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Source(s)	<p>Su Chang Chae, Young-il Kim, E-mail:schae@etri.re.kr Hyunjae Kim,Sunggeun Jin ETRI</p> <p>Kyu Ha Lee, Changyun Kim, E-mail:kyuha.lee@samsung.com Yong Wook Lee Samsung Thales</p> <p>Jai H. Eu, E-mail:jeu@jcastnet.com Jcast Networks Korea, Inc</p> <p>Hyung-joon Jeon E-mail:hjjun@posdata.co.kr POSDATA</p> <p>Jun Bae Ahn SOLiD technologies jbahn@st.co.kr</p>	
Re:	This is a response to the call for technical contributions IEEE 802.16j-07/019	
Abstract	This contribution proposes combined M&F relaying.	
Purpose	To incorporate the proposed text into the P802.16j Baseline Document (IEEE 802.16j-06/026r4)	
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Direct Relaying Zone in Transparent RS system

Introduction

There are three relaying method 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 takes a few frames to relay data from sender to receiver.

This contribution proposes the direct relaying zone on which RS relays data from sender to receiver within one frame by using M&F method. Since RS does not decode data on this zone, MR-BS should notify the zone information to RS and control the transmission on this zone.

Direct Relaying Zone

In Figure 1, two direct relaying zones are defined in each sub-frame. First direct relaying zone in DL sub-frame is the zone where RS should receive data from MR-BS, and second direct relaying zone in DL sub-frame is the zone where RS should forward signal or data to MS under RS. The direct relaying zone in UL sub-frame is also similar.

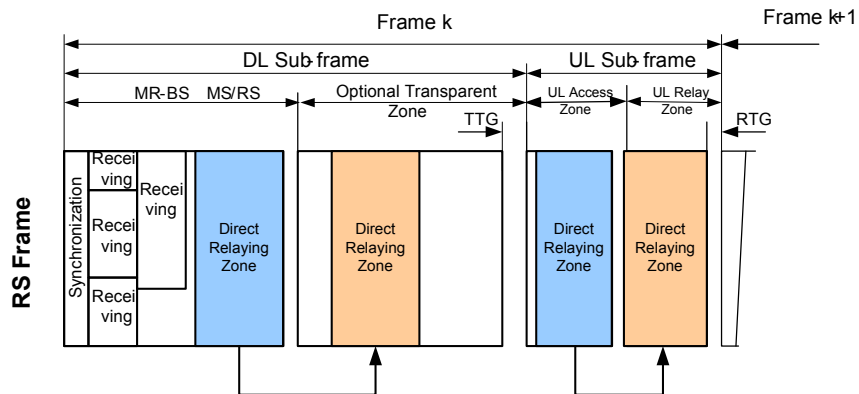


Figure 1 Direct Relaying Zone

RS receives data from sender on the direct relaying zone in receiving area, and forwards it to receiver on the direct relaying zone in sending area by using M&F method.

IE for Direct Relaying Zone

MR-BS decides the direct relaying zone and relaying method on this zone which is A&F method or M&F method, and notifies this information about the zone to RS by DL/UL MAP including a value of frame offset. RS starts to relay at frame defined by this value. The value of frame offset is defined considering of the decoding delay of DL/UL MAP at RS. And the other parameters that MR-BS notifies RS about the direct relaying zone are the following and Figure 2 shows the relation these parameters and the frame.

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

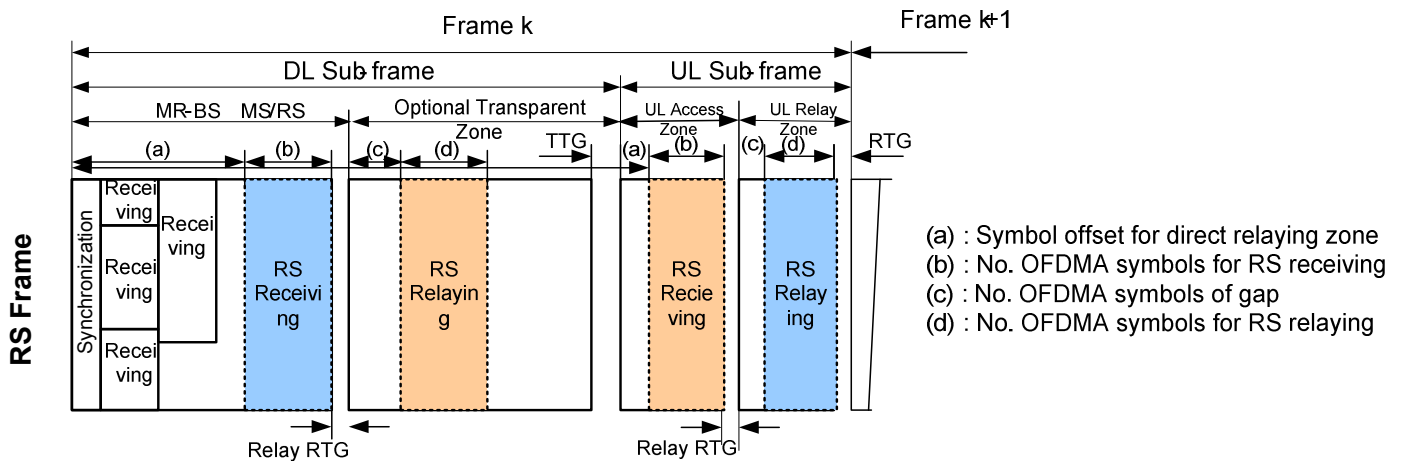


Figure 2 IE of Direct Relaying Zone

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

M&F : Modulation and Forward.

[Change Table 277e385 as indicated.]

Table 277e385—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	RS-RNG_RSP_ALLOC_IE
0BC	Direct Relaying DL Zone IE
0B -0D	<i>Reserved</i>
0E	AAS_SDMA_DL_IE
0F	<i>Reserved</i>

Insert a new subclause 8.4.5.3.28

8.4.5.3.28 Direct Relaying DL Zone IE format

~~This IE is sent transmitted by MS-BS to RS to notify the zone of downlink for relaying within one frame without decoding and re-encoding. If this IE indicates M&F method for relaying, and RS should relay signal symbol data from MR-BS with FFT, demodulation, modulation and IFFT. In order to change the modulation order used in access zone to another modulation order to use in optional transparent zone for downlink in RS, MR-~~

BS shall allocate slots of both access and optional transparent zone so that channel encoder of MR-BS can fill the padding bits('1's) at the end of the data to be encoded in the access zone for downlink. Table xxx allows transparent RS to use M&F with direct relaying zone for downlink.

Direct Relaying DL Zone IE denotes the direct relay zone for downlink sub-frame. It is used for RS to relay symbol data within a single frame. For the purpose, RS shall relay symbol data without the processing of channel decode/encode through direct relay zone for downlink.

When RS relays symbol data within a single downlink subframe according to Direct Relaying DL Zone IE, it may change modulation order used in access zone into another modulation order in transparent relay zone as described in 8.4.4.7.1.2.

The number of slots allocated for bursts in access zone can possibly mismatch that in transparent relay zone. For this reason, MR-

BS may allocate additional slot(s) for each burst in access zone so as to provide exact modulation order change. In this case, padding bits ('1') are appended to the end of aggregate of MPDUs prepared for channel encoding in each burst.

Table xxx allows transparent RS to use M&F with direct relaying zone for downlink.

Table xxx - Direct Relaying DL Zone IE

<u>Syntax</u>	<u>Size</u>	<u>Notes</u>
<u>Direct Relaying DL Zone IE() {</u>		
<u>Extended-2 DIUC=</u>	<u>4 bits</u>	<u>0x0C</u>
<u>Length</u>	<u>8 bits</u>	<u>0x03</u>
<u>Relaying Method Type</u>	<u>1bit</u>	<u>0:D&F, 1:M&F</u>
<u>Symbol offset for direct relaying zone</u>	<u>6 bits</u>	
<u>No. OFDMA symbols for RS receiving</u>	<u>46 bits</u>	
<u>No. OFDMA symbols of gap</u>	<u>46 bits</u>	
<u>No. OFDMA symbols for RS relaying</u>	<u>46 bits</u>	
<u>Frame offset</u>	<u>2bits</u>	

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

[Change Table 290a 421 as indicated.]

Table 290a421—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	RS-RNG_RSP_Allocation_IE
0C	UL_Burst_Receive_IE
0D	Direct Relaying UL Zone IE
0DE ... 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 transmitted by MS-BS to RS to notify the zone of uplink for relaying within one frame. If this IE indicates M&F method for relaying, and RS should relay signal symbol data from MR-BS with FFT, demodulation, modulation and IFFT. In order to change the modulation order used in access zone to another modulation order to use in relay zone for uplink in RS, MR-BS shall allocate slots of both access and relay zone so that channel encoder of MS can fill the padding bits('1's) at the end of the data to be encoded in the access zone for uplink. Table yyy allows transparent RS to use M&F with direct relaying zone for uplink.~~

Direct Relaying UL Zone IE denotes the direct relay zone for uplink sub-frame. It is used for RS to relay symbol data within a single frame. For the purpose, RS shall relay symbol data without the processing of channel decode/encode through direct relay zone for uplink. The remaining procedure for the uplink direct relaying according to Direct Relaying Zone UL IE is manipulated in the same manner as described in 8.4.5.4.29. In case of uplink, MS shall append padding bits ('1') to the end of aggregate of MPDUs prepared for channel encoding in each burst.

Table yyy allows transparent RS to use M&F with direct relaying zone for uplink.

Table yyy - Direct Relaying UL Zone IE

<u>Syntax</u>	<u>Size</u>	<u>Notes</u>
<u>Direct Relaying UL Zone IE() {</u>		
<u>Extended UIUC=</u>	<u>4 bits</u>	<u>0x0B</u>
<u>Length</u>	<u>8 bits</u>	<u>0x03</u>
<u>Relaying Method Type</u>	<u>1bit</u>	<u>0:D&F, 1:M&F</u>
<u>Symbol offset for direct relaying zone</u>	<u>6 bits</u>	
<u>No. OFDMA symbols for RS receiving</u>	<u>46 bits</u>	
<u>No. OFDMA symbols of gap</u>	<u>46 bits</u>	
<u>No. OFDMA symbols for RS relaying</u>	<u>46 bits</u>	
<u>Frame offset</u>	<u>2bits</u>	

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

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"
- C802 16j-06_26r4,"Baseline Documents for Draft Standard for Local and Metropolitan Area Networks"