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Source(s)	D.H. Ahn, Junhong Hui, C.I.Yeh, Young-il Kim ETRI 161, Gajeong-Dong, Yuseong-Gu, Daejeon, 305-350, Korea Hyukjoon Lee Kwangwoon University 447-1 Wolgye-Dong, Nowon-Gu Seoul, 139-701, Korea Kyu Ha Lee Samsung Thales San 14, Nongseo-Dong, Giheung-Gu, Yongin, Gyeonggi-Do, 449-712, Korea Chung-wook Suh Securepia 480-4, Kochuck-Dong, Kuro-Gu, Seoul, 725-325, Korea Voice: +82-42-860-6479 Fax : +82-42-860-1040 dhahn@etri.re.kr junhonghui@etri.re.kr ciyeh@etri.re.kr yikim@etri.re.kr Voice: +82-11-252-3168 Fax : hlee@kw.ac.kr Voice: +82-31-280-9917 Fax: +82-31-280-1562 kyuha.lee@samsung.com Voice: +82-11-431-5964 Fax : +82-2-824-2706 cwsuh@securepia.com
Re:	This is a response to the call for proposals 80216j-06_034.pdf
Abstract	This proposal describes multiple frame operation in the communication between MMR-BS and RS
Purpose	Proposal of MMR-BS's operation and RS's response method in multiple frame operation for the IEEE802.16 Relay TG
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Multiple Frame and Relay Operation for 802.16 MMR Networks

I. Introduction

This contribution proposes a multiple frame structure for non-transparent multi-hop relay operation which avoids inter-RSs and inter MMR-BS and RS interference in field operation.
This contribution has been made under the assumptions as follows:
(1) An MS could be located where significant level of signals are received from more than 2 RSs, or a BS and RSs.
(2) Only one TDD channel is considered in the MMR network
(3) No changes is required for IEEE802.16e MS operation

II. Purpose

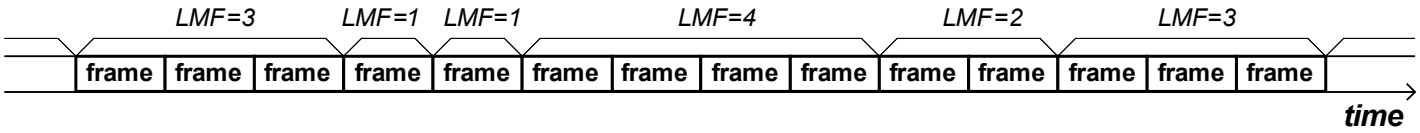
- to alleviate limitation of hopping count for enhancement of flexible network deployment capability
- to eliminate mutual interference b/w MMR-BS and RS, or between RSs
- to minimize the revision of PHY and MAC in legacy BS and MS

III. Proposal for Multi-frame Operation

1. Overview

(1) Multi-frame concept
- A Multi-frame consists of *L* subsequent frames.

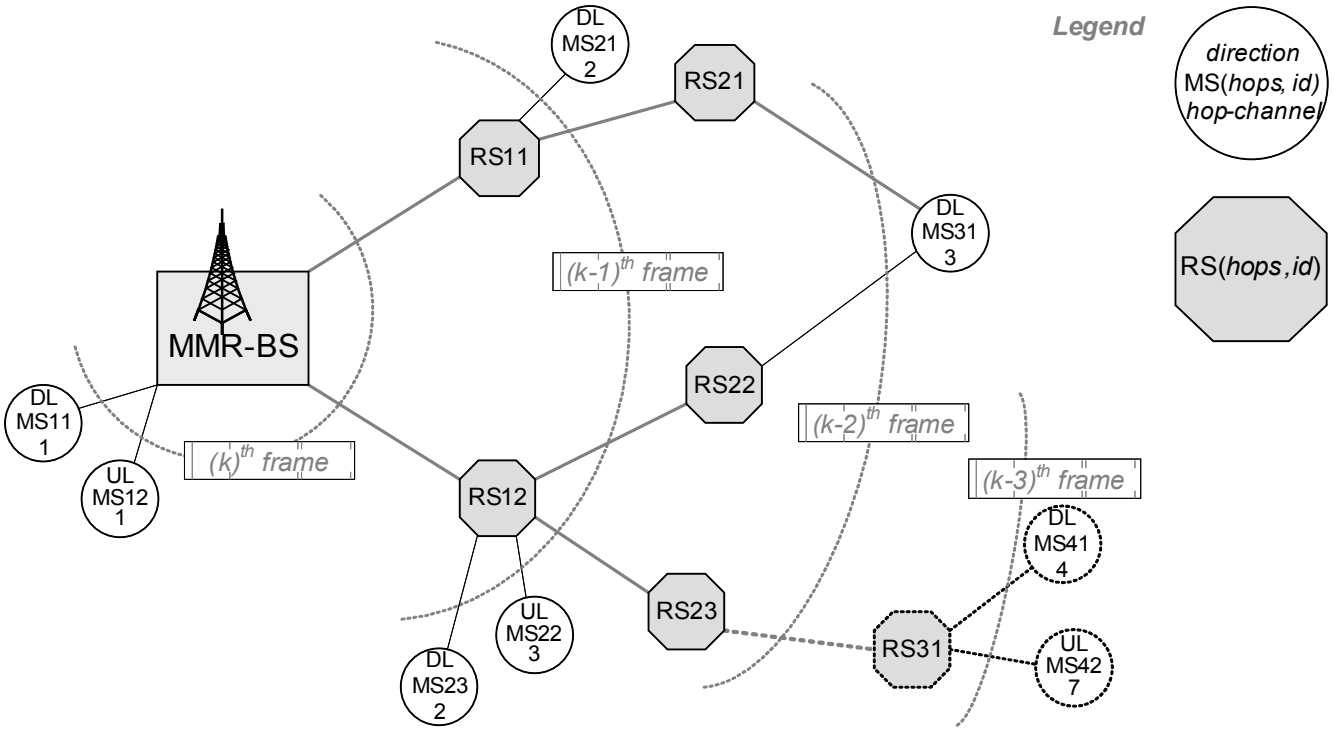
LMF: length of Multi Frame



(2) Dynamic Multi-frame considering MMR topology and traffic load

The length of Multi-frame(*LMF*) is determined before the Multi-frame start time, in consideration of topology and traffic load.
LMF = the length of Multi-frame = max (*MHR*+1, 2 * *MHM* - 1)
MHR : the maximum hop counts of active RSs
MHM : the maximum hop counts of MSs who have at least one UL traffic at start of Multi-frame
Example:
if no RS in a cell, *LMF* = max (0+1, 2-1) = 1
else if there exist 1-hop RSs and 2-hop MSs {
if at least an MS has UL data to send, *LMF* = max (1+1, 2*2-1) = 3
else no MS has UL data to send, *LMF* = max (1+1, -1) = 2
}

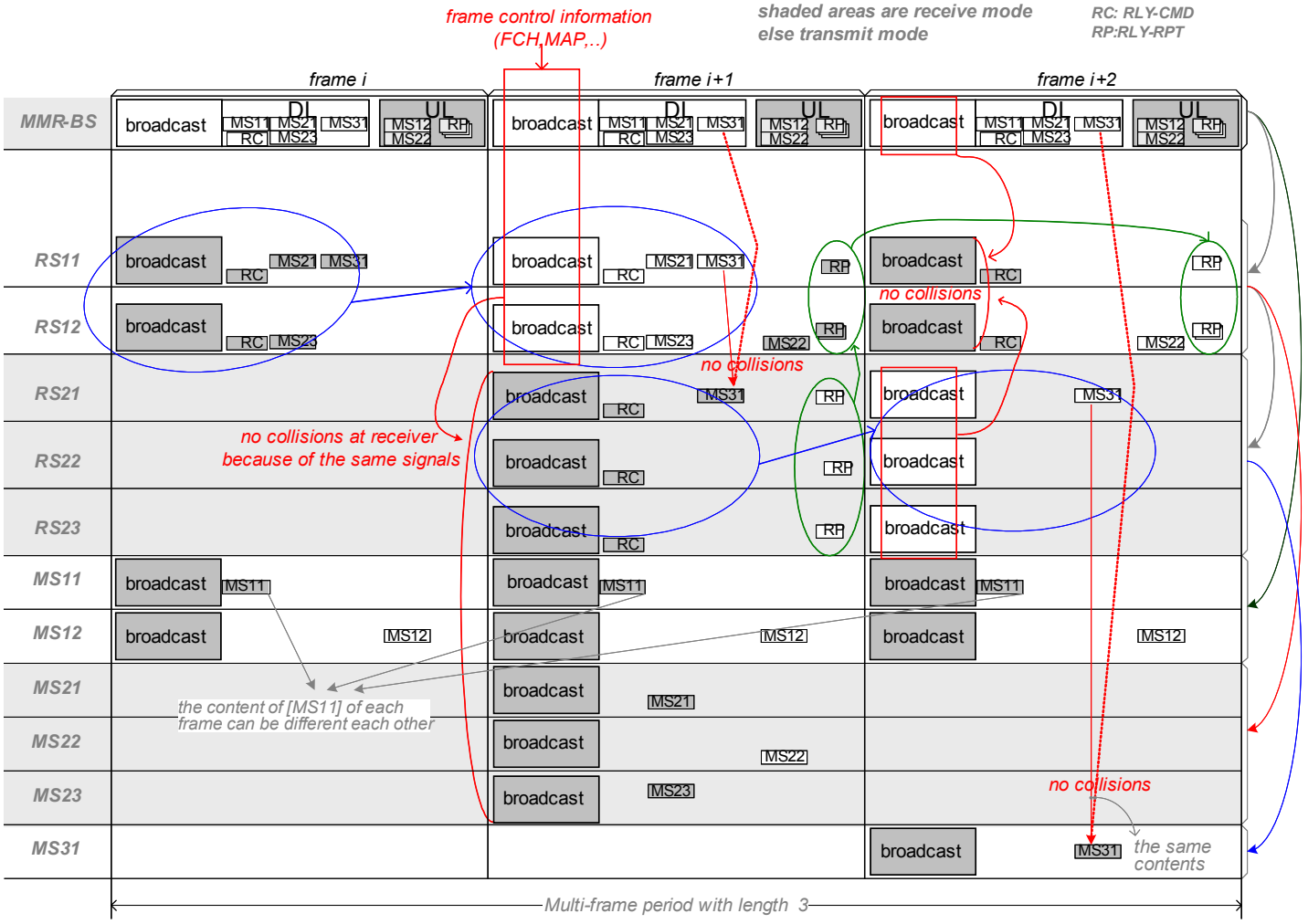
(3) Sample topology



(fig. 1) A sample for showing network topology and frame transmissions of hop links during k^{th} frame transmission at MMR-BS

In figure 1, k is an arbitrary frame sequence number of a Multi-frame with the range of $1 \leq k \leq LMF$(length of Multi-frame). In addition, before every Multi-frame is transmitted into the air, k shall be renewed and LMF shall be re-calculated.
An RSs shall transmit received frame to subordinates according to the control message of the multi-frame.

(4) Use of identical frame control information
- use frame control information containing Preamble, FCH and MAPs (or including DCD and UCD)
- apply identical frame control information to all of the frames in a Multi-frame except for the frame number.
- an RS shall update the frame number of received frame control information by incrementing and reassembling for relaying.
- no collision occurs at frame control information even if MMR-BS and RSs transmit different frames at the same time.
- RS ignores the burst which is not related to the RS's subordinates.



(fig. 2) Burst transmission and reception state diagram at nodes for the sample topology

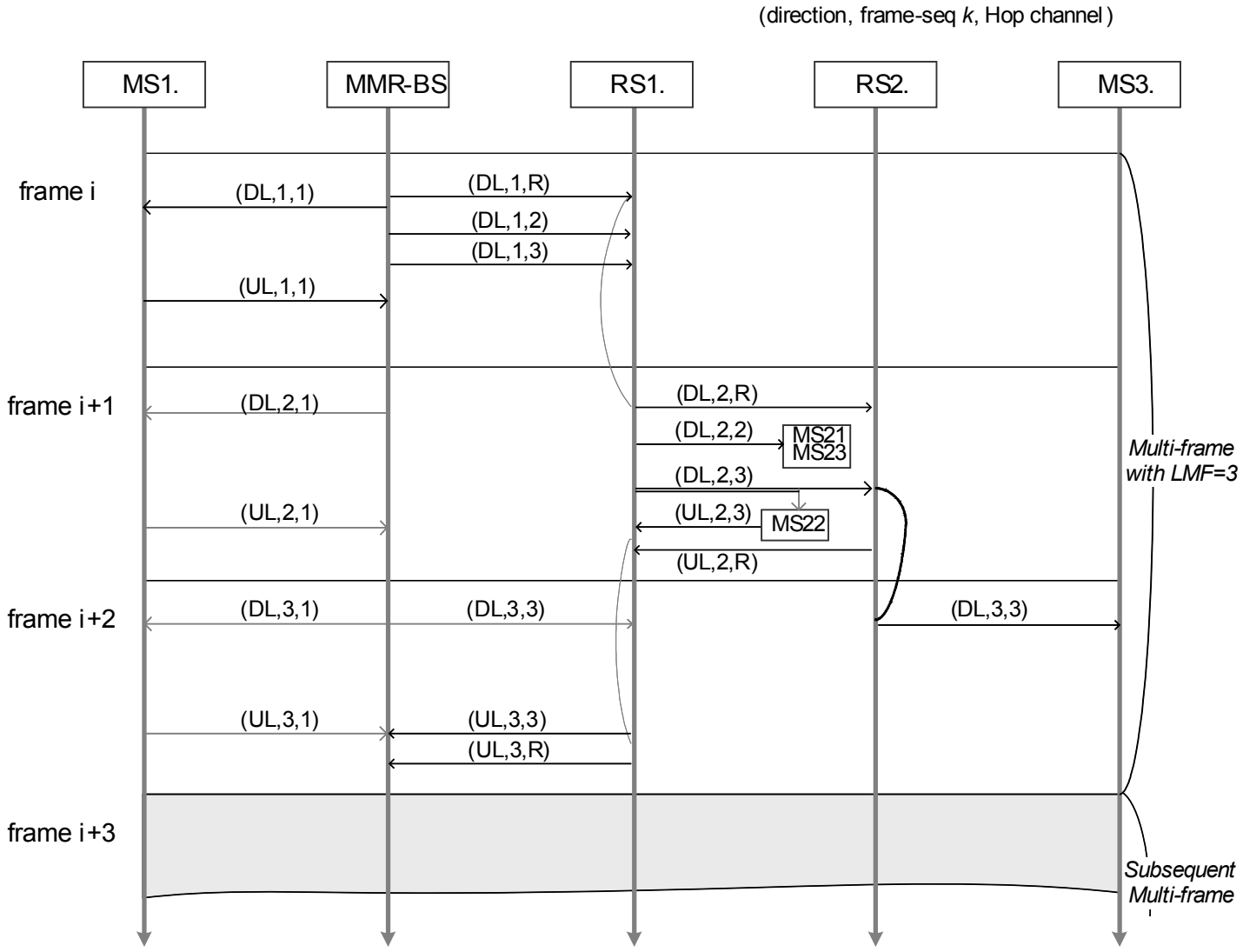
(5) An example of Hop Channel(HC) Assignment

assignment (hop based)	Forward to MS: frame control information		RS Command	HC1	HC2	HC3	Backward to MMRBS: common access	RS Report	HC3	HC1
frame i	PR	FCH MAP	BS→RS1.	BS→MS1.	BS→RS1.	BS→RS1.	UL access & control	RS1.→BS	-	MS1.→BS
frame i+1	PR	FCH MAP	RS1.→RS2.	BS→MS1.	RS1.→MS2.	RS1.→RS2.	UL access & control	RS2.→RS1.	MS2.→RS1.	MS1.→BS
⋮										
frame i+*L*-1	PR	FCH MAP	-	BS→MS1.	-	RS2.→MS3.	UL access & control	RS1.→BS	RS1.→BS	MS1.→BS

identical at every frame in the multi frame excluding frame number | RS control information | may be different contents | should be the same contents | only for one hop access never used for relay channel | RS control information including access data from MSs | should be the same content | may be different contents

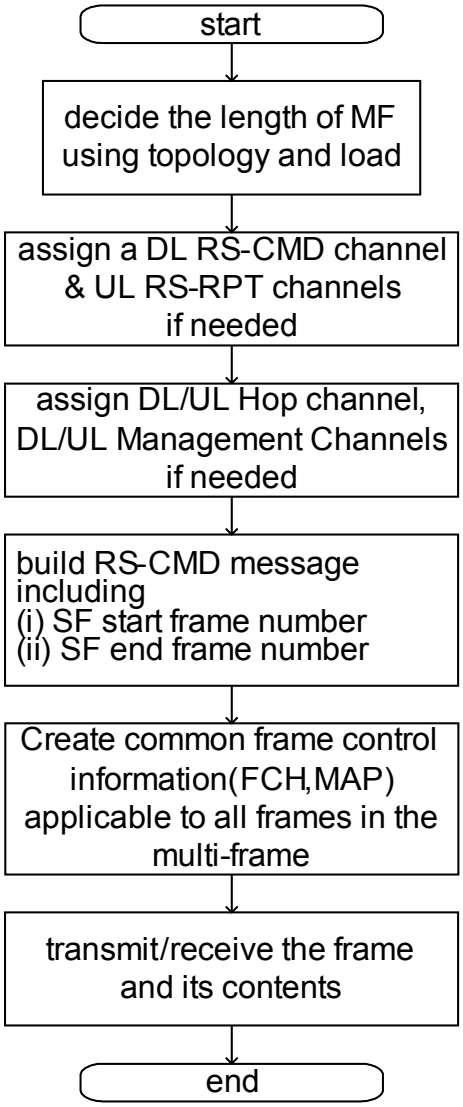
(fig. 3) An example of hop channels assignment

(6) Link Flows for the Sample topology



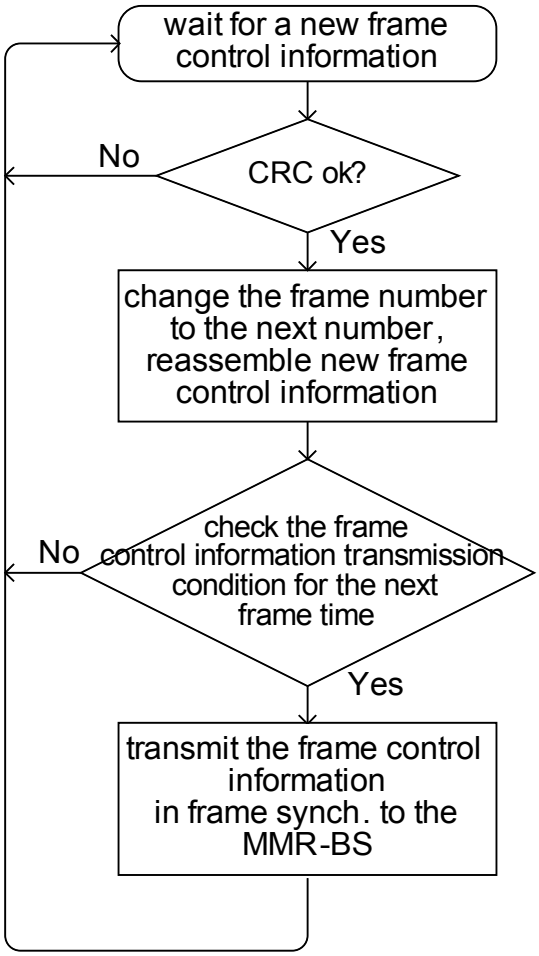
(fig. 4) Link Flows for the Sample topology

3. Operation flow of a Multi-frame in MMR-BS

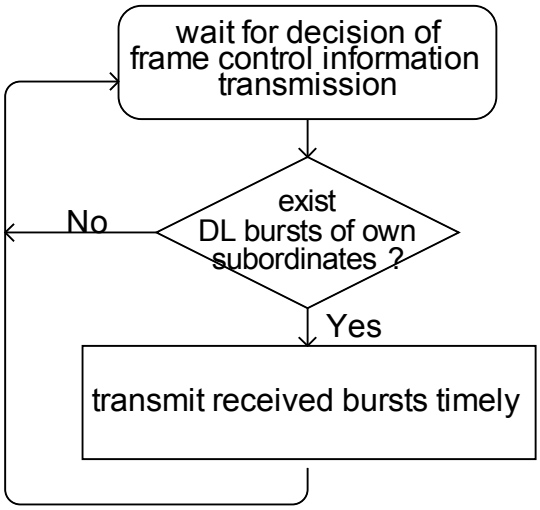


4. RS Operation

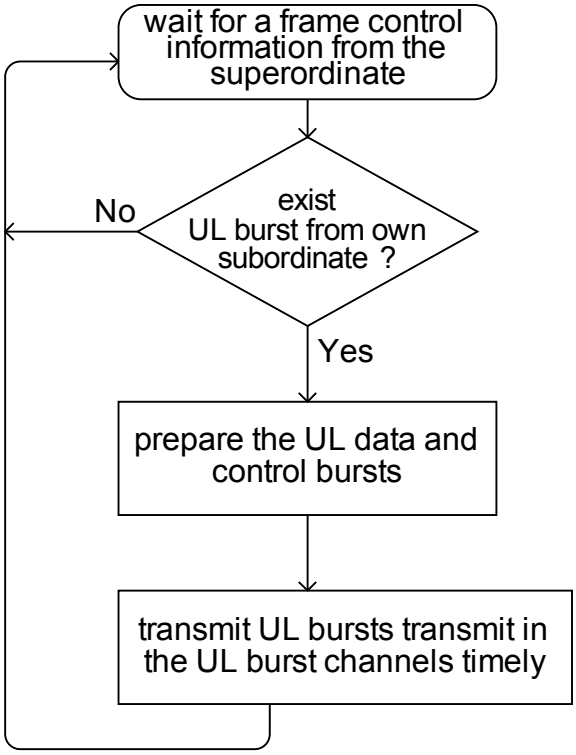
<Operation flow of frame relaying for the subsequent frame>



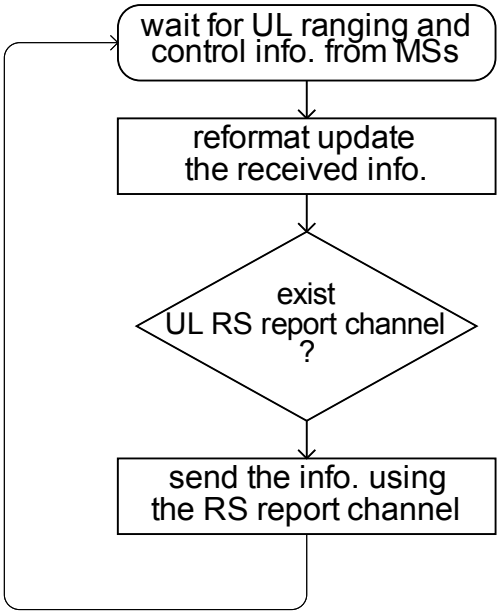
<Operation flow of DL burst relaying for the subsequent frame time at RS>



<Operation flow of UL burst relaying for the subsequent frame time at RS>



<Operation flow of UL Ranging information relay at RS>



IV. Advantages

o Enhanced hopping capacity using dynamic scalability of Multi-frame size.
o Alleviation of mutual interference between MMR-BS and RS, or between RSs because of using identical frame control information

V. Related ToC

6.3.2.3 MAC management message
6.3.6.7.2 Centralized scheduling
6.3.26 Relay Operation for Multi-frame Mode (*append this section*)

VI. Text Proposal

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6.3.2.3 MAC management message

Append following two rows into Table 14:

Type	Message name	Message description	Connection
??70	RLY-CMD	Relay Request	Basic
??71	RLY-RPT	Relay Report	Basic

Append following text into subsection of 6.3.2.3

6.3.2.3.??70 Relay command message

In order to control RS's correct operation, MMR-BS shall transmit the same RLY-CMD messages to the relay group for every frame of the corresponding Multi-frame.

Table xx --- RLY-CMD message format

Syntax	Size	Notes
RLY-CMD_message_format() {		To multicast id of relay group
Management Message Type = ??70	8	
Multi-frame Identification		
Start frame number	8	The least significant 8 bits
End frame number	8	The least significant 8 bits
N_Relays	8	The number of relays to be received a command body
For (i=0; i< N_Relays; i++) {		
CID	16	Relay CID
Length of command body	8	
Command Body	*variable*	Command dedicated to specific RS
Padding	v	Number of bits required to align to byte length. Shall be set to zero.
}		
}		

An MMR-BS generates RLY-CMDs including all of the following parameters, as shown in Table xx:

Start frame number

Start frame number of current Multi-frame. The value is the least significant 8 bits of the start frame

End frame number

End frame number of current Multi-frame. The value is the least significant 8 bits of the end frame

Command Body

This parameter is reserved for future use of higher layer. This may contain routing information for specific RS or RS's operation due to MS's association.

Append following text into subsection of 6.3.2.3

6.3.2.3.??71 Relay report message

An RS shall transmit a RLY-RPT message using UL burst allocated to the RS. An RS shall generate RLY-RPT message including parameters shown in Table yy.

Table yy --- RLY-RPT message format

Syntax	Size	Notes
RLY-RPT_message_format() {		From RS via UL unicast
Management Message Type = ??71	8	
Length of report body	4	Length of the slot
Report Body	*variable*	
Padding	v	Number of bits required to align to byte length. Shall be set to zero.
}		

Report Body

These parameter is reserved for future use. It may contain the ranging information from MSs and/or from neighbors.

6.3.6.7.2 Centralized scheduling

Append following sentences in section 6.3.6.7.2

(1) Multi-frame Mode (optional)
A Multi-frame(MF) is comprised of a set of subsequent frames generated according to network topology and traffic load.
Before making up next Multi-frame, an MMR-BS should determine the length of next Multi-frame and prepare contents of hop channels of each frame with reference to the routing topology and traffic load. The routing topology will be maintained by path management described in 6.3.25.
The Multi-frame mode is based on relaying principle of frame unit. So the length of Multi-frame should guarantee delivery of burst from/to the designated MS.

The Length of Multi-frame (*LMF*) may be calculated as follows:

$LMF = \max. \{MHR+1, 2*MHM - 1)$

where,

MHR = the maximum hop distance of connected RSs within the MMR network

MHM = the maximum hop distance of MSs which have at least one UL burst to be supposed to be served by MMR-BS at the start of MF

A hop channel is a collection of bursts located in the same time position within a Multi-frame for a relay path. Each burst of the channel has the same MCS every frame of the Multi-frame, so that the MAP messages shall be the same in every frame, excluding frame number.

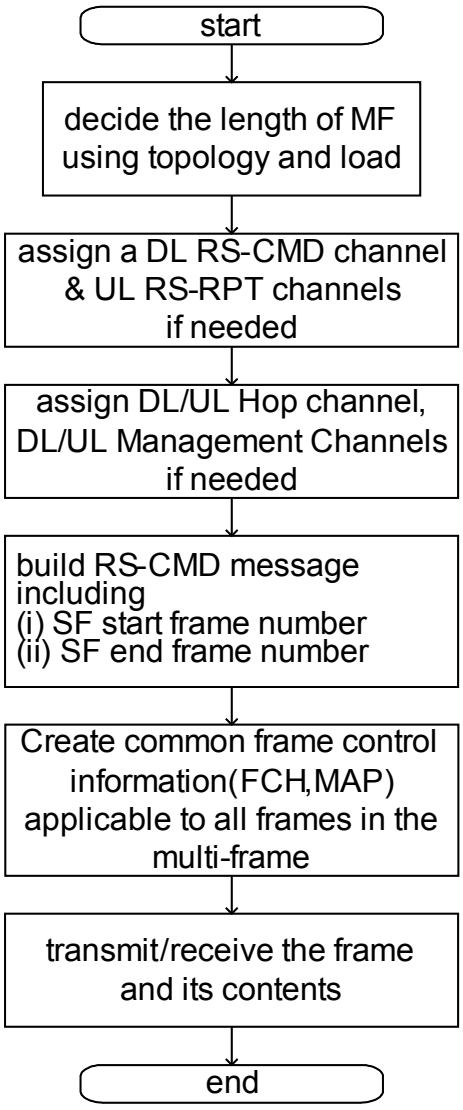

Figure xxx---Multi-frame control flow at MMR-BS

Create following section

6.3.??26 Relay Operation for Multi-frame Mode(optional)

6.3.??26.1 Frame relaying for the subsequent frame at RS

(This section is applied only when RLY-CMD is received successfully.)
After successful reception of the frame control information including the messages, the RS shall reconstruct the

frame with the frame number increased by 1. With the synchronization of the subsequent frame, the RS shall transmit the reconstructed frame if the following conditions are met:

C1: the value of modulo 2^8 of revised frame number is within the Start frame number and End frame number parameter in the RLY-CMD message

C2: No UL burst transmission is expected in the subsequent frame period.

RS shall reconstruct the frame according to the procedures of following subsection 6.3.26.2, 6.3.26.3 for DL/UL bursts.

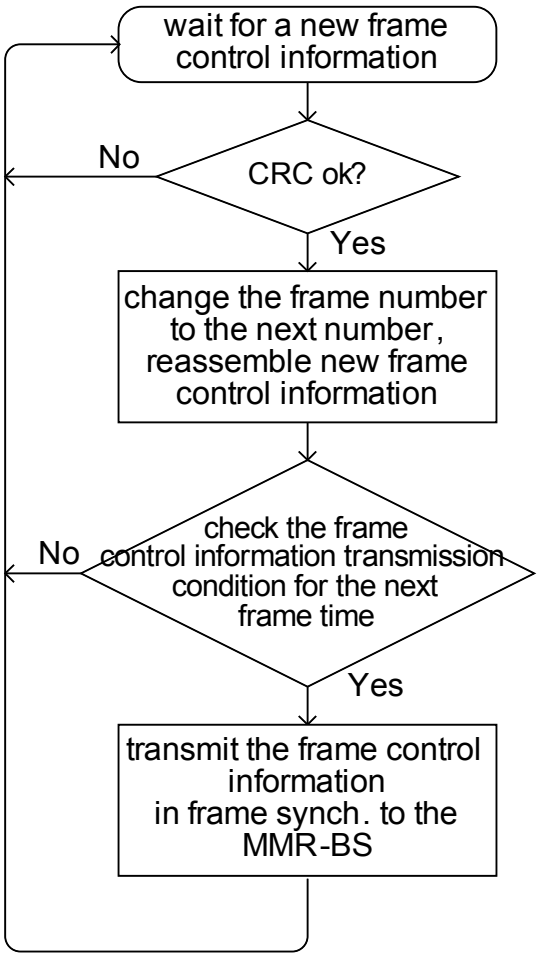

Figure xxx---Frame relaying flow at RS

6.3.??26.2 DL/UL burst relaying for the subsequent frame at RS

DL burst relaying is performed only when all the conditions C1,C2 in 6.3.??26.1 are satisfied and the bursts to be relayed are related to the RS's subordinate MSs or RSs

UL burst relaying should be performed in the subsequent frame whenever new UL burst was received in current frame.

6.3.??26.3 Relay operation for UL Ranging information at RS

(This section is applied only when RLY-RPT message channel is received successfully.)

Whenever ranging information is received from MSs, RS should collect each information and insert into incoming RLY-RPT message channel.