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Title	**Frame Structure to Support Relay Node Operation**	
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Source(s)	Chenxi Zhu Fujitsu Laboratories America Inc Dorin Viorel Fujitsu Microelectronics Canada Inc Michiharu Nakamura Fujitsu Laboratories Japan	Voice: 1-301-4860671 E-mail:chenxi.zhu@us.fujitsu.com
	Wen Tong, Mo-Han Fong, Peying Zhu Nortel	Voice: 1-613-7631315 E-mail: wentong@nortel.com
	Jaeweon Cho, Changyoon Oh Samsung Electronics	Voice: 82-31-279-5796 E-mail: jaeweon.cho@samsung.com
	Kanchei(Ken) Loa Heng-Iang Hsu Institute for Information Industry	Voice: +886-2-27399616 E-mail: loa@nmi.iii.org.tw
	Raekesh Taori Samsung AIT	Voice: +82-31-280-9635 E-mail: rakesh.taori@samsung.com
	Adrian Boariu Nokia	Voice : +1-817-5017584 E-mail : adrian.boariu@nokia.com
	Qu Hongyun, Cancan Huang ZTE Corporation	Voice : +86-755-26776604 E-mail : qu.hongyun@zte.com.cn
	John Lee, David Comstock Huawei Technologies	Voice : +86-21-68644808 E-mail : John_Lee@huawei.com
	Fang-Chin Ren, I-Kang-Fu, Wern-HO Sheen	Voice : +886-3-571221x59237 E-mail : IKFu@itri.org.tw

ITRI

Kerstin Johnsson
Intel Corporation
Voice : +1-508-6539651
E-mail : kerstin.johnsson@intel.com

Zhifeng Tao, Koon Hoo Teo,
Jinyun Zhang, Toshiyuki Kuze
Mitsubishi Electric
Voice : +86-21-50551240-8194
E-mail : Kaibin.zhang@alcatel-sbell.com.cn

Kaibin Zhang
Alcatel

Re:	A response to a Call for Technical Proposal, http://wirelessman.org/relay/docs/80216j-06_027.pdf
Abstract	This document describes a minimal requirement of the MR frame structure to support 2 hop relay operations.
Purpose	
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Frame Structure to Support Relay Node Operation

Introduction

The frame structure for the MR-BS and RS shall be defined to enable backward compatibility and efficient R-link operation. This harmonized contribution proposes a frame structure to enable two hop relaying operations. The contribution covers a frame structure for both the Relay and the Access links. This proposal is intended for in-band relay operation with non-transparent RS (a RS that transmits a preamble at the beginning of the DL subframe).

The following assumptions are made:

No changes are required for a IEEE802.16e-2005 MS operation;

To enable efficient and flexible R-link operation by extension of IEEE802.16e-2005 frame structure;

The impact upon the current IEEE802.16e frame structure is minimized

The RS-link delay is minimized;

A unified frame structure to enable two-hop relaying and all the usage models.

The centralized scheduler and distributed scheduler are supported.

This contribution proposes a frame structure for in-band relay operation.

Proposed Frame Structure

The current TDD frame structure divides the frame into two subframes for downlink and uplink transmission. In this proposal, a simple extension to the frame structure is proposed to enable relaying that involves defining the existence of a relay link transmission and reception intervals in the MR-BS DL and UL subframes, respectively, to facilitate BS-RS communication.

Overview

The proposed frame structure to enable two hop relaying is illustrated in Figure 1. The access zone at the BS and RS require no changes to the frame structure in IEEE Std. 802.16 in order to define them. The new relay link (R-Link) requires an extended frame structure in order to support the associated operation.

Based on Fig. 1, the basic two hop relay frame structure is composed of:

A DL subframe and a UL sub-frame like in the 802.16e case

The DL sub-frame is composed of a DL access zone followed by a DL relay zone. Between the DL access zone and relay zone a Relay TTG (RTTG) is placed.

The DL access zone is dedicated to the BS→MS related traffic and RS→MS related traffic. The DL relay zone is dedicated to the BS→RS related traffic.

Between the DL sub-frame and the UL sub-frame a TTG is placed

The UL sub-frame is composed of a UL access zone followed by a UL relay zone. Between the UL

access zone and the related UL relay zone a Relay RTG (RRTG) is placed.
The UL access zone is dedicated to the MS-->BS related traffic and MS→RS related traffic. The UL relay zone is dedicated to the RS→BS related traffic.
The DL access zone is started by a preamble as specified by the 802.16e-2005 standard. The preamble is followed by the Frame Control Header (including the DLFP), DL MAP and UL MAP.
The DL relay zone is started by a Relay Frame Control Header (R-FCH), including a DLFP, followed by a DL R-MAP and an UL R-MAP

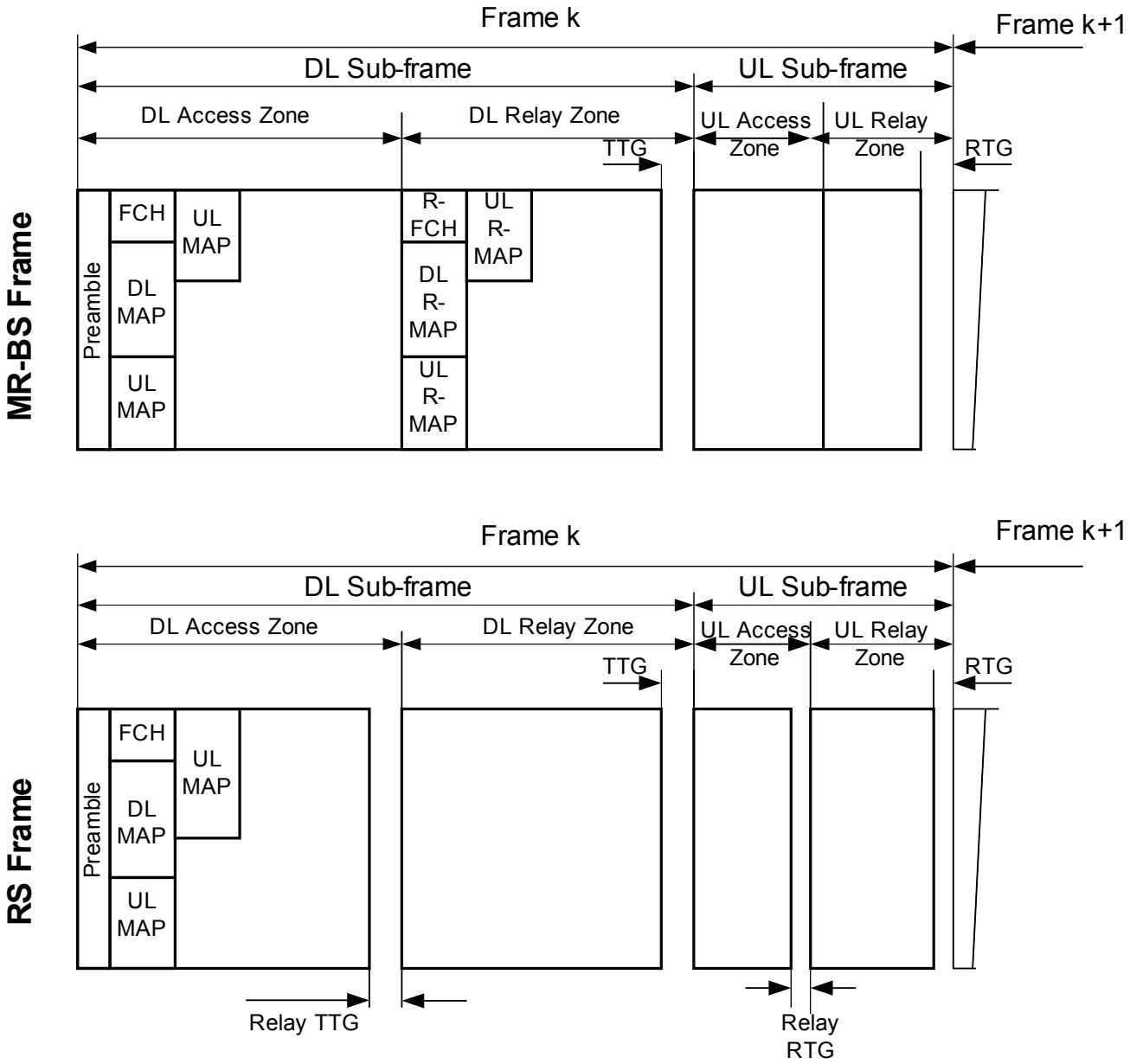

Figure aaa. Example of minimum configuration for relay frame structure.

At initialization, the RS performs an initial network entry with the MR-BS in the same way as the MS does, the RS detects a preamble in the MR-BS frame and it establishes the synchronization with the MR-BS. RS continues with the remaining initial entry network procedures in the access region of the MR-BS frame. After completion of the initial network entry, RS communicates with MR-BS in the relay region of the MR-BS frame.

Conclusion

This proposal provides a simple extension to the existing frame structure defined in IEEE Std. 802.16 that enables support for the 2nd hop R-link.

Proposed text changes

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

[Insert the followings after the end of section xxx:]

MR-BS frame: Frame structure for DL transmission/UL reception by MR-BS.
RS frame: Frame structure for DL transmission/UL reception by RS.
DL Access_Zone: A portion of the DL sub-frame in the MR-BS/RS frame used for MR-BS/RS to MS transmissions.
UL Access_Zone: a portion of the UL sub-frame in the MR-BS/RS frame used for MS(s) to MR-BS / RS transmissions.
DL Relay_Zone: a portion of the DL sub-frame in the MR-BS/RS frame used for MR-BS/RS to RS transmission
UL Relay_Zone: a portion of the UL sub-frame in the MR-BS/RS frame used for RS to MR-BS/RS transmission.
R-TTG: Relay-TTG.
R-RTG: Relay-RTG.
R-FCH: Relay-FCH
R-MAP: Relay MAP.
[Insert the following text at the end of the subclause 6.3.7.2:]

For the case where MR-BS supports two-hop relay, the DL and UL subframes shall include at least one access zone and may include one or more relay zone to enable RS operating in either transmit or receive mode. The related frame structure is defined in the OFDMA PHY specific section.

[Change subclause 6.3.7.3 as indicated:]

6.3.7.3 DL-MAP
The DL-MAP message defines the usage of the downlink intervals on the access links for a burst mode PHY.

[Change subclause 6.3.7.4 as indicated:]

6.3.7.4 UL-MAP
The UL-MAP message defines the uplink usage on the access link in terms of the offset of the burst relative to the Allocation Start Time (units PHY-specific).
[Insert a new subclause 8.4.4.7:]

8.4.4.7 Frame structure of MR-BS and RS
This section describes the minimal requirements for an in-band frame structure for a MR-BS and its subordinate RS.
8.4.4.7.1 Frame structure for transparent mode.

8.4.4.7.2 Frame structure for non-transparent mode

8.4.4.7.2.1 MR-BS frame structure
For the TDD mode, an example of the MR-BS frame structure is shown in Figure xxx.
Each MR-BS frame begins with a preamble followed by a FCH and the DL MAP and possibly UL MAP. The DL sub-frame shall include at least one DL Access Zone and may include ~~at least~~ one or more DL Relay Zone(s). The UL sub-frame may include ~~include at least~~ one or more UL Access Zones and it may include one or more UL Relay_Zones. In each frame, the TTG shall be inserted between the DL sub-frame and the UL sub-frame. The RTG shall be inserted at the end of each frame. In the DL Access Zone, the subchannel allocation, the FCH transmission, and the FCH shall be defined as in Section 8.4.4.2.

The DL Relay_Zone shall include a R-FCH and a R-MAP. In the DL Relay Zone, the subchannel allocation may be the same as that in the DL Access Zone. The R-FCH may be the same as the FCH in the DL Access Zone. Other attributes of the MR-BS frame and the RS frame such as transition between modulation and coding, presence of multiple zones, may be the same as those described in 8.4.4.2.

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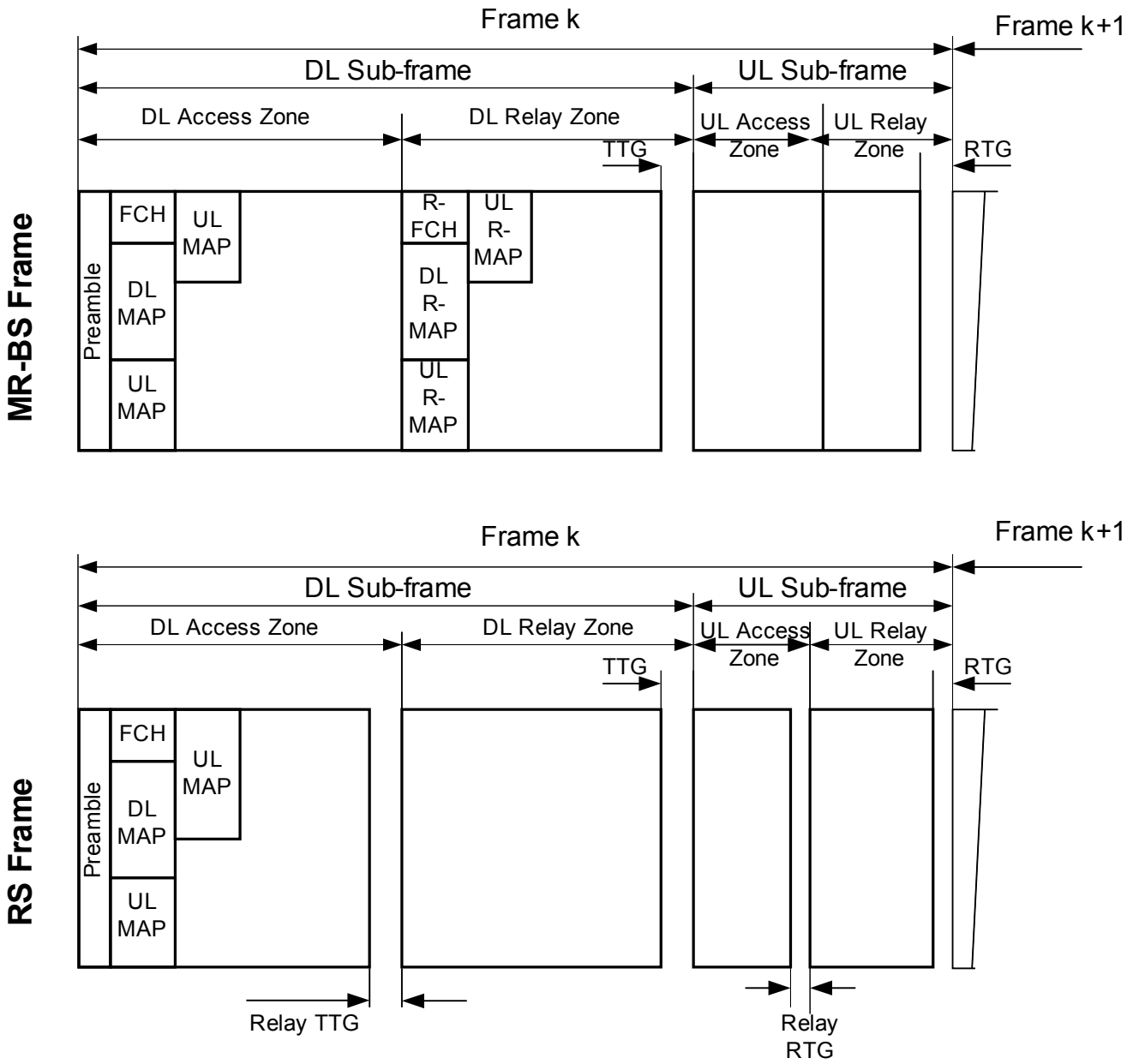

Figure xxx Example of minimum configuration for an in-band non-transparent relay frame structure

8.4.4.7.2.2 Relay frame structure

For the TDD mode, an example of an RS frame structure is shown in Figure xxx.

The Relay Station transmits its frame start preamble time aligned with its serving MR-BS frame start preamble.

The DL sub-frame shall include at least one DL Access Zone and may include ~~at least~~ one or more DL Relay Zones. An R-TTG ~~shall~~ may be placed between a DL Access Zone and a DL Relay Zone..

The UL sub-frame may include ~~at least~~ one or more UL Access Zones and one or more UL Relay Zones. An R-RTG ~~shall~~ may be placed between a UL Access Zone and a UL Relay Zone.

If the relay station switches from transmission to reception mode, an R-TTG shall be required-. If the relay station switches from reception to transmission mode, an R-RTG shall be required. There may be more than one R-TTG and more than one R-RTG inserted in the RS frame. In each frame, the TTG shall be inserted between the DL sub-frame and the UL sub-frame. The RTG shall be inserted at the end of each frame.

Each RS frame begins with a preamble followed by an FCH and the DL MAP and possibly a UL MAP. In the DL Access Zone, the subchannel allocation, the FCH transmission, and the FCH shall be as defined in Section 8.4.4.2.

The number, size, and location of the relay zones shall be configurable.

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