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Title	**RS-amble position for Multihop Relays**	
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Re:		
Abstract	The document proposes that RSs should transmit an amble at a fixed position in the frame structure. The RS-amble transmission is configurable.	
Purpose	Review and adopt.	
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RS-amble Position for Multihop Relays

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Introduction

The current relay frame structure specifies that an RS should use the access preamble for synchronization when the RS get access into the wireless network. However, after the initial entry is performed, an RS is not able to use the access preamble for synchronization or monitoring the environment because it has to transmit the access preamble synchronously with the BS to which it is attached. Due to of this situation, there are several issues that have to be taken into account:

- The RS has to rely only on pilot tones to perform the synchronization. Because the relay zone in the frame structure can be small, this can cause synchronization misadjustment, especially for a mobile RS.
- The RS does not have capabilities to scan the environment while serving in the same time the MSs that are attached to it. It has to put, for example, all the attached MSs in the sleep mode in order to perform scanning. This can reduce significantly the throughput and the mobility of the RS, and is not very efficient.

Some requirements for RS-amble position

Based on the above discussion, the position for the RS-amble should satisfy the following requirements:

- It should be on a fix position relative to the beginning of the access preamble in order to allow those RS that want to monitor the ambles to do it for all other RS, simultaneously;
- The transmission/reception (TX/RX) of the RS-amble could be configured depending on the radio network deployment (e.g. if a fixed RS deployment is preferred, then there is no need to TX the RS-amble every frame, while if there are present mobile RSs that have a relative high mobility, TX of RS-preamble may be required every frame);

Options for the RS-amble position

There are a few options for positioning the RS-amble within a frame. As a general note, either the RS-amble is positioned in the DL-subframe or in the UL-subframe, the actual format of the amble can be tailored to match the subframe where it is positioned, i.e. using the corresponding subchannel allocation.

First option would be at the beginning of the RS zone in the DL-subframe. Fixing the first RS zone in order to allow all other RSs to monitor the amble is problematic because this has to be done across all hops, and reduces the flexibility of the scheduling.

A second option is to place the RS-amble at the end of the DL-subframe. There is an issue with the optional common sync symbol (8.4.6.1.1.1) that is TX every 4th frame and with the fact that this option requires data buffering. Also, because the DL-subrame duration varies, it is difficult to have an easy RS identification, especially for a mobile RS that has to sense the environment continuously. An example of placing the RS-amble at the end of the DL-subframe is presented in the Figure 1, where we have considered that the system uses PUSC mode.

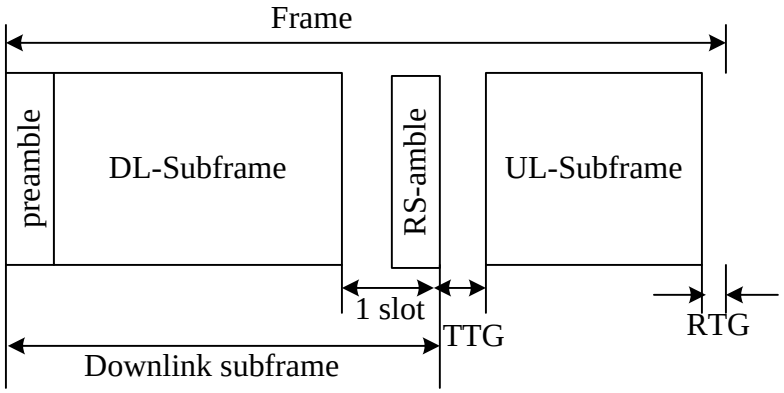

Figure 1. RS-amble position at the end of DL-subframe for PUSC mode

The third option is to place the RS-amble in the UL-subframe before the access preamble. In order to *allign* the RS-amble TX with DL-subframe, it should be position as an integer offset of OFDM symbols durations *in* the UL-subframe *relative* to access preamble. This is the preferred solution, and is depicted in Figure 2

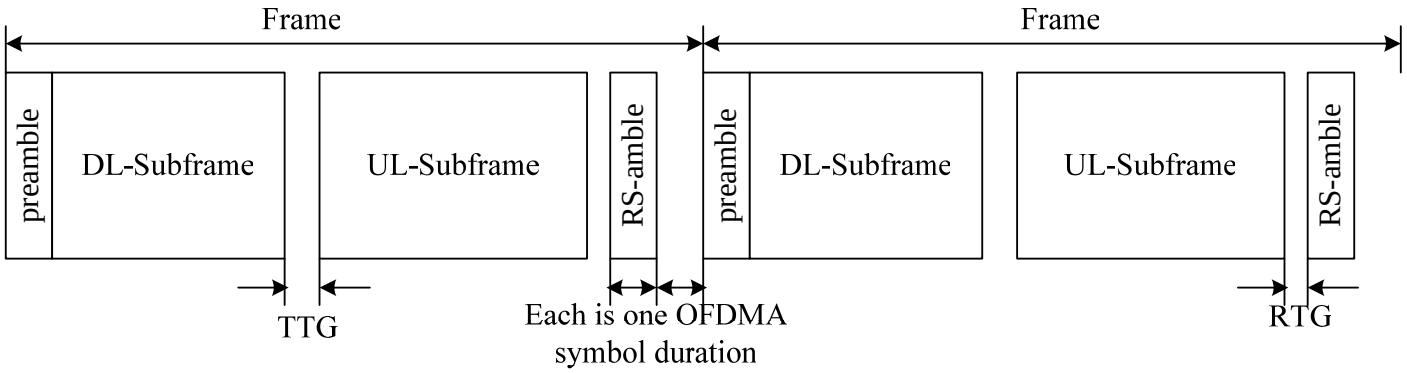

Figure 2. RS-amble position within a frame for an RS that transmits it.

As Figure 2 shows, the actual transmission of the RS-amble is 2 OFDM symbols *before* the access preamble is transmitted. The RS-amble is *preceded* by an RTG interval and is *followed* by a no transmission OFDM symbol interval in order to allow the RSs that are in the reception mode to switch to transmission mode.

Specification Changes

[In section 8.4.4.2 insert the following]

8.4.4.2.1 RS-amble position

The RS-amble is associated with the frame in which it is transmitted, and its duration is one OFDMA symbol.

If the RS-amble is locate within the UL subframe, the transmission of RS-amble should start two OFDMA symbols before a new frame starts, this means before the preamble of next frame starts. The OFDMA symbol that follows the RS-amble is used to allow the RSs that were in the receive mode to turn into transmission mode. The RS-amble is preceded by and RTG interval.

If the RS-amble is located in the DL subframe, it should be positioned in the last OFDMA symbol of the DL subframe; following this symbol an TTG interval is inserted. For the PUSC mode, the OFDMA before the RS-amble which is part of the last slot of the DL subframe shall be null, in order to allow the RSs that are in the transmission mode to turn into reception mode. For the FUSC mode, the RSs that are in the transmission mode and want to detect the RS-ambles transmitted by other RSs, should terminate their DL transmission at least one OFDMA symbol before the RS-ambles are transmitted. The optional Common_Synch symbol of the 802.16e shall not be transmitted if the RS-amble is at the end of the DL subframe.

The transmission of the RS-amble is configurable.