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Title	Multi-frame structure consistent to 802.16e for MMR Networks
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Re:	This is a response to the call for technical contributions 80216j-07_007r2.pdf
Abstract	This contribution proposes a multiple frame operation consistent with 802.16e legacy frame structure to support multi-hop between MR-BS and RS
Purpose	Text proposal for 802.16j Baseline Document
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Multi-frame structure consistent to 802.16e for MMR Networks

1. Introduction

This contribution proposes a multiple frame structure for consistency with the 802.16e legacy frame structure to support multi-hop relay operation which avoids inter RSs and inter MR-BS and RS interference.

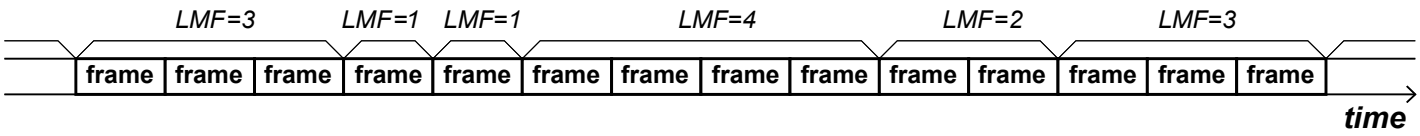
2. Characteristics

o complete backward compatible frame structure to 802.16e legacy system.
o no PHY revision for the legacy BS.
o without RS, multi-frame length is equal to 1. It is exactly the legacy system.
o no mutual interference between MR-BS and RS, or between RSs anywhere in the cell.
o applicable to dynamic topology
o to allow large hop counts and enhance the flexible network deployment capability
o very simple RS deployment and less overhead.

3. Proposal for Multi-frame Operation

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

LMF: length of Multi Frame

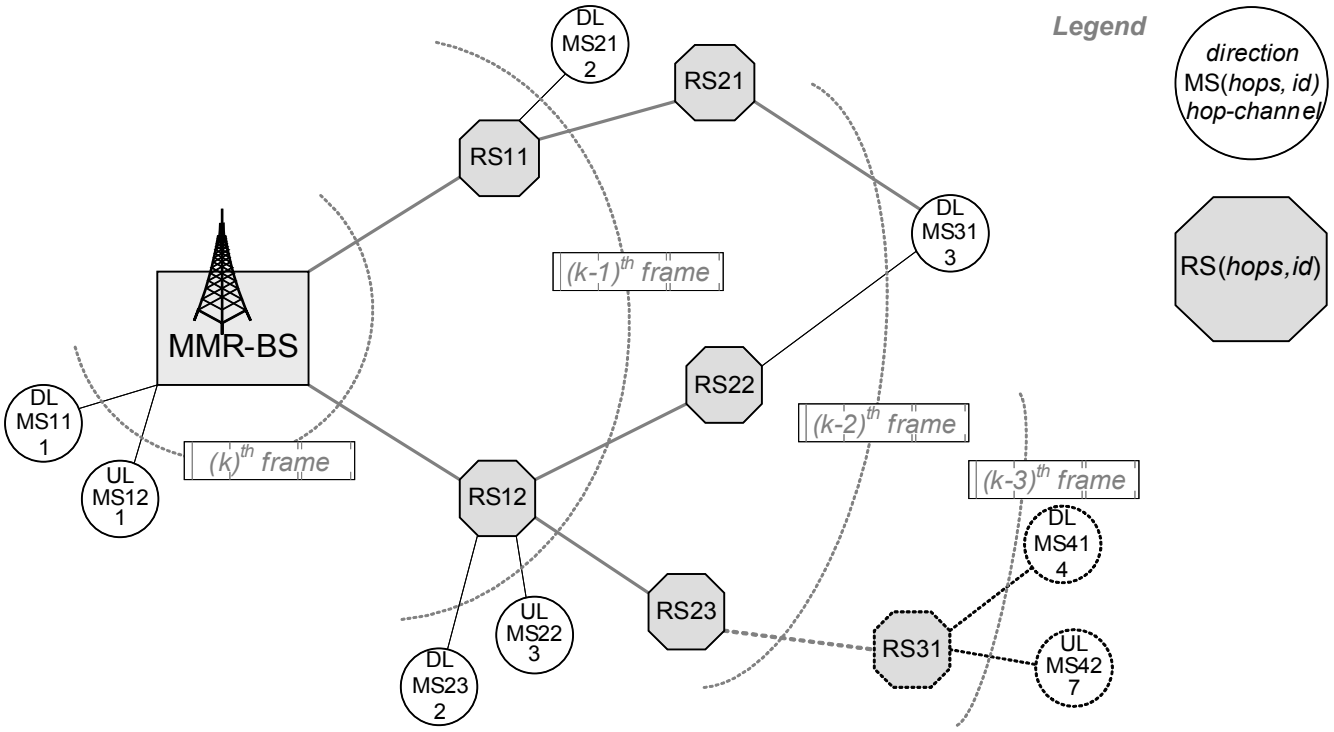


A legacy frame can be a multi-frame with multi-frame length of 1. Multi-frame structure is actually an extended version of the legacy system frame structure when it is also used for relay function.

(2) Dynamic Multi-frame considering MR 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
}

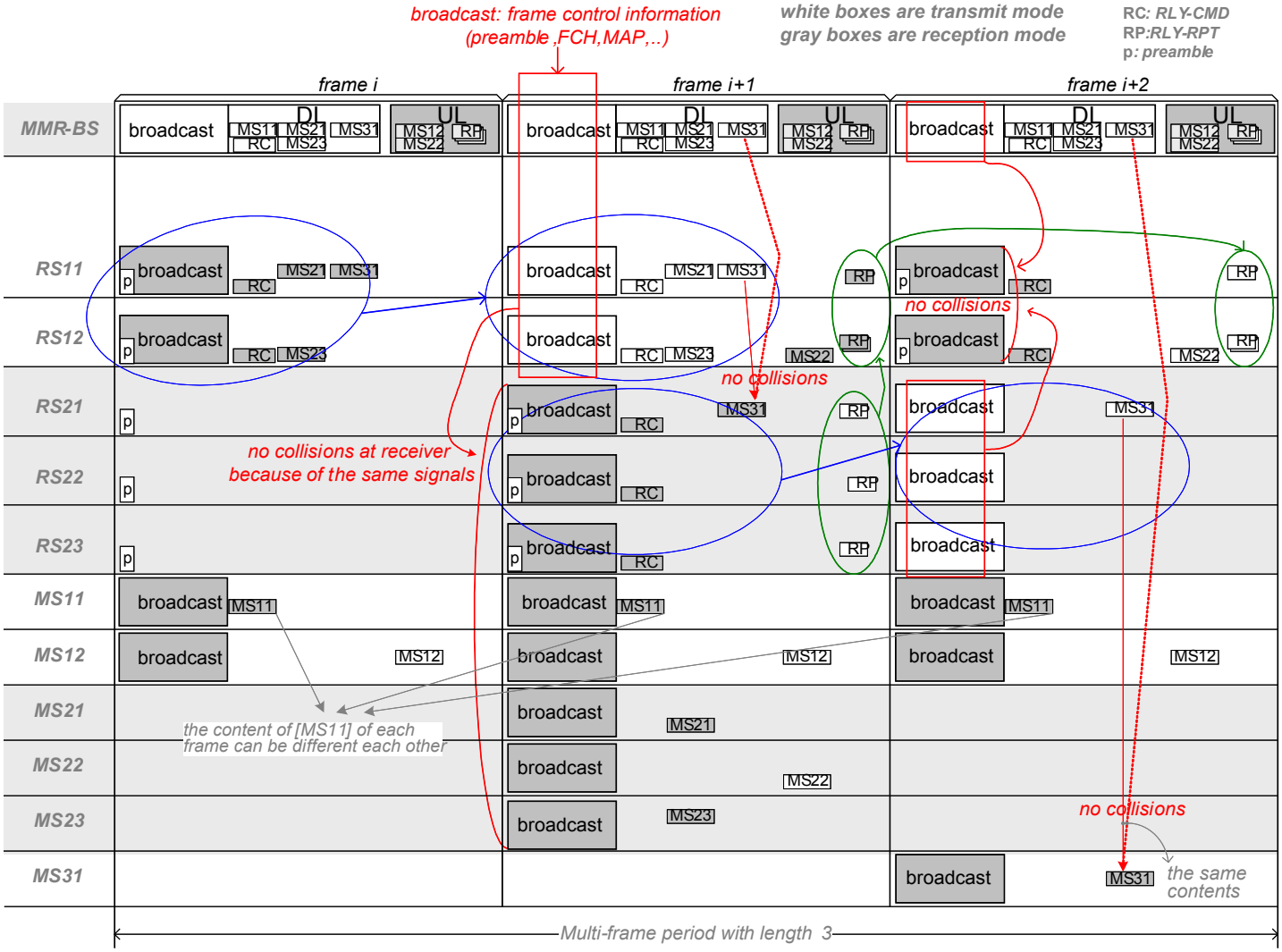
(3) Sample topology



(fig. 1) A sample for showing network topology and frame transmissions of hop links during k^{th} frame transmission at MR-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 RS 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 the frame number.
- an RS shall update the frame number in the received frame control information by incrementing and reassembling for relaying.
- RS ignores the bursts which are not related to the RS's subordinates.



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

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

assignment (hop based)	Forward to MS: frame control information		Forward to MS: RS Command	Forward to MS: HC1	Forward to MS: HC 2	Forward to MS: HC3	Backward to MMR-BS: common access	Backward to MMR-BS: RS Report	Backward to MMR-BS: HC3	Backward to MMR-BS: 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+2	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

4. Text Proposal

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Insert new subclause 8.4.4.7.3

8.4.4.7.3 Multi-frame structure consistent to 802.16e

A Multi-frame consists of certain number of subsequent frames. An example of the multi-frame structure is shown in Figure <xxx>.

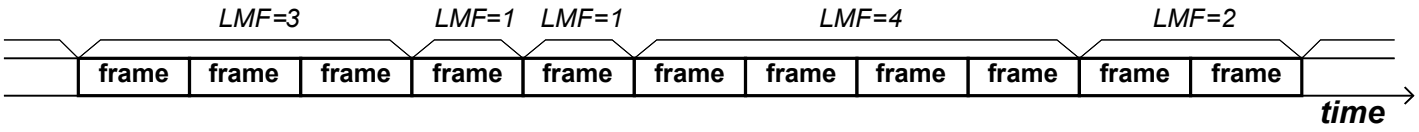

Figure <xxx> Multi-frame structure

Insert new subclause 8.4.4.7.3.1

8.4.4.7.3.1 MR-BS multi-frame structure

For the TDD mode, MR-BS uses the legacy 802.16e frame as a unit frame to construct a multi-frame by grouping these units with a repeating pattern according to the network topology. In every multi-frame for MR-BS, each unit frame is the same as in legacy 802.16e Section 8.4.4.2. Within a multi-frame, all the unit frames shall use the same preamble/FCH/ MAP/UCD/DCD as the first unit frame.

Insert new subclause 8.4.4.7.3.2

8.4.4.7.3.2 Relay frame structure

For the TDD mode, Relay has two mode of operation, MS-mode and BS-mode.
During MS-mode, each RS functions as a legacy MS frame operation.
During BS-mode, each RS transmits the unit frame with the same structure as described in legacy 802.16e Section 8.4.4.2, but ignores the bursts which are not related to its subordinate RS or MS.
Relay changes its operation mode between MS-mode and BS-mode.
Within a multi-frame, RS works in MS-mode at first. Only after receiving the correct frame control information (Preamble/FCH/MAP/UCD/DCD), RS shall change to BS-mode in next frame and then return to MS mode again.
RS could transmit the preamble simultaneously as it receives the preamble during MS-mode.
An example for RS unit frame structure in MS-mode is shown in Figure <yyy>.

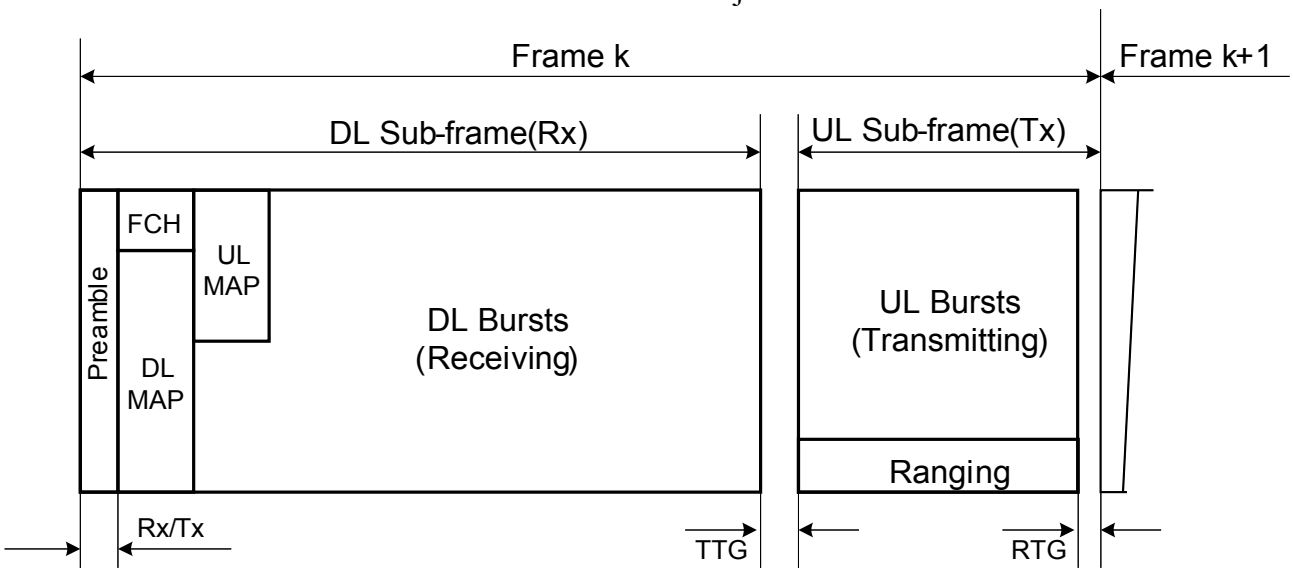

Figure <yyy> RS unit frame structure in MS-mode

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