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Title	**The 2nd fast feedback channel region to reduce transfer delay of fast feedback data for 2-hop MMR system**
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Re:	This is a response to Call for Technical Proposals regarding IEEE project P802.16j
Abstract	In this contribution, we propose the 2nd fast feedback channel region between RS and MMR-BS
Purpose	Adoption of the proposed text and tables
Notice	
Release	
Patent Policy and Procedures	

The 2nd fast Feedback channel region to reduce transfer delay of fast feedback data for 2-hop MMR system

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1. Motivation

Generally, the fast feedback data in uplink fast feedback channel should be transferred as fast as possible. If MS sends the feedback data to MMR-BS via RS with one or more frame transfer delays, the channel adaptation for MS can not be performed promptly by MMR-BS. Therefore, the additional feedback channel region for rapid and accurate transmission of feedback data of MS in RS area is required. On the other hand, CQI is not seriously affected by transfer delay. However, If CQI can be also transmitted to MMR-BS in a frame, MMR-BS can easily control the CQICH allocation of MSs. Therefore, this additional feedback channel region can be also used to transfer the CQI of MS. Consequently, in our proposal, MMR-BS can obtain the feedback data and CQI from MS in a frame by inserting another fast feedback channel region within RB period where RS can send the uplink data to MMR-BS. Therefore, we can expect to get better system performance if the transfer delay can be reduced by the proposed fast feedback channel region.

2. Suggested Remedy

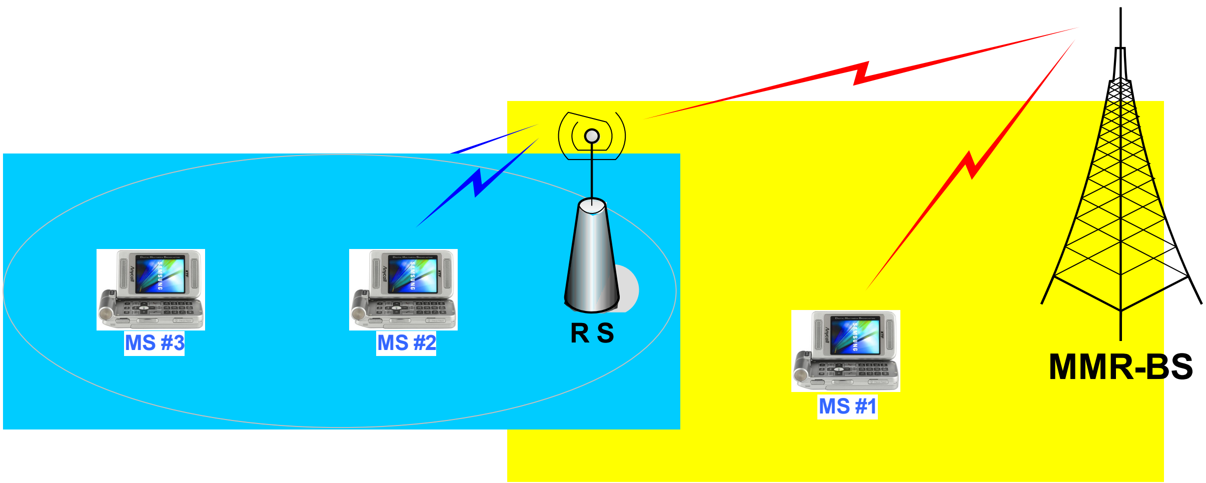

Figure 1. 2-hop MMR system

Figure 1 shows the configuration diagram of 2-hop MMR system. The purpose of MMR system is to achieve the cell coverage extension and throughput enhancement. In the view of throughput enhancement, after receiving the MMR-BS signal, RS can transmit it to the MS in the shadow region with higher modulation and coding rate and the performance of system with RS will be better than that without RS. The fast feedback data such as channel quality information and DL measurement value between RS and MS must be transferred to MMR-BS as fast as possible and CQI also should be received in an allocated frame by MMR-BS. Because the rapid and accurate transmission of wireless channel information makes the performance improvement of system possible. That's why we focus in reducing the transfer delay of fast feedback information.

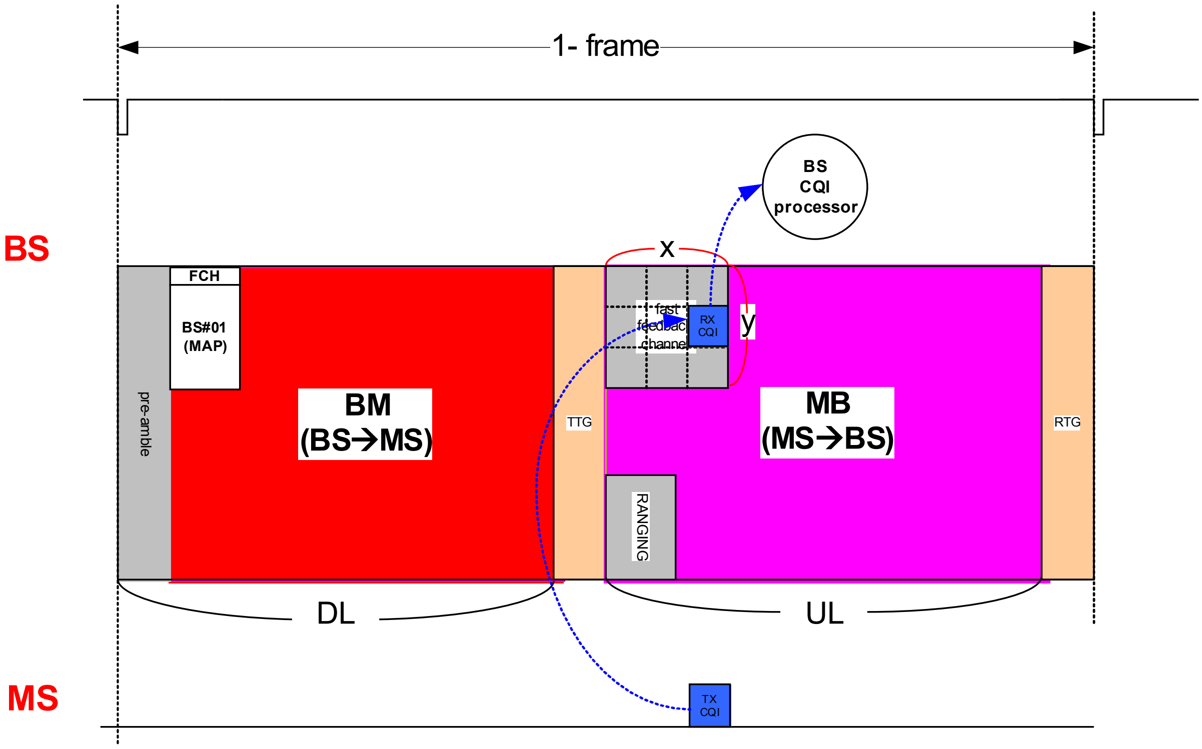

Figure 2. The example of frame structure including fast feedback channel region for OFDMA TDD system based on IEEE 802.16e standard

Figure 2 shows the example of fast feedback channel allocation for OFDMA TDD system based on IEEE 802.16e standard. Generally, BS transmits downlink data to the MS during the BM period and MS sends uplink data to BS during the MB period. In order to transfer some fast feedback data to BS, BS allocates the fast feedback channel region in uplink time slots by using the fast feedback allocation IE which is broadcasted by BS and MS sends some information requiring the fast response such as fast DL measurement and fast MIMO feedback data to BS through the allocated fast feedback channel for each MS.

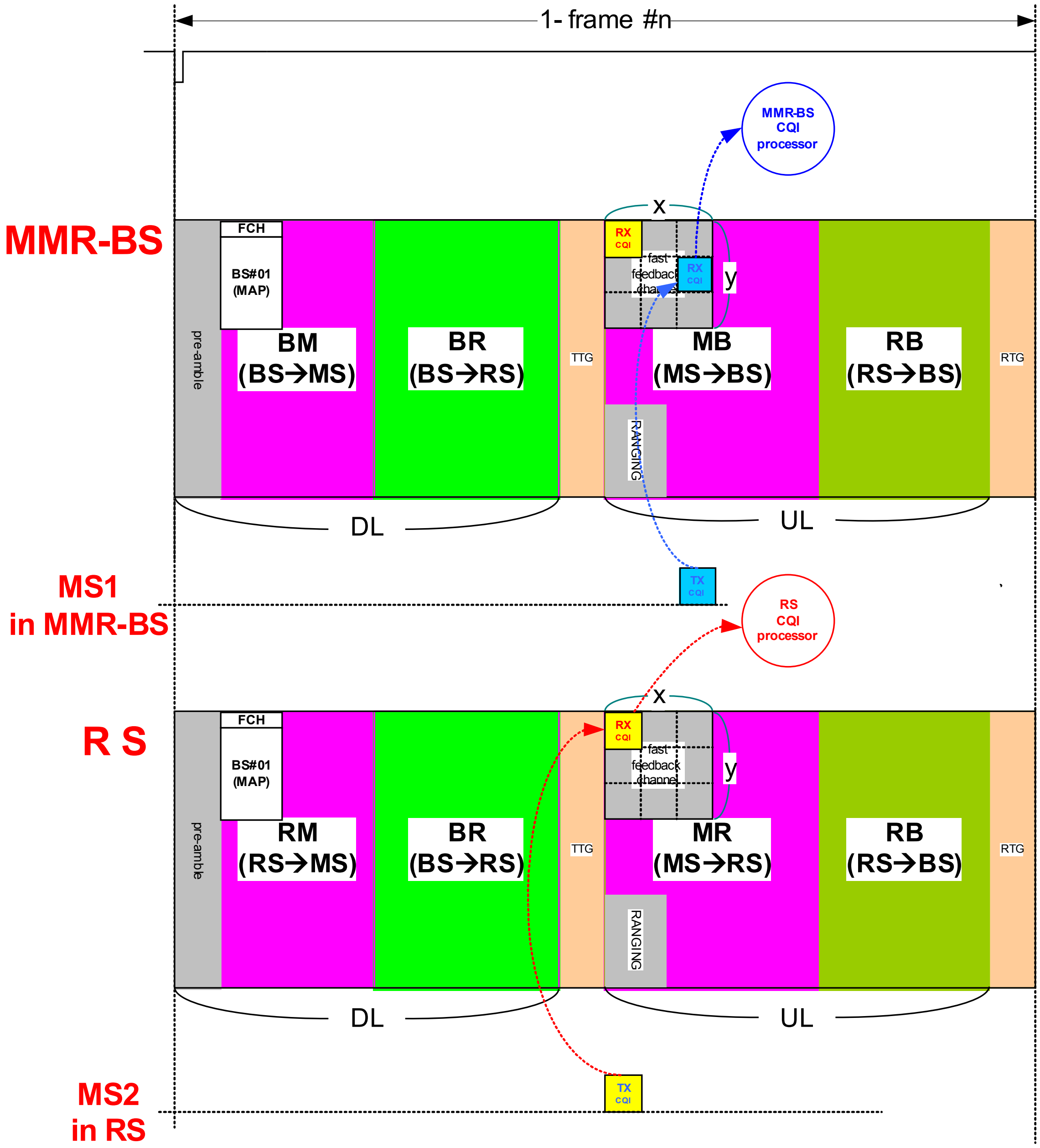

Figure 3. The example of frame structure in MMR system

Figure 3 shows the example of frame structure when RS exists between MMR-BS and MS. In downlink region, the BM period also exists and RM period can co-exist in the same time slot of BM period but these two regions should be separated by time division or frequency division. Additionally, BR period should be inserted to transmit downlink data of MS from MMR-BS to RS. If MMR-BS allocates properly three regions without overlapping, the order of three regions can be reversed suitably. In uplink region, RB period is necessary to transmit uplink data of MS from RS to MMR-BS in addition to MB period. Also, MR period can co-exist in the same time slot of MB period and if MMR-BS allocates properly three regions without overlapping, the order of three regions can be changed. In figure3, the MS1 in MMR-BS area can send directly the fast feedback data to MMR-BS through the allocated feedback channel.

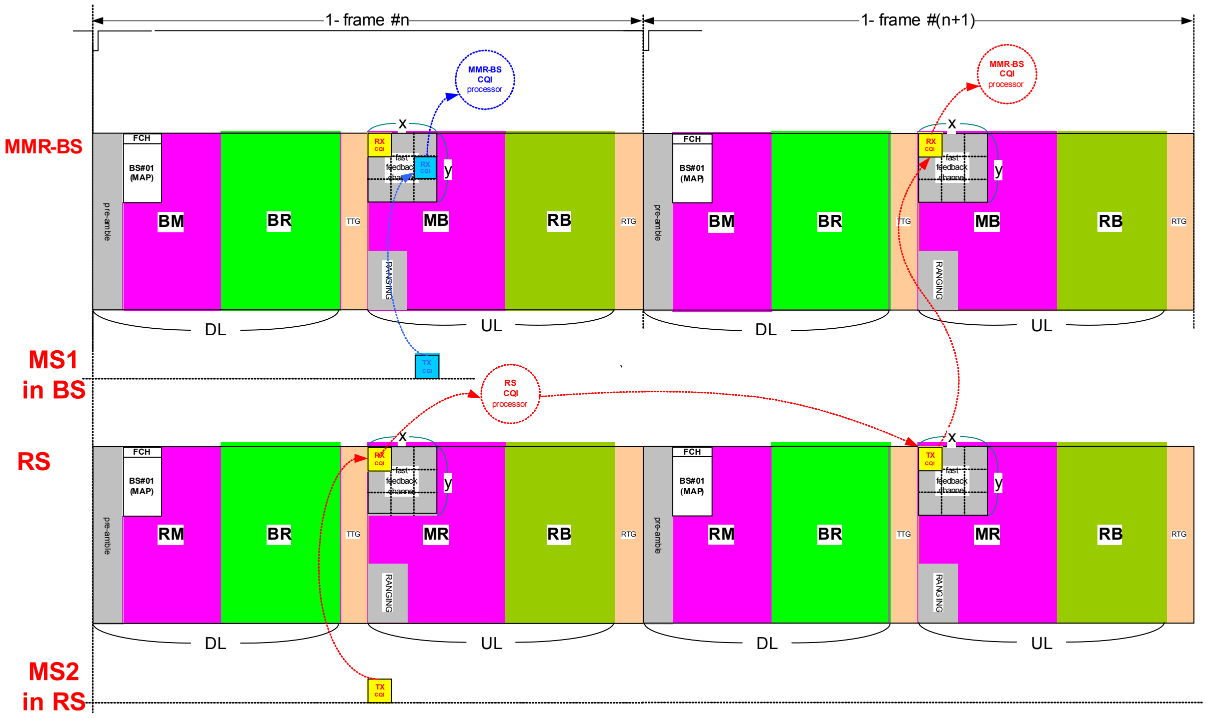

Figure 4. The example of fast feedback channel allocation in the case of using only one fast feedback channel region

On the other hand, As MS2 activated in RS area can not send directly the fast feedback data to MMR-BS, firstly, RS should receive the fast feedback data of MS2 and should retransmit the received fast feedback data of MS2 to MMR-BS.

Figure 4 shows the example of feedback channel allocation in the case of using only one fast feedback channel in a frame to retransmit feedback data to MMR-BS via RS. MS1 in MMR-BS area can send directly the fast feedback data to MMR-BS through the allocated feedback channel. Therefore, MMR-BS can obtain the fast feedback data without transfer delays. However, in the case of MS2 in RS area, if one fast feedback channel region is only allocated to MS2, RS will receive the feedback data at #n th frame and retransmit it to MMR-BS at next frame by using the same fast feedback channel. In this case, one frame delay should be necessary to deliver the fast feedback data from MS2 to MMR-BS via RS. Of course, we can consider the method using unicast-message but this kind of method also requires many delays to transfer uplink message from RS to MMR-BS. Therefore, we ignore the message-based transfer scheme for feedback data.

2.1 Proposed Fast Feedback Channel Structure for 2-hop MMR system

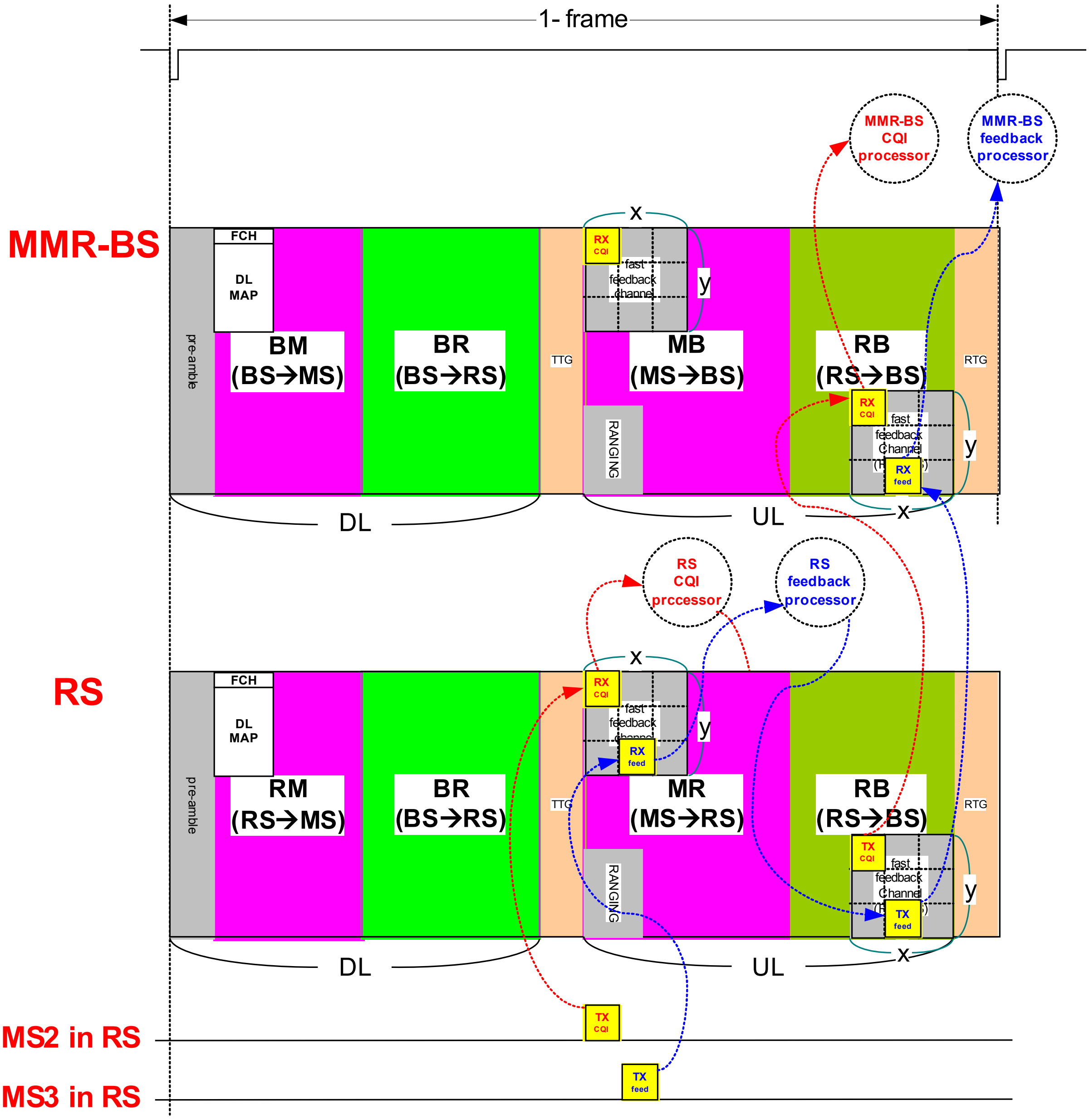

Figure 5. The example of fast feedback channel allocation in the case of using two fast feedback channel regions in a frame

Figure 5 shows the example of feedback channel allocation in the case of using two fast feedback channel regions in a frame. In order to reduce the transfer delay of fast feedback data, we propose another fast feedback channel region in addition to conventional one. This 2nd fast feedback channel region may be located within RB period where RS can send the uplink data to MMR-BS. However, the location of 2nd fast feedback channel region which is informed by additional fast feedback allocation IE can be changed according to the position

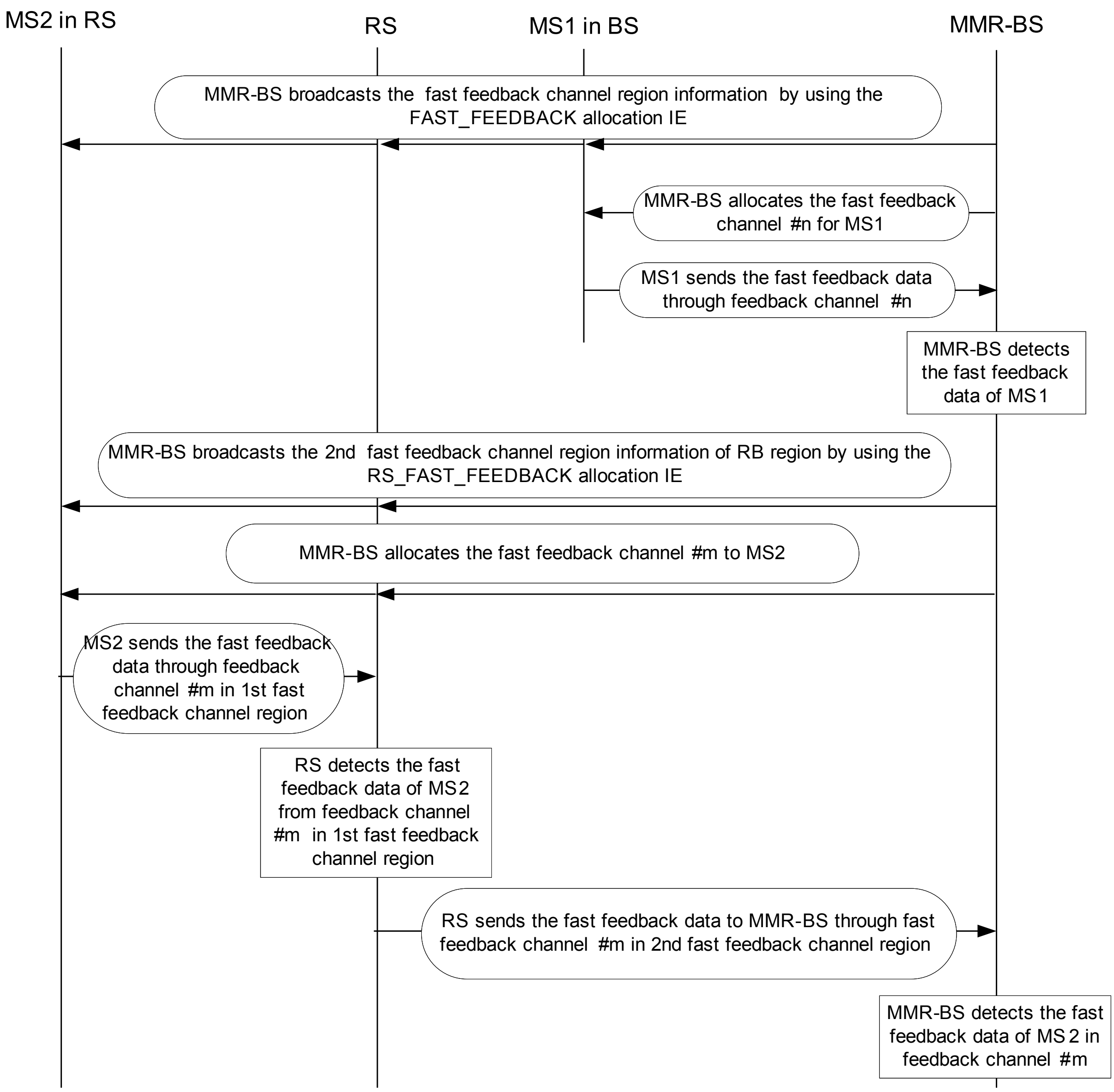

Figure 6. The process diagram for the proposed fast feedback channel allocation

of RB period. The time-slot difference between the 1st and 2nd fast feedback channel region must be considered in the view of the processing time which is the time to retransmit the feedback data of MS1 to MMR-BS after processing it. In RB period, MMR-BS sets up the Tx fast feedback channel for RS in order to transmit fast feedback data and also sets up the Rx fast feedback channel for MMR-BS to receive fast feedback data.

Figure 6 shows the process diagram for the proposed fast feedback channel allocation. First of all, MMR-BS broadcasts the 1st fast feedback channel allocation information by using FAST_FEEDBACK allocation IE. Therefore, all MSs and RSs in MMR-BS can know the 1st fast feedback channel region. In the case of MS1 in MMR-BS area, MMR-BS allocates the fast feedback channel #n for MS1. After measuring downlink channel quality information, MS1 sends the fast feedback data through fast feedback channel #n and MMR-BS can detect the fast feedback data of MS1. In the case of MS2 in RS area, after broadcasting the 2nd fast feedback channel allocation information by using the RS_FAST_FEEDBACK allocation IE, MMR-BS and RS allocate the 2nd fast feedback channel region within RB region. MMR-BS allocates the fast feedback channel #m in 1st feedback channel region to MS2. And then, MS2 sends the fast feedback data through feedback channel #m. RS detects the fast feedback data of MS2 from feedback channel #m in the 1st fast feedback channel region. And then, RS sends the fast feedback data to MMR-BS through feedback channel #m in 2nd fast feedback channel region. Finally, MMR-BS detects the fast feedback data of MS2 from feedback channel #m in 2nd fast feedback channel region. Generally, the 2nd fast feedback channel with the same size of 1st fast feedback channel should be allocated within RB period. Optionally, BS may allocate different size of region for the 1st and 2nd fast feedback channels. In this case, BS shall provide the RS with the mapping table of the 1st and the 2nd fast feedback channels. But this kind of method is also ignored in this contribution due to the complexity of pre/post processing.

3. Proposed Text Changes

[*insert section 8.4.5.29 as follow*]

8.4.5 Map message fields and IEs

8.4.5.4.29 RS-FAST-FEEDBACK allocation IE

MMR-BS may place RS-FAST-FEEDBACK allocation IE() in the UL-MAP to allocate RS-FAST-FEEDBACK region. RS forwards the fast feedback messages from MS to MMR-BS through RS-FAST-FEEDBACK region. The format of RS-FAST-FEEDBACK allocation IE is defined in Table xxx.

Table xxx. RS-FAST-FEEDBACK allocation IE Format

Syntax	Size	Notes
RS_FAST_FEEDBACK allocation IE {		
OFDMA symbol offset	8 bits	
Subchannel offset	7 bits	
No. OFDMA symbols	7 bits	
No. subchannels	7 bits	
Reserved	3 bits	
}		