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
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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.

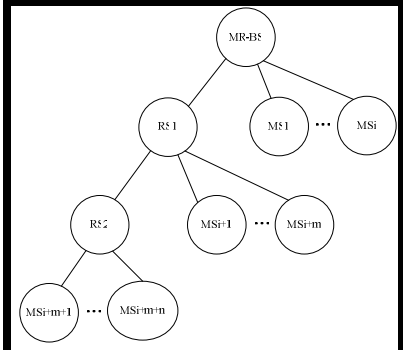
In order to elaborate that the burst-based data forwarding scheme proposed in C80216j-07/255 can be applied to non-transparent RS systems, the R-MAP IE with "RS-DL_Burst_Transmit_IE" proposed in C80216j-07/255 is first described in Tables 1 for the corresponding non-transparent RS to transmit data burst 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

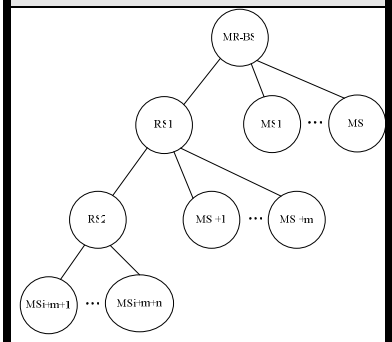
for (n = 0; n < Nr1; n++) {	-	-
Relay burst length	16 bits	Relay burst length (in unit of byte)
}		
If (Length > 3 + 2Nr1) {		
Ns2	8 bits	The first IE number in associated R-MAP the RS shall relay in the DL Relay Zone
Nr2	8 bits	Number of IEs following the Ns2-th IE for RS transmitting to subordinated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

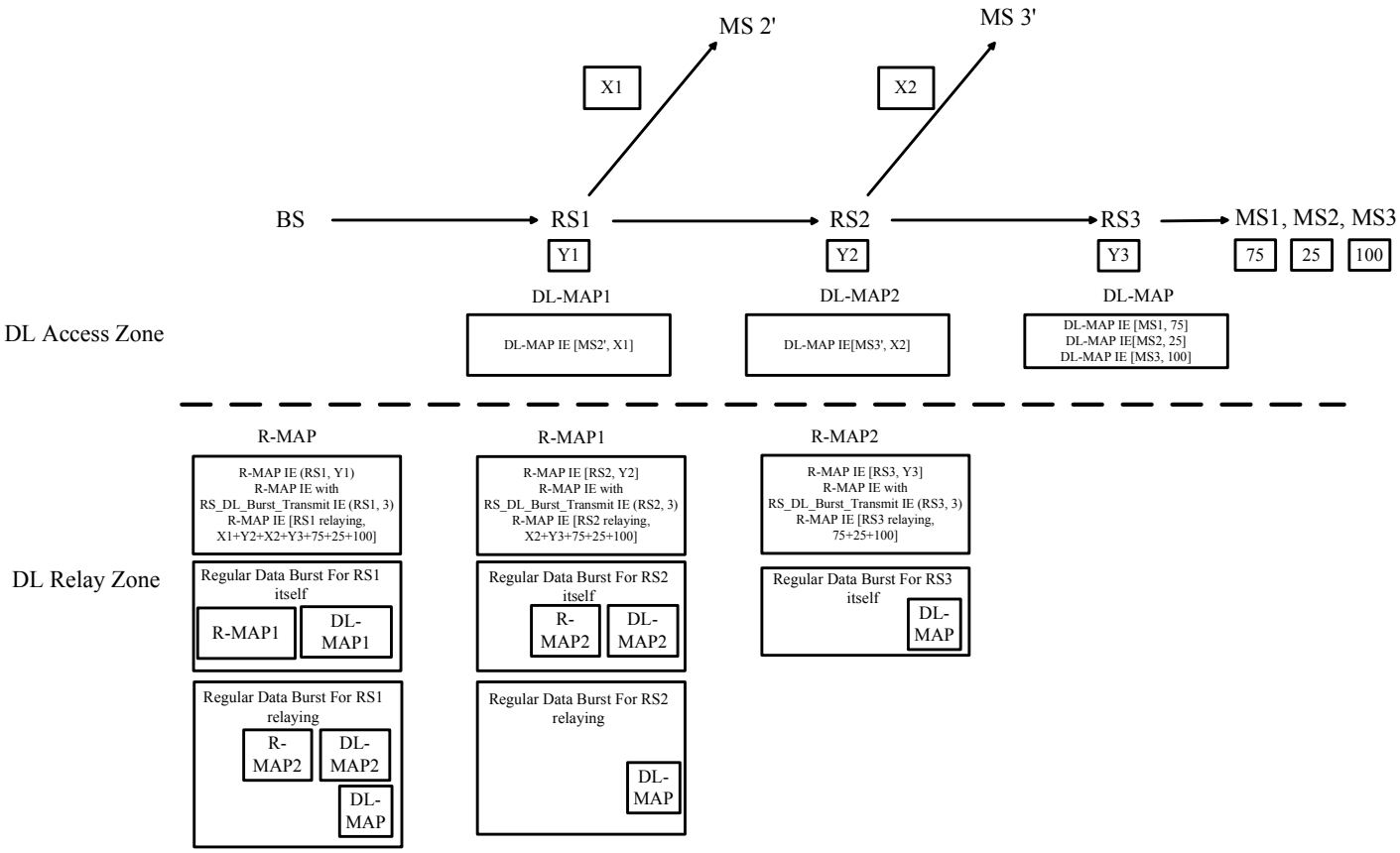


Figure 1 Example of proposed burst-based scheme for unicast data relaying

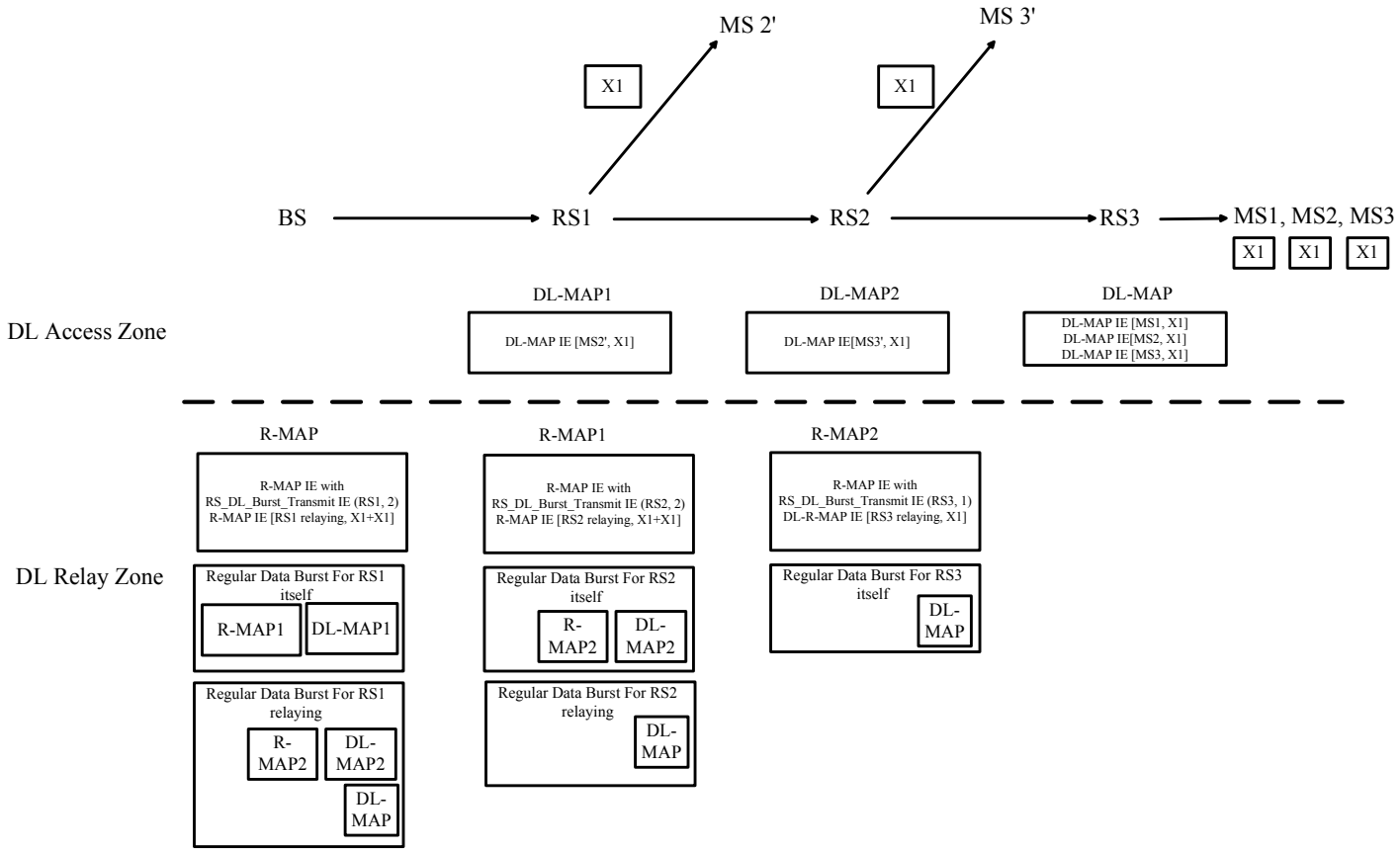
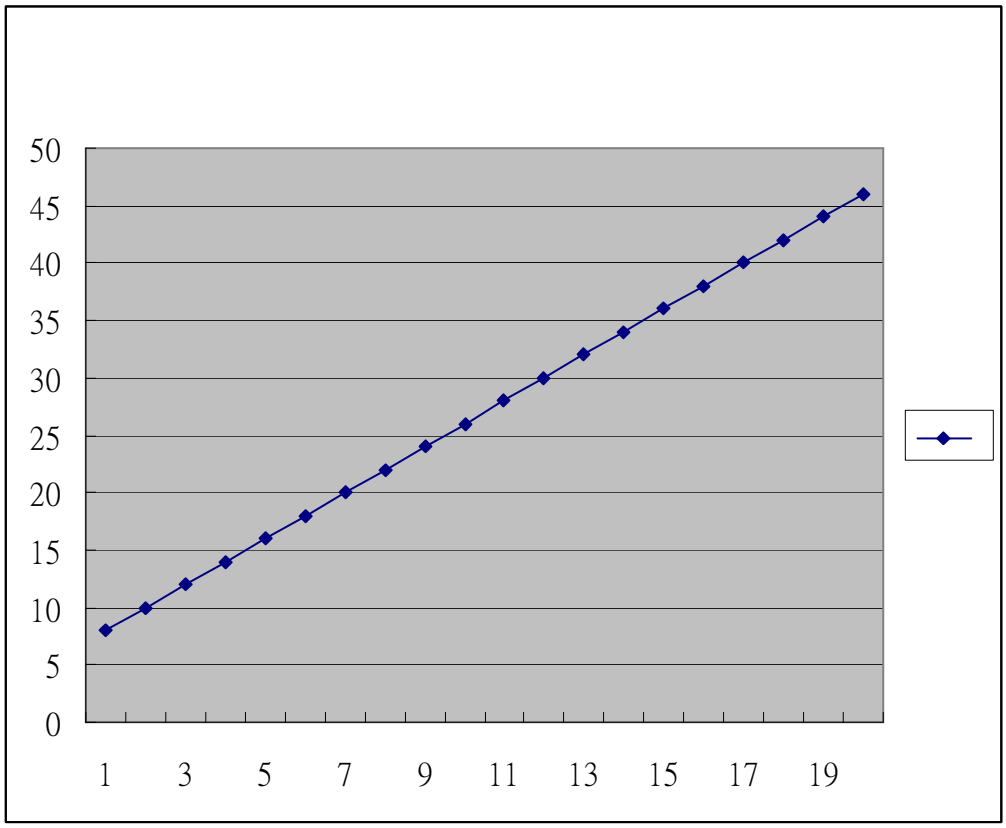


Figure 2 Example of proposed burst-based scheme for multicast data relaying

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.

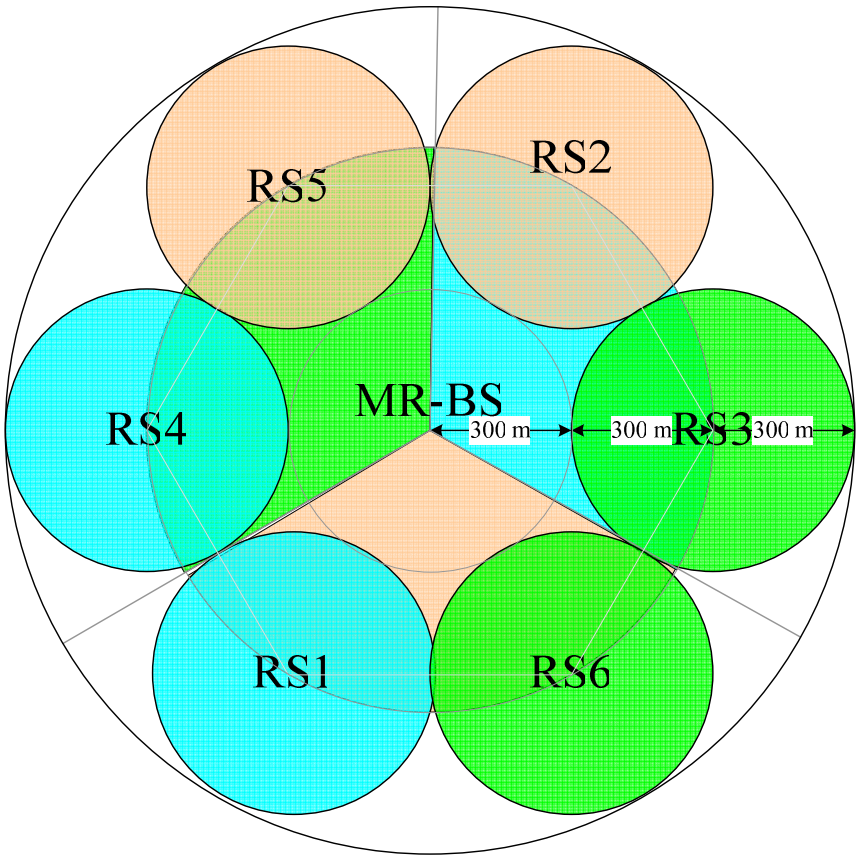


Figure-2 Two-hops Deployment (1×3×3 in Access Link/1×3×3 in Relay Link)

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)
}		
}		