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THIS IS NOT AN IEEE DRAFT STANDARD.

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

~~Sponsor~~
~~**LAN MAN Standards Committee**~~
~~**of the**~~
~~**IEEE Computer Society**~~

Prepared by the Relay Task Group of IEEE 802.16

Abstract: This document specifies OFDMA physical layer and medium access control layer enhancements to IEEE Std. 802.16 for licensed bands to enable the operation of relay stations.

Keywords:

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Introduction

(This introduction is not part of the IEEE P802.16j, Draft amendment to IEEE Standard for Local and Metropolian Networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems - Multihop Relay Specifications).

Participants

~~This document was developed by the IEEE802.16 Working Group on Broadband Wireless Access, which develops the WirelessMAN™ Standard for Wireless Metropolitan Area Networks.~~

IEEE 802.16 Working Group Officers

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~~Primary development was carried out by the Working Group's Relay Task Group.~~

TG Officers

[Editor's Note: Insert list of TG Officers]

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NOTE-The editing instructions contained in this amendment define how to merge the material contained herein into the existing base standard and its amendments to form a comprehsive standard.

The editing instructions are shown ***bold italic*.** Four editing instructions are used: ***change***, ***delete***, ***insert***, and ***replace***. ***Change*** is used to make small corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by either by using ~~strikethrough~~ (to remove old material) or underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make large changes in existing text, subclauses, tables, or figures by removing existing material and replacing it with new material. Editorial notes will not be carried over into future editions because the changes will be incorporated into the base standard.

1. Overview

1.1 Scope

This document specifies OFDMA physical layer and medium access control layer enhancements to IEEE Std 802.16 for licensed bands to enable the operation of relay stations. Subscriber station specifications are not changed.

1.2 Purpose

The purpose of this amendment is to enhance coverage, throughput and system capacity of 802.16 networks by specifying 802.16 multihop relay capabilities and functionalities of interoperable relay stations and base stations.

1.3 Frequency bands

1.3.4 Air interface nomenclature and PHY compliance

1.4 Reference model

Insert new subclause 1.4.2:

1.4.2 Relaying reference model

2. References

3. Definitions

Insert the following at the end of section 3:

3.88 MR-BS frame: Frame structure for DL transmission/UL reception by MR-BS.

3.89 RS frame: Frame structure for DL transmision/UL reception by RS.

3.90 DL Access_Zone: A portion of the DL sub-frame in the MR-BS/RS frame used for MR-BS/RS to MS transmission.

3.91 UL Access_Zone: A portion of the UL sub-frame in the MR-BS/RS frame used for MS(s) to MR-BS/RS transmission.

3.92 DL Relay_Zone: A portion of the DL sub-frame in the MR-BS/RS frame used for MR-BS/RS to RS transmission.

3.93 UL Relay_Zone: A portion of the UL sub-frame in the MR-BS/RS frame used for RS to MR-BS/RS transmission.

4. Abbreviations and acronyms

Insert the followings at the end of section 4:

R-TTG	Relay-TTG
R-RTG	Relay-RTG
R-FCH	Relay-FCH
R-MAP	Relay MAP

6. MAC common part sublayer

6.1 PMP

Insert new subclause 6.1.1:

6.1.1 Relaying extension

6.3 Data/Control plane

6.3.1 Addressing and connections

Insert new subclause 6.3.1.3:

6.3.1.3 Addressing and connections for relay support

6.3.2 MAC PDU formats

6.3.2.1 MAC header formats

6.3.2.2 MAC subheaders and special payloads

6.3.2.3 MAC management messages

6.3.3 Construction and transmission of MAC PDUs

6.3.4 ARQ mechanism

6.3.4.6 ARQ operation

Insert new subclause 6.3.4.6.4:

6.3.4.6.4 ARQ modifications for relaying

6.3.5 Scheduling services

6.3.6 Bandwidth allocation and request mechanisms

Insert new subclause 6.3.6.7:

6.3.6.7 Relaying support for scheduling

Insert new subclause 6.3.6.7.1:

6.3.6.7.1 Distributed scheduling

Insert new subclause 6.3.6.7.2:

6.3.6.7.2 Centralized scheduling

6.3.7 MAC support of PHY

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 new subclause 6.3.7.7:

6.3.7.7 Optional MAC support of the PHY for relaying

6.3.8 Contention resolution

6.3.9 Network entry and initialization

Insert new subclause 6.3.9.16:

6.3.9.16 Support for network entry and initialization in relay mode

6.3.10 Ranging

6.3.10.3 OFDMA based ranging

Insert new subclause 6.3.10.3.4:

6.3.10.3.4 Relaying support for OFDMA based ranging

6.3.11 Update of channel descriptors

6.3.12 Assigning SSs to multicast groups

6.3.13 Establishment of multicast and broadcast transport connections

6.3.14 QoS

6.3.17 MAC support for HARQ

6.3.18 DL CINR report operation

Insert new subclause 6.3.18.3:

6.3.18.3 Relay station DL CINR report operations

6.3.19 optional Band AMC operations using 6-bit CQICH encoding

6.3.21 Sleep mode for mobility-supporting MS

6.3.22 MAC layer handover procedures

Insert new subclause 6.3.22.4:

6.3.22.4 Mobile relay station handover

6.3.23 Multicast and broadcast services (MBS)

6.3.23.1 Single-BS access

6.3.23.2 Multi-BS access

6.3.24 MS Idle Mode (optional)

Insert new subclause 6.3.25:

6.3.25 Relay path management and routing

Insert new subclause 6.3.26:

6.3.26 Relay station neighborhood discovery

Insert new subclause 6.3.27:

6.3.27 Interference measurement for MR

This subclause describes a measurement and reporting procedure with supported messaging mechanism to estimate the interference level in MR network.

7. Security sublayer

7.1 Architecture

7.2 PKM protocol

7.3 Dynamic SA creation and mapping

7.4 Key usage

7.5 Cryptographic methods

7.6 Certification profile

7.7 Pre-Authentication

7.8 PKMv2

8. PHY

8.4 WirelessMAN-OFDMA PHY layer

8.4.1 Introduction

8.4.4 Frame structure

Insert 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.

Insert new subclause 8.4.4.7.1:

8.4.4.7.1 Frame structure for transparent mode

Insert new subclause 8.4.4.7.2:

8.4.4.7.2 Frame structure for non-transparent mode

Insert new subclause 8.4.4.7.2.1:

8.4.4.7.2.1 MR-BS frame structure

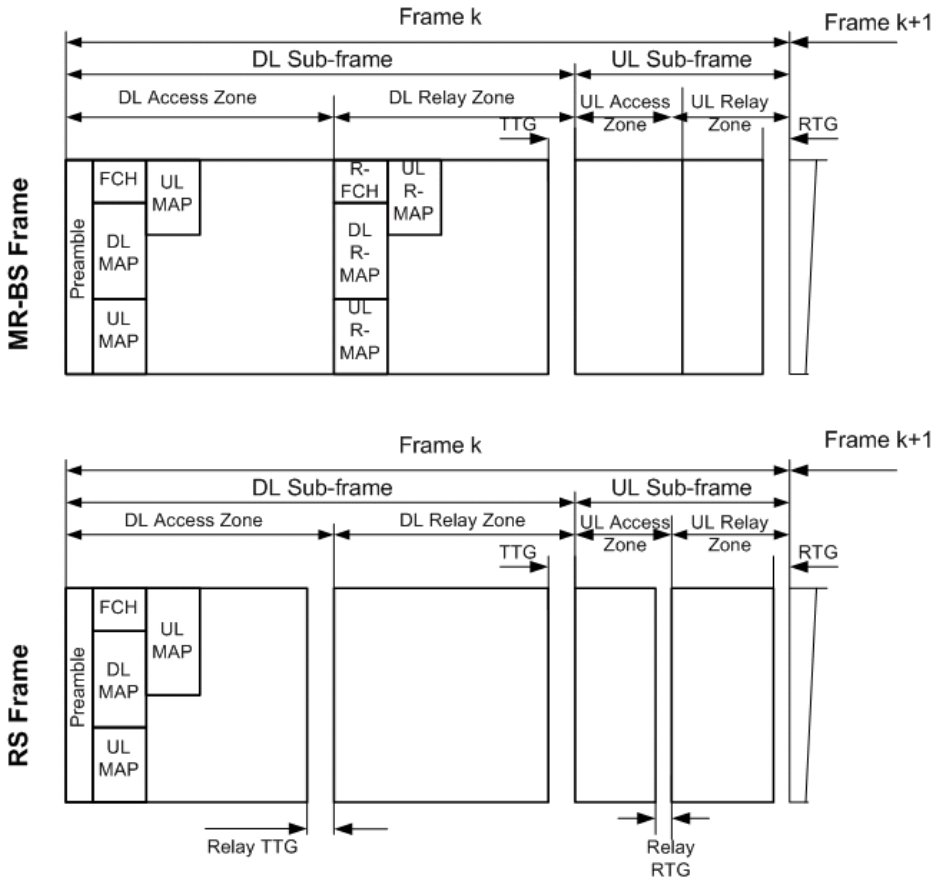
For the TDD mode, an example of the MR-BS frame structure is shown in Figure <xxx>.

Each MR-BS frame begins with a preamble followed by an FCH and the DL MAP and possibly UL MAP. The DL sub-frame shall include at least one DL Access_Zone and may include one or more DL Relay_Zones. The UL sub-frame may include 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.

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

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 one or more DL Relay_Zones. An R-TTG may be placed between a DL Access_Zone and a DL Relay_Zone.

The UL sub-frame may include one or more UL Access_Zones and one or more UL Relay_Zones. An R-RTG 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.

The contents of the FCH, DL-MAP and UL-MAP in the Relay Frame may be different from those in the MR-BS 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.

Insert new subclause 8.4.4.8:

8.4.4.8 Relaying frame structure

8.4.5 Map message fields and IEs

8.4.7 OFDMA ranging

8.4.8 Space-Time Coding (optional)

8.4.9 Channel coding

8.4.10 Control mechanisms

8.4.11 Channel quality measurements

8.4.12 Transmitter requirements

8.4.13 Receiver requirements

8.4.14 Frequency control requirements

8.4.15 Optional HARQ support

9. Configuration

Insert new subclause 9.3:

9.3 MR-BS configuration

Insert new subclause 9.4:

9.4 RS configuration

10. Parameters and constants

10.1 Global values

10.2 PKM parameter values

10.3 PHY-specific values

Insert new subclause 10.3.5:

10.3.5 Relay mode PHY parameters and definitions

10.4 Well-known addresses and identifiers

11. TLV Encodings