Project	**IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>**
Title	Non-transparent RS in Virtual Group
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Re:	IEEE 802.16j-07/019: "Call for Technical Comments Regarding IEEE Project 802.16j"
Abstract	This contribution proposes required changes in baseline document in order to accommodate the non-transparent RS in a virtual group.
Purpose	Text proposal for 802.16j Baseline Document.
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Non-transparent RS in Virtual Group

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1. Introduction

In IEEE 80216j-06/026r4 section 6.3.9.16.3.1 RS grouping, it states that "*when the virtual RS group include an MR-BS, all the RSs in the virtual group shall either* ***transmit the same preamble as the MR-BS****, FCH and MAP or they all do not transmit any preamble. When an MR-BS is not included in the virtual group, one of the RSs in the virtual group is a non-transparent RS and all the others shall either transmit the preamble, FCH and MAP of the said non-transparent RS or they all do not transmit preamble, FCH and MAP. The radio resources may be shared by these RSs for data burst transmission. The existence of the group is totally transparent to its MS(s).*"

Even though each RS transmitting same preamble in a virtual RS group utilizes non-transparent frame structure and follow the procedures of non-transparent RS to obtain FCH, DL-MAP, UL-MAP DCD and UCD (for transmit in the next frame) from BS. But, for other operations such as MS network entry and MS CDMA ranging, the RS transmitting same preamble must follow the procedures defined for transparent RS. Therefore, this contribution proposes required changes in baseline document IEEE 802.16j-06/026r4 in order to accommodate the non-transparent RS in a virtual group.

In order to facilitate the incorporation of this proposal into IEEE 802.16j standard, specific changes to the baseline working document IEEE 802.16j-06/026r4 are listed below.

2. Spec Changes

[Insert the text in section 3 "Definitions"in line 11, page 5 as indicated:]

3.107 Non-transparent RS in virtual RS group: When a virtual RS group consists of non-transparent relays, a member RS transmitting the corresponding DL frame-start preamble, FCH, DLMAP/UL-MAP, and DCD/UCD of the assigned virtual RS group.

6.3.1.3 Addressing and connections for relay support

[Change the following text in the second paragraph in 6.3.1.3 in page 5 as indicated:]

~~RSs that broadcast a preamble, FCH, and DL Map shall be assigned a unique Base Station ID.~~

Non-transparent RSs which do not belong to a vitural RS group shall be assigned a unique Base Station ID. A virtual RS group having a preamble different from the MR-BS, shall be assigned a unique Base Station ID.

[Change the following subclause at page 135 as indicated]

6.3.9.16.3.1.1 ~~MS network entry procedures~~ Non-transparent RS in Virtual Group

~~Each RS group member shall monitor the CDMA ranging codes from subordinate nodes. If the group parent is not a member of the RS group, then RS group members shall follow the procedures in 6.3.9.16.1. If the group parent is a member of the RS group, then the RS group members other than the parent shall follow the procedure in 6.3.9.16.1, and the parent (if not MR-BS) shall follow the procedures in 6.3.9.16.2.~~

A non-transparent RS in virtual group shall be assigned Base Station ID based on section 6.3.1.3, and follow the procedures for Non-transparent RS (e.g., 1. Frame structure 2. Relaying messages and data), except for the following cases for which it shall follow the transparent RS procedures.

1. Network Entry
2. Handoff

Project	**IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>**
Title	MAP IEs for Non-transparent RS Systems
Date Submitted	2007-07-05
Source(s)	Kanchei (Ken) Loa, Yi-Hsueh Tsai, Yung-Ting Lee, Hua-Chiang Yin, Shiann-Tsong Sheu, Youn-Tai Lee, Institute for Information Industry 8F, No. 218, Sec. 2, Dunhua S. Rd., Taipei City 106, Taiwan Voice: +886-2-27399616 Fax: +886-2-23782328 loa@nmi.iii.org.tw
Re:	IEEE 802.16j-07/019: "Call for Technical Comments Regarding IEEE Project 802.16j"
Abstract	This contribution proposes MAP IEs in non-transparent RS systems
Purpose	Text proposal for 802.16j Baseline Document.
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MAP IEs for Non-transparent RS Systems

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Introduction

In C80216j-07/255r1, a burst-based data forwarding scheme for transparent RS systems is proposed by defining new MAP IEs, namely DL-MAP IE with "DL_Burst_Transmit_IE" and UL-MAP IE with "UL_Burst_Receive_IE" in DL-MAP and UL-MAP sent by MR-BS. For a non-transparent RS, the RS broadcasts legacy MAPs (namely, DL-MAP and UL-MAP) in the first DL Access Zone and R-MAP if presented in the first DL Relay Zone that is in Tx mode. Under centralized scheduling, the legacy MAPs and R-MAPs are sent from MR-BS to the RS in the corresponding DL Relay Zone. The relaying scheme of legacy MAPs has been proposed in C80216j-07/257. Consequently, the same relaying scheme can also be applied to relay the R-MAP to the destining RS. Based on the relayed legacy MAPs and R-MAP received from MR-BS, the non-transparent RS is able to extract the information of downstream transmissions in the corresponding DL Access/Relay Zone and the information of upstream receptions in the corresponding UL Access/Relay Zone. From the viewpoint of burst-based data forwarding, the upstream bursts, a non-transparent RS received from its subordinated MS/RS(s) in the UL Access/Relay Zone within a frame, shall be transmitted by the RS in the corresponding UL Relay Zone to its superordinated station altogether. Therefore, the burst-based data forwarding can be easily achieved by only providing a non-transparent RS linkages between its downstream receptions and its downstream transmissions. Since the R-MAP must be decoded by a non-transparent RS in order to obtain the information of downstream receptions, the linkage information shall be included in the same R-MAP.

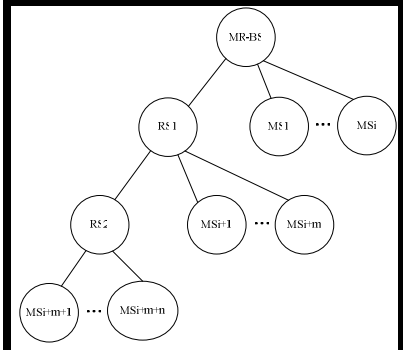
In order to elaborate that the burst-based data forwarding scheme proposed in C80216j-07/255 can be applied to non-transparent RS systems, the R-MAP IE with "RS-DL_Burst_Transmit_IE" proposed in C80216j-07/255 is first described in Tables 1 for the corresponding non-transparent RS to transmit data burst it received to its subordinated stations. Then an example of using the proposed MAP IE in R-MAP is given in Table 2. Moreover, two examples are given in Figures 1 & 2 to illustrate the proposed burst-based scheme for unicast and multicast data forwarding in non-transparent RS systems. Finally, in order to facilitate the incorporation of this proposal into IEEE 802.16j standard, specific changes to the baseline working document IEEE 802.16j-06/026r3 are listed below.

Table 1 R-MAP IE with "RS-DL_Burst_Transmit_IE"

Syntax	Size	Notes
R-MAP_IE()	variable	
{		
DIUC	4 bits	15 (Extended DIUC dependent IE)
RS_DL_Burst_Transmit_IE() {		
Extended DIUC-2	8 bits	RS_DL_Burst_Transmit_IE = 0x0F
Length	8 bits	Length = 3 + 2Nr1 or 5+2Nr1+2Nr2
RCID	8 bits	Reduced RS basic CID
Ns1	8 bits	The first IE number in associated DL-MAP the RS shall relay in DL Access Zone
Nr1	8 bits	Number of IEs following the Ns1-th IE for RS transmitting to subordinated MSs

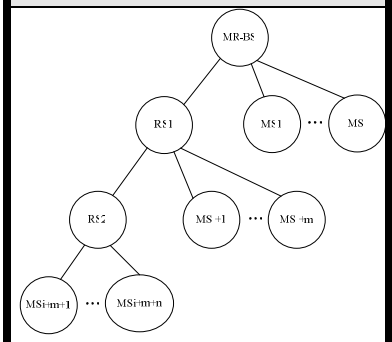
for (n = 0; n < Nr1; n++) {	-	-
Relay burst length	16 bits	Relay burst length (in unit of byte)
}		
If (Length > 3 + 2Nr1) {		
Ns2	8 bits	The first IE number in associated R-MAP the RS shall relay in the DL Relay Zone
Nr2	8 bits	Number of IEs following the Ns2-th IE for RS transmitting to subordinated RSs
for (n = 0; n < Nr2; n++) {	-	-
Relay burst length	16 bits	Relay burst length (in unit of byte)
}		
}		
}		

Table 2a : Example of proposed scheme for RS1 in DL

	Zone	MAP/ data region	MAP-IEs used to describe the zone(s)	Notes
	DL Access Zone (BS :Tx, RS1 :Tx, RS2 :Tx, MS :Rx)	DL-MAP	$DL\text{-}MAP\_IE_1()$	MAP IEs for MS receiving from RS1 in DL access zone
			⋮	
			$DL\text{-}MAP\_IE_i()$	
			STC_Zone_IE	Indicate zone switch
			DL-MAP_IE ()	Describe 1st DL relay zone
			STC_Zone_IE	Indicate switch
			DL-MAP_IE ()	Describe 2nd DL relay zone
	1st DL Relay Zone (BS :Tx, RS1 :Rx)	R-MAP (DL Part)	R-MAP_IE()	Data burst for RS1 itself, similar to legacy DL-MAP_IE(), with RS1 basic CID
			R-MAP_IE() with RS DL Burst Transmit IE for RS1	RS1 is assigned to transmit data as indicated by (condensed) DL-MAP and (condensed) DL- R-MAP sent in regular DL data burst. The relaying data is described in following R-MAP_IE
			R-MAP_IE()	Data burst for RS1 relaying, similar to legacy DL-MAP_IE(), with RS1 primary management CID

		Regular DL data burst for RS1	(Condensed) DL-MAP	DL-MAP for RS1 sending to its subordinated MSs in first DL access zone of next frame
			(Condensed) R-MAP (DL Part)	R-MAP for RS1 sending to RS2 in next DL relay zone
	2nd DL Relay Zone (RS1 :Tx ,RS2 :Rx)	R-MAP (DL Part)	R-MAP_IE()	Data burst for RS2 itself with RS2 basic CID, similar to legacy DL-MAP_IE()
			R-MAP_IE() with RS DL Burst Transmit IE for RS2	RS2 is assigned to transmit data as indicated by (condensed) DL-MAP sent in regular DL data burst. The relaying data is described in following R-MAP_IE
			R-MAP_IE()	Data burst for RS2 relaying with RS2 primary management CID, similar to legacy DL-MAP_IE()
		Regular DL data burst for RS2	(Condensed) DL-MAP	DL-MAP for RS2 sending to its subordinated MSs in DL access zone of next frame

Table 2b: Example of proposed scheme for RS1 in UL

	Zone	MAP/ data region	MAP-IEs used to describe the zone(s)	Notes
	UL Access Zone (RS1 :Rx , MS :Tx)	UL-MAP	UL-MAP_IE$_1$()	MAP IEs for MS transmitting
			⋮	
			UL-MAP_IE$_j$()	
			UL_Zone_IE	Indicate zone switch
			UL-MAP_IE ()	Describe the UL relay zone(s)
			UL_Zone_IE	Indicate zone switch
			UL-MAP_IE ()	Describe the UL relay zone(s)
	1st UL Relay Zone (RS1 :Rx RS2 :Tx)	R-MAP (UL Part)	R-MAP_IE()	MAP IE for RS2 transmitting to RS1, similar to legacy UL-MAP_IE

	2nd UL Relay Zone (BS :Rx, RS1 :Tx)	R-MAP (UL Part)	UR-MAP_IE()	MAP IE for RS1 transmitting to MR-BS, similar to legacy UL-MAP IE

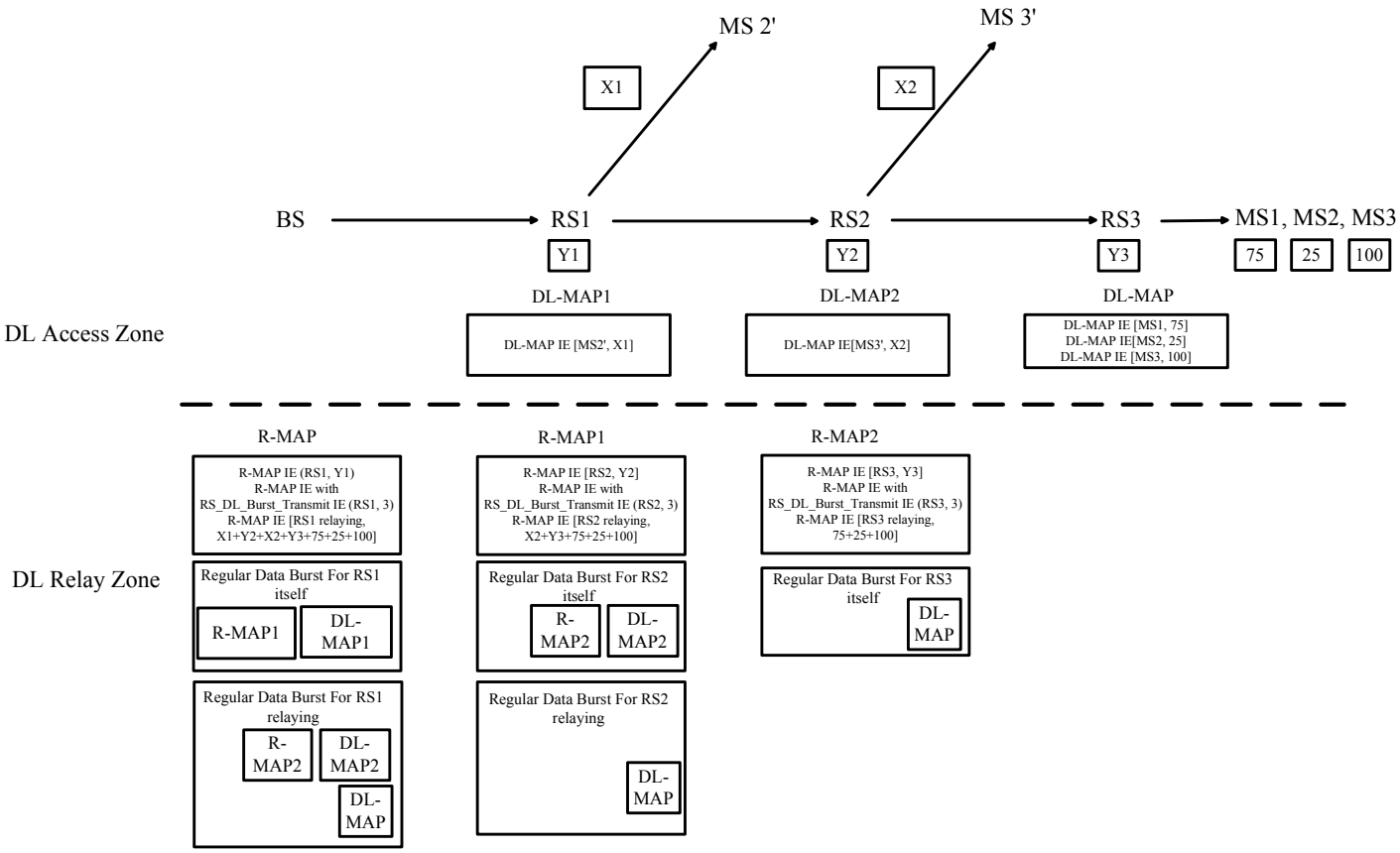


Figure 1 Example of proposed burst-based scheme for unicast data relaying

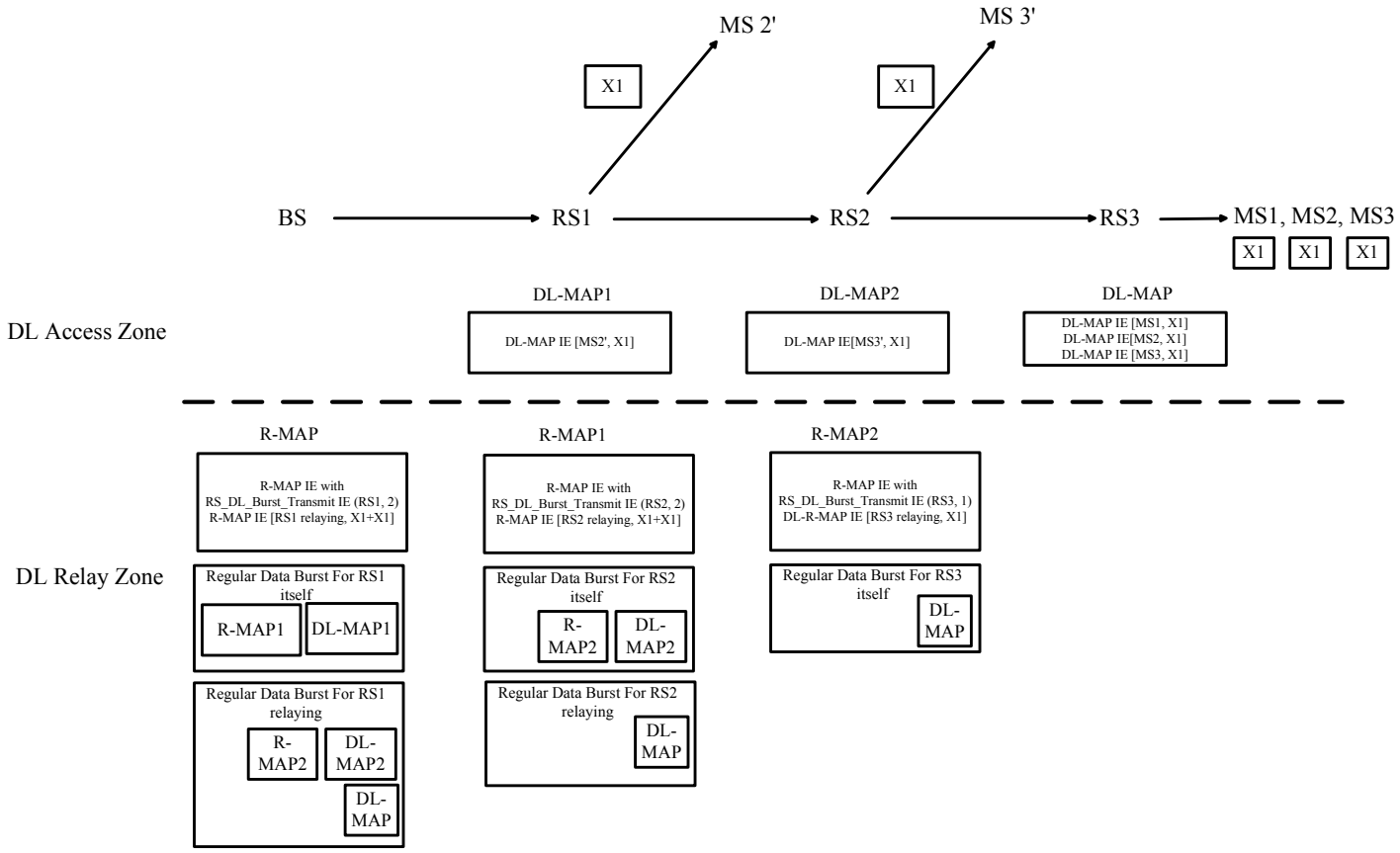
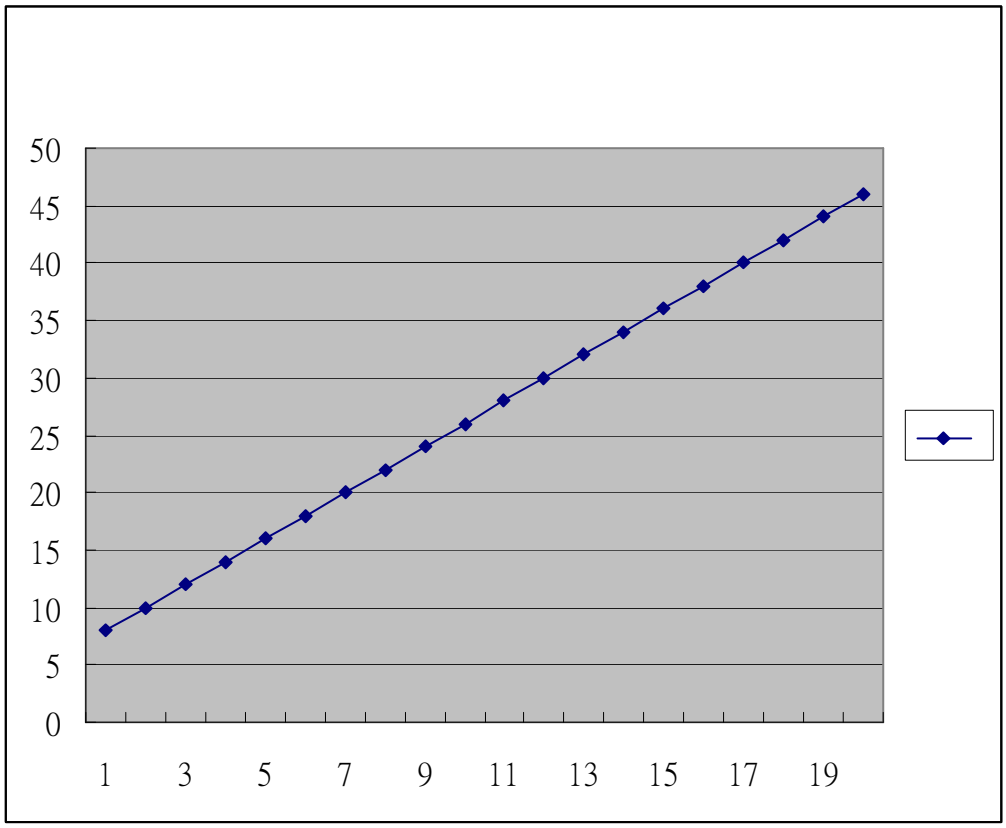


Figure 2 Example of proposed burst-based scheme for multicast data relaying

Overheads Analysis

The size of RS-DL_Burst_Transmit_IE in relay link is as follows

$$\textit{Size of RS-DL Burst Transmit IE} = 6 + 2(\textit{Number of burst in access-link})$$



Size of RS-DL_Burst_Transmit_IE v.s. serving numbers of burst

An example of 2-hops deployment of BS-RS are illustrated in Figure 2, and all users establish VoIP (voice over IP) service and each connection takes 134bytes (6-byte header + 128-byte voice) and transmitting by 64-QAM CC ¾; Both BS and RS transmit DL-MAP and UL-MAP by QPSK ½ with repetition 1. In the simulation, the max number of concurrent VoIP PDU pairs per MR-BS cell is 42, which is the same as one-hop deployment (no RS) or 2-hops deployment with PDU based forwarding schemes. The simulation also shows that burst-based data forwarding scheme for non-transparent RS increases aggregated overheads by less than 0.2% comparing with PDU based data forwarding schemes defined in the baseline document.

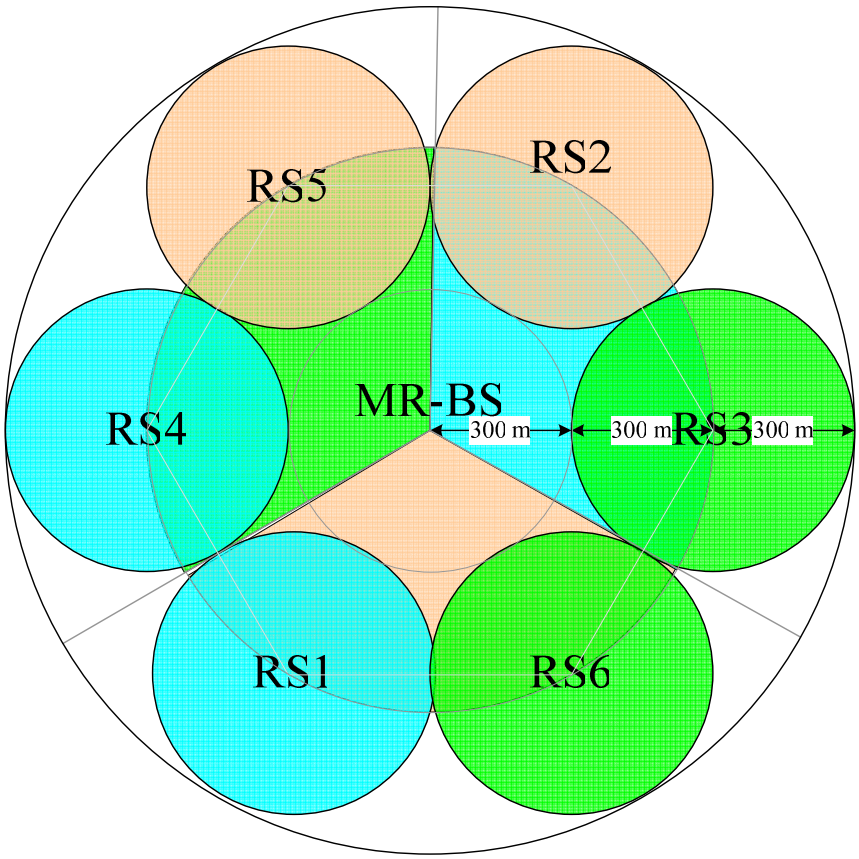


Figure-2 Two-hops Deployment (1×3×3 in Access Link/1×3×3 in Relay Link)

Text Proposal

6.3.3.8.2 Transmission using station CID

[Change the following text as indicated:]

[Author's Note: the difference from C80216j-07/255r1 is marked in red as indicated:]

The construction of MPDUs is the same as without relay. There are two schemes for RS to forward received data. One is the MPDU-based forwarding and the other is burst-based forwarding.

In MPDU-based forwarding scheme, ~~T~~the forwarding of MPDUs by each RS is performed based on the CID of MPDUs. An RS is informed apriori about the next hop station during SF setup for a station CID. The inclusion of CID in DL-MAP is optional as it is without relay.

Optionally, under centralized scheduling, forwarding of MPDUs by each RS is performed based on burst described in MAP IEs, namely burst-based forwarding. The burst-based forwarding rules are encoded in the MAPs sent by MR-BS. Data bursts that are scheduled to be relayed by burst-based forwarding mechanism and destining to stations other than the receiving RS are described by MAP IEs with RS primary management CID. If burst-based forwarding is used for transparent RS, DL_Burst_Transmit_IE and UL_Burst_Receive_IE defined in 8.4.5.3.29, and 8.4.5.4.29, respectively, shall be used, where DL_Burst_Transmit_IE is used to describe DL data relaying information and UL_Burst_Receive_IE is used to describe UL data relaying information. If burst-based forwarding is used for non-transparent RS, RS-DL_Burst_Transmit_IE defined in

8.4.5.3.30 shall be used, which is used to describe DL data relaying information.

8.4.5.3.2 DL-MAP extended IE format
8.4.5.3.2.2 DL-MAP extended-2 IE format
[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-0D	Reserved
0E	AAS_SDMA_DL_IE
0F	~~Reserved~~ RS-DL_Burst_Transmit_IE

[Insert the following new subclause]
8.4.5.3.30 RS DL Burst Transmit IE format

Table xxx — RS DL Burst Transmit IE format

Syntax	Size	Note
RS_DL_Burst_Transmit_IE() {		
Extended DIUC-2	4 bits	RS_DL_Burst_Transmit_IE = 0x0F
Length	8 bits	Length = 3 + 2Nr1 or 5+2Nr1+2Nr2
RCID	8 bits	Reduced RS basic CID
Ns1	8 bits	The first IE number in associated DL-MAP the RS shall relay in DL Access Zone
Nr1	8 bits	Number of IEs following the Ns1-th IE for RS transmitting to subordinated MSs
for (n = 0; n < Nr1; n++) {	-	-
Relay burst length	16 bits	Relay burst length (in unit of byte)
}		
If (Length > 3 + 2Nr1) {		
Ns2	8 bits	The first IE number in associated R-MAP the RS shall relay in the DL Relay Zone
Nr2	8 bits	Number of IEs following the Ns2-th IE for RS transmitting to subordinated RSs

for (n = 0; n < Nr2; n++) {	-	-
Relay burst length	16 bits	Relay burst length (in unit of byte)
}		
}		