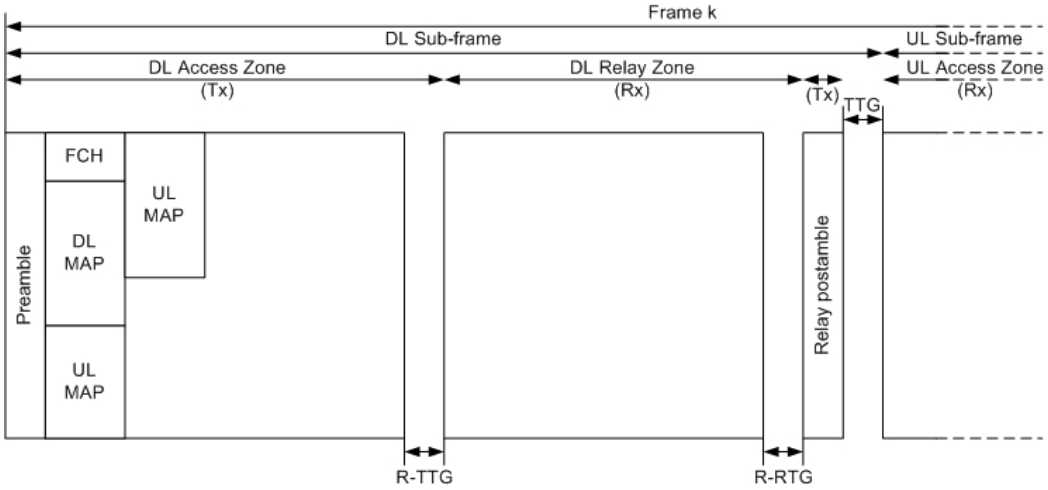

Figure 1. Downlink subframe at RS with last relay zone being used for receive.

Relay zone preamble

The advantage of the relay zone preamble is that it overcomes the disadvantages associated with the relay postamble, in that it does not cause any potential conflict with the common sync symbol and the example in Figure 1 would not cause wasted transmission resource due to the extra R-RTG after the last relay zone in the DL. However, the disadvantage is that it requires the RS that wants to learn signal quality of the MR-BSs or RSs in its vicinity to scan the entire DL subframe to find all potential amble transmissions, assuming that the position of the first relay zone in the DL subframe changes across neighboring transmitters. Consequently, in the frame in which the RS scans, it will not be able to provide full access link or relay link transmissions, depending on the window over which it decided to scan.

Summary

Both approaches have some issues, hence it is proposed that both be supported in the standard. Which approach is selected is then left to the choice of the network operator or can be specified in particular equipment profiles once other operational parameters are determined. As an example consider these scenarios: if the common sync symbol is supported then the relay zone preamble approach could be selected; if common sync symbol is not required and relay zone position is very flexible then postamble approach could be selected; and if common sync symbol is not supported then and the position of the relay zone in the DL subframe is in someway restricted then the relay zone preamble could be selected.

Consequently, the text in the next section is proposed to be included into the baseline document to enable this flexibility.

Proposed text changes

[Insert new subclause at the end of Section 8.4.4.7.2:]

8.4.4.7.2.x Relay postamble and relay zone preamble

An MR-BS or an RS that supports connection of other RSs to it may transmit a relay amble either as a relay zone preamble in the first symbol of the first relay zone transmitted in the downlink subframe or alternatively a relay postamble in the last symbol of the downlink subframe if the common sync symbol is not being transmitted.

References

[1] Chenxi Zhu et al., “Frame Structure to Support Relay Node Operation”, IEEE C802.16j-06/233r8, 16 November 2006.

[2] IEEE 802.16 Relay TG, “Baseline Document for Draft Standard for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems: Multihop Relay Specification”, IEEE 802.16j-06/026r1, 1 December 2006.

[3] Hart, M. et al., “Relay amble sequence”, IEEE C802.16j-07/017, 8 January 2007.

[4] Mike Hart et al., “Frame structure for multihop relaying support”, IEEE C802.16j-06/138, 7 November 2006.

[5] Hart, M. et al., “Relay zone definition”, IEEE C802.16j-07/xxx, 8 January 2007.

[6] Chang, Y. et al., “Frame structure for multi-hop relay”, IEEE C802.16j-06/257, 7 November 2006.

[7] IEEE Std. 802.16e-2005

[8] Hart, M. et al., “Frame structure for multihop relaying support”, IEEE C802.16j-07/138, 7 November 2006.