Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Direct Relaying Zone**
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Re:	This contribution is response to call for technical proposal (IEEE 802.16j-06/034)
Abstract	This contribution proposes combined A&F and D&F relaying.
Purpose	For discussion and approval of inclusion of the proposed text into the P802.16j baseline document.
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Direct Relaying Zone

Introduction

This contribution proposes the Direct Relaying Zone on which RS relays data from sender to receiver within one frame. It becomes possible by defining relay operation within PHY layer.

There are three possible PHY layer relaying methods as follows,
- A&F (Amplify and Forward)
- M&F (Modulation and Forward)
- D&F (Decode and Forward)

Since A&F method is relaying data from sender to receiver in time domain (i.e. without FFT, demodulation and FEC decoding), RS can relay data with minimum delay by using A&F method. However burst profile for A&F relaying may be dominated by the radio link that has the worst condition between relay link and access link.

M&F method is relaying data without decoding and re-encoding. RS which receives data from sender demodulates and modulates it, and relays regenerated data to receiver. Though some gaps are needed for RS to demodulate and modulate, RS can relay data within one frame by using M&F method.

Decode and forward is the most robust, hence higher modulation schemes can be used, because the burst profile on relay link and the burst profile on access link can be set individually. However it takes time to decode and re-encode data at RS, RS may take a few frames to relay data from sender to receiver.

We propose to introduce 'Direct Relaying Zone' on which A&F and M&F relay can be operated. We don't consider the D&F method since in-frame relay is not feasible with it.

Direct Relaying Zone

In Figure 1, two direct relaying zones are defined in each subframe. First direct relaying zone in DL subframe is the zone where RS should receive data from MR-BS, and second direct relaying zone in DL subframe is the zone where RS should forward signal or data to MS under RS. The direct relaying zone in UL subframe can be defined similarly.
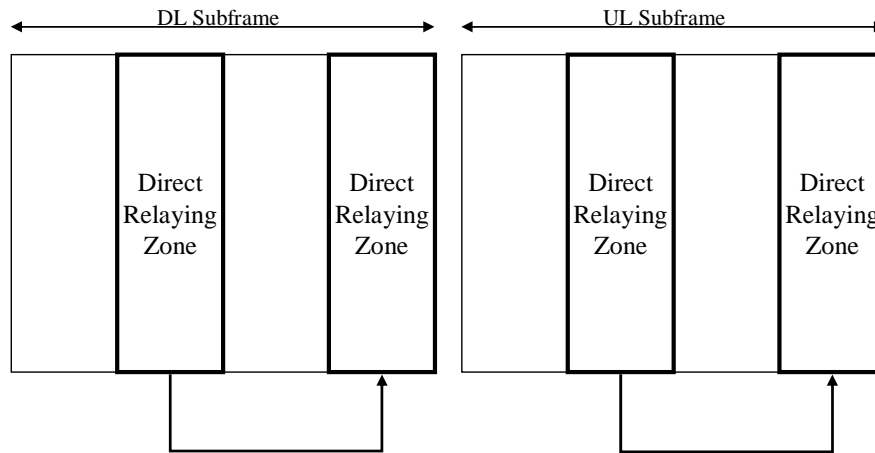
Figure 1 Direct Relaying Zone

IE for Direct Relaying Zone

 MR-BS decides the direct relaying zone and relaying method and notifies the required information about the zone to RS by DL/UL MAP. The required information are listed below. Figure 2 shows the relation between the parameters.

a) Symbol offset for direct relaying zone
  The OFDMA symbol offset in which direct relaying zone starts
b) No. OFDMA symbols for RS receiving
  The number of OFDMA symbols which RS should receive for direct relaying
c) No. OFDMA symbols of gap
  The number of OFDMA symbols between the receiving area and the forwarding area
d) No. OFDMA symbols for RS relaying
  The number of OFDMA symbols by which RS should relay signal without decoding and re-encoding
e) Relaying method
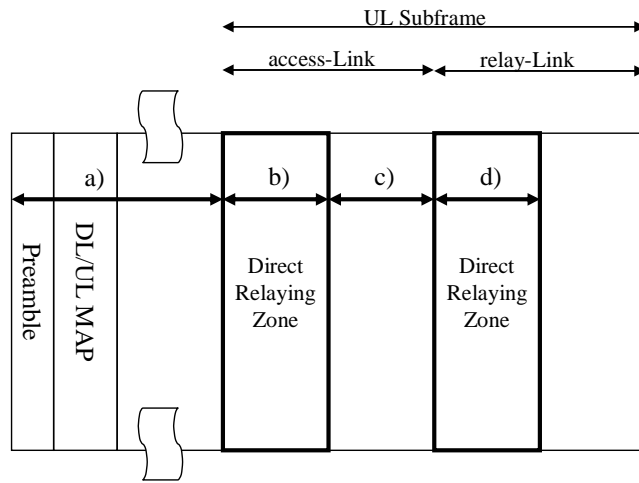 To indicate whether A&F or M&F is used.

Figure 2 IE of Direct Relaying Zone

RS which receives these parameters relays signal from sender to receiver without decoding and re-encoding on the zone indicated by these parameters.

Specific text changes

[Change Table 277c as indicated.]

Table 277c—Extended-2 DIUC code assignment for DIUC=14

Extended-2 DIUC (hexadecimal)	Usage
00	MBS_MAP_IE
01	HO_Anchor_Active_DL_MAP_IE
02	HO_Active_Anchor_DL_MAP_IE
03	HO_CID_Translation_MAP_IE
04	MIMO_in_another_BS_IE
05	Macro-MIMO_DL_Basic_IE
06	Skip_IE
07	HARQ DL MAP IE
08	HARQ ACK IE
09	Enhanced DL MAP IE
0A	Closed-loop MIMO DL Enhanced IE
0B	Direct Relaying DL Zone IE
0B - 0D	*Reserved*
0C-0D	*Reserved*
0E	AAS_SDMA_DL_IE
0F	*Reserved*

Insert a new subclause 8.4.5.3.28

8.4.5.3.28 Direct Relaying DL Zone_IE format

 This IE is sent by MS-BS to RS to notify the Direct Relaying Zone in downlink. The RS that received this IE receives data from MR-BS for the symbols indicated by 'Symbol offset for direct relaying zone' and 'No. OFDMA symbols for RS receiving' and transmits it to MS after the gap indicated by 'No. OFDMA symbols of gap'. If this IE indicates A&F method for relaying, RS should relay signal without FFT, demodulation and FEC. If M&F method is indicated, RS should relay signal from MR-BS with FFT, demodulation, modulation and IFFT.

Table 286za - Direct Relaying DL Zone IE

Syntax	Size	Notes
Direct Relaying_DL_Zone IE() {		
Extended-2 DIUC=	4 bits	0x0B
Length	8 bits	
Relaying Method Type	1 bit	0: A&F, 1: M&F
Symbol offset for direct relaying zone	6 bits	
No. OFDMA symbols for RS receiving	4 bits	
No. OFDMA symbols of gap	4 bits	
No. OFDMA symbols for RS relaying	4 bits	
Frame offset	2 bits	

Relaying Method Type
Indicates the relaying method which is A&F or M&F
Symbol offset for direct relaying zone
The OFDMA symbol offset in which direct relaying zone starts
No. OFDMA symbols for RS receiving
The number of OFDMA symbols which RS should receive for relaying without decoding and encoding
No. OFDMA symbols of gap
The number of OFDMA symbols between the receiving area and the forwarding area
No. OFDMA symbols for RS relaying
The number of OFDMA symbols by which RS should relay signal without decoding and encoding
Frame offset
Frame offset from the current frame. RS starts relaying indicated by this IE at frame defined this value.

[Change Table 290a as indicated.]

Table 290a—Extended UIUC Code Assignment for UIUC=15

Extended UIUC (hexadecimal)	Usage
00	Power_control_IE
01	Mini-subchannel_allocation_IE
02	AAS_UL_IE
03	CQICH_Alloc_IE
04	UL Zone IE
05	PHYMOD_UL_IE
06	MIMO_UL_Basic_IE

07	UL-MAP_Fast_Tracking_IE
08	UL_PUSC_Burst_Allocation_in_Other_Segment_IE
09	Fast_Ranging_IE
0A	UL Allocation Start IE
0B ~~… 0F~~	~~*Reserved*~~ Direct Relaying Zone UL IE
0C … 0F	*Reserved*

Insert a new subclause 8.4.5.4.29

8.4.5.4.29 Direct Relaying Zone UL_IE format

 This IE is sent by MS-BS to RS to notify the Direct Relaying Zone in uplink. The RS that received this IE receives data from MS for the symbols indicated by 'Symbol offset for direct relaying zone' and 'No. OFDMA symbols for RS receiving' and transmits it to MS after the gap indicated by 'No. OFDMA symbols of gap'.If this IE indicates A&F method for relaying, RS should relay signal from MR-BS without FFT, demodulation and FEC. If this IE indicates M&F method for relaying, RS should relay signal from MR-BS with FFT, demodulation, modulation and IFFT.

Table 302w - Direct Relaying UL Zone IE

Syntax	Size	Notes
Direct Relaying UL Zone IE() {		
Extended UIUC=	4 bits	0x0B
Length	8 bits	
Relaying Method Type	1 bit	0: A&F, 1: M&F
Symbol offset for direct relaying zone	6 bits	
No. OFDMA symbols for RS receiving	4 bits	
No. OFDMA symbols of gap	4 bits	
No. OFDMA symbols for RS relaying	4 bits	
Frame offset	2 bits	

Relaying Method Type
Indicates the relaying method which is A&F or M&F
Symbol offset for direct relaying zone
The OFDMA symbol offset in which direct relaying zone starts
No. OFDMA symbols for RS receiving
The number of OFDMA symbols which RS should receive for relaying without decoding and encoding
No. OFDMA symbols of gap
The number of OFDMA symbols between the receiving area and the forwarding area
No. OFDMA symbols for RS forwarding

The number of OFDMA symbols by which RS should forward signal without decoding and encoding
Frame offset
Frame offset from the current frame. RS starts relaying indicated by this IE at frame defined this value.

References

- C802 16j-06_127, "A Proposal for combined A&F and D&F relaying"

- C802 16j-06_250, "Hybrid Relay Structure with a Single Frame"