Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Uplink HARQ for transparent RS**
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Shashikant Maheshwari 3/13/07 4:49 PM
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Re:	Call for Technical Proposals regarding IEEE Project P802.16j (IEEE 802.16j-07/007r2)
Abstract	This contribution proposes a procedure for handling retransmission of uplink HARQ for transparent RS.
Purpose	Add proposed spec changes in P802.16j Baseline Document
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Uplink HARQ for transparent RS

1. Introduction

 This contribution introduces an uplink HARQ mechanism for transparent type of RS where the RS does not transmit a preamble, FCH and DL/ULMAP directly as shown Figure 1.
  In order to reduce the resource for retransmission of HARQ bursts, the RS retransmits the HARQ burst instead of MS, if the RS has the correct HARQ burst.

 In this contribution, we propose the procedure for HARQ transmission. We don't suggest the MAP allocation for HARQ burst and an ACK/NAK channel on relay-link.
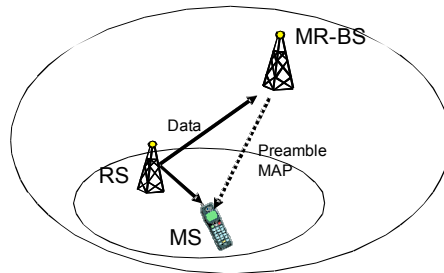

Figure 1 transparent RS

2. Proposed Uplink HARQ procedure

 For uplink HARQ, RS decodes a HARQ burst from MS and reports the status of HARQ burst by using ACK/NAK through ACK channel prepared by MR-BS. By the result of ACK channel, the MR-BS decides whether RS or MS retransmits the HARQ burst.

 If RS decodes HARQ burst from MS correctly, the RS sends ACK signal to MR-BS. Then the MR-BS allocates bandwidth to RS to relay the HARQ burst. On the other hand, if RS fails to receive the HARQ burst from MS, the RS sends NAK signal to MR-BS. The MR-BS transmits the UL MAP to the MS to retransmit the burst and to the RS to report ACK or NAK.

 Figure 2 shows the UL HARQ procedure. MR-BS allocates uplink resource for the MS to transmit HARQ burst and ACKCH for the RS by UL MAP. The RS transmits ACK/NAK signal to the MR-BS which indicates the result of decoding the HARQ burst from MS. If RS fails to receive the HARQ burst from MS, the RS sends NAK signal to MR-BS. Subsequently, the MR-BS requests MS to retransmits the HARQ burst and RS to send ACK/NAK of the retransmission. On the other hand, if RS received the HARQ burst correctly, the RS sends ACK signal to MR-BS. Then the MR-BS requests RS to relay the HARQ burst.
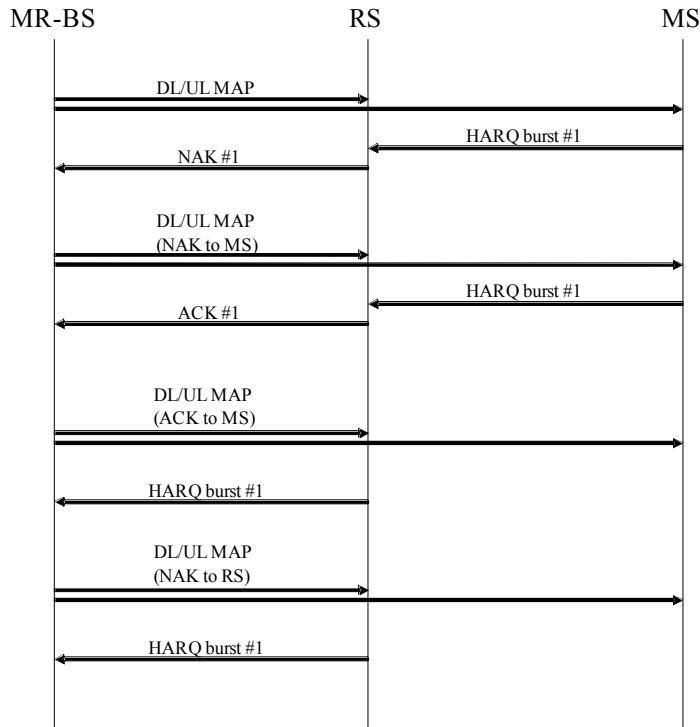
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Figure 2 UL HARQ procedure for transparent RS

3. Specific text changes

[Insert new sub-clause 6.3.17.5.2]
6.3.17.5.2 UL HARQ for two-hop transparent RS

 When the MR-BS chooses to receive an HARQ sub-burst from the MS through the RS, it shall inform the RS and allocate UL transmission for the RS to relay the burst to the MR-BS. If an RS receives a HARQ sub-burst from an MS correctly, the RS saves it for any possible retransmission, and sends an ACK signal to the MR-BS using the ACK channel prepared by MR-BS. Then the MR-BS allocates bandwidth for the RS to relay the HARQ sub-burst. If the MR-BS receives ACK signal from the RS, it sends an ACK on HARQ ACK Bitmap IE to the MS directly. If the MR-BS cannot decode the sub-burst relayed by the RS correctly, the MR-BS sends a NAK to the RS and allocates bandwidth for the RS to retransmit the saved sub-burst. If an RS fails to receive

the HARQ sub-burst from MS correctly, the RS sends a NAK signal to the MR-BS and the MR-BS sends a NAK to the MS. Subsequently, the MR-BS may request the MS to retransmit the HARQ sub-burst.

 It is also possible for the MR-BS to receive the first transmission from an MS directly. In such a case, the MR-BS informs the RS using the Compact_UL-MAP MONITOR IE that it needs to monitor the transmission. The RS, having the information on uplink resource allocations sent in the UL-MAP for the MS, monitors the HARQ sub-burst transmission sent by the MS to the MR-BS directly and attempts to decode it. When the RS receives the HARQ sub burst correctly, the RS saves it for a possible retransmission and sends an ACK to the MR-BS. On receiving the ACK from RS, MR-BS sends an ACK on HARQ ACK Bitmap IE to the MS directly. If the burst is received incorrectly at the RS the RS sends a NAK to MR BS. If MR-BS did not receive the HARQ sub-burst from the MS correctly and received a NAK from the RS, the MR-BS sends NAK on HARQ ACK Bitmap IE to the MS. Subsequently, the MR-BS may request the MS to retransmit the HARQ sub-burst. If MR-BS receives the HARQ sub-burst from the MS correctly then regardless of the ACK/NAK received from the RS, the MR-BS sends ACK on HARQ ACK Bitmap IE to the MS.

[Insert new subclause 6.3.2.3.43.6.11 and add table:]
6.3.2.3.43.6.11 UL HARQ for two-hop transparent RS

 The Compact_UL-MAP MONITOR IE provides the list of CIDs of the MS whose transmissions need to be monitored in the UL part of the current frame and relayed in the next frame to the MS.

Syntax	Size	Notes
Compact DL-MAP_IE() {		
UL-MAP Type = 7	3 bits	
UL-MAP subtype	5 bits	
Number of CIDs	4 bits	Number of CIDs in the IE
For(i=0; i<Number of CIDs; i++) {		
CID(i)	16 bits	The CIDs of the connections that RS shall monitor in the current frame
}		
}		

8.4.5.4.25 HARQ ACK region allocation IE
[Insert the following text at the end of the subclause]

 This IE may be used by MR-BS to define an ACK channel region on the R-UL to include one or more ACK channel(s) for RS.

 RS receives HARQ UL sub-burst from MS for relaying to MR-BS at frame *i* shall transmit the ACK/NAK signal through the ACK Channel in the ACKCH region for UL MS data at frame $(i+k)$. The frame offset k is defined by the "HARQ ACK Delay for UL Burst for MR" field in the UCD message.

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[Insert the following table after table 302t]

Table 302xx – HARQ ACKCH region allocation for UL MS Data IE

Syntax	Size	Notes
HARQ ACKCH_Region_for UL Relay IE() {		
Extended-2 UIUC	4 bits	0xYY
Length	8 bits	Length in bytes
OFDMA Symbol offset	8 bits	
Subchannel offset	7 bits	
No.OFDMA symbols	5 bits	
No.subchannels	4 bits	
}		

4. References

[1] C802.16j-06_132, "Relaying methods proposal for 802.16j"

[2] C802.16j-06_266r1, "Relay-Assisted Hybrid ARQ"

[3] C802.16j-06_197r1, "HARQ with Relays"

[4] C802.16j-07_002r1, "DL HARQ with Relays"

[5] C802.16j-07_029, "UL HARQ with Relays"

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