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Title	Downlink HARQ for transparent RS	
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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 downlink HARQ for transparent RS.
Purpose	Add proposed spec changes in P802.16j Baseline Document
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Downlink HARQ for transparent RS

~~1.~~ **Assumption**

~~It is assumed that in case of transparent RS operation ACK/NAK signaling happens between MR-BS and M.~~

2. Specific text changes

[Insert new sub-clause 6.3.17.5.1]

6.3.17.5.1 DL HARQ for Transparent RS

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[Insert new sub-clause 6.3.17.5.1.1]

6.3.17.5.1.1 RS Hop-by-Hop HARQ

When MR-BS or RS sends a HARQ sub-burst to MS through RS, the RS shall receive the HARQ sub-burst from the MR-BS for relaying the burst to the MS. If the RS receives the HARQ sub-burst correctly, then the RS sends an ACK signal to the MR-BS and saves it for the event that there may be a retransmission to MS. Subsequently, the RS forwards the sub-burst to the MS. If the RS does not receive the HARQ sub-burst successfully, the RS shall send a NACK signal to the MR-BS. Upon receiving the NACK from the RS, the MR-BS shall retransmit the HARQ sub-burst to the RS. When HARQ sub-burst is successfully received at RS, MS-BS request RS to transmit HARQ sub-burst. When the MR-BS receives a NACK from the MS, the MR-BS notifies the RS to retransmit the HARQ sub-burst to the MS, and the RS shall retransmit the stored correct HARQ sub-burst to the MS.

[Insert new sub-clause 6.3.17.5.1.2]

6.3.17.5.1.2 RS assisted HARQ

In a case where the MR-BS sends a HARQ sub-burst to the MS directly, the MR-BS informs the RS that it needs to monitor that particular transmission by Compact DL-MAP MONITOR IE and also allocate HARQ ACK region allocation IE on the relay link for sending ACK/NACK from RS. The RS, having information on the downlink resource allocations sent in the DL-MAP for the MS and Compact DL-MAP MONITOR IE, monitors the HARQ sub-burst transmission sent to MS by 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.

When MR-BS receives ACK/NACK from MS directly, MR-BS informs RS to reply ACK/NACK signal after RS receives the HARQ sub-burst. In this case, MR-BS receives ACK/NACK from RS and MS separately. When MR-BS receives NACK from both RS and MS, MR-BS retransmits the HARQ sub-burst. If MR-BS receives ACK from RS and NACK from MS, MS-BS makes the RS retransmits the HARQ sub-burst.

MR-BS may also configure RS to listen the ACK/NACK from the MS using Compact DL-MAP MONITOR IE.

After the RS receives ACK/NACK from the MS, the RS replies using an encoded ACK/NACK defined in Table xxx through ACK channel prepared by MR-BS. RS shall clear the HARQ sub-burst depending upon the ACK/NACK information received from MS. If the RS received the HARQ sub-burst correctly and receives a NACK from MS, the RS replies the C_2 to MR-BS. In this case, the MR-BS requests the RS to retransmit the HARQ sub-burst saved at the RS. When the RS fails to receive the HARQ sub-burst and receives a NACK from the MS, the RS sends a NACK to the MR-BS. Then the MR-BS retransmits the burst by itself. When the RS receives an ACK from MS then irrespective of whether RS receives the HARQ sub-burst correctly or not, the RS replies ACK to the MR-BS. RS will send the encoded ACK/NACK in the UL ACKCH according to the order of CID in the compact DL-MAP MONITOR IE.

Multiple transparent RSs can also be involved in the HARQ process. The schedule of source station transmitting a sub-burst to multiple transparent RSs can be signaled by using DL_COMPACT_MONITOR_IE Compact DL-MAP MONITOR IE which points to the burst to be received by the RSs. If an RS fails to decode the burst correctly, it shall not reencode the erroneous packet to transmit to the next hop station. In case of hop-by-hop HARQ involving multiple RSs, HARQ data is scheduled and forwarded to the next hop when MR-BS receives an ACK from at least one of the RSs, and the MR-BS shall schedule one or more RSs that sent ACK to forward the data to the next hop. In case of multiple RSs when the resource is prescheduled for all the links, one of the RSs can be selected as designated RS per hop, which is responsible for forwarding and reporting status to MR-BS in addition to the data forwarding. The designated RS waits for the UL ACK from the next-hop RS or MS after it forwards the HARQ packet or transmits the pilots to the next hop.

If MS sends an ACK, the designated RS reports a C_0 code; otherwise the designated RS replies by choosing C_2 from Table xxx.

6.3.2.3.43.4 HARQ control IE

[Insert new field in table 94 (HARQ control IE format) as indicated:]

<u>Syntax</u>	<u>Size</u>	<u>Notes</u>
<u>RSH</u>	<u>1 bit</u>	<u>0 = RS-assisted HARQ is enabled</u> <u>1 = RS-assisted HARQ is disabled</u>

[Insert new subclause 6.3.2.3.43.6.10 and add table:]

6.3.2.3.43.6.10 Compact_DL-MAP MONITOR IE

In RS-assisted relay case, MR-BS sends the Compact DL-MAP MONITOR IE to RS. The Compact DL-MAP MONITOR IE provides the list of CIDs of the MS whose transmissions need to be monitored in the DL part of the current frame and relayed in the next frame to the MS.

<u>Syntax</u>	<u>Size</u>	<u>Notes</u>
<u>Compact DL-MAP_IE()</u> {		
<u>DL-MAP Type = 7</u>	<u>3 bits</u>	
<u>DL-MAP subtype</u>	<u>5 bits</u>	
<u>N_CID_encoded</u>	<u>4 bits</u>	<u>Number of CIDs for which RS uses the encoded ACK/NACK</u>
<u>N_CID_direct</u>	<u>4 bits</u>	<u>Number of CIDs for which RS uses the direct feedback</u>
<u>For(i=0; i<N_CID_encoded + N_CID_direct; i++) {</u>		
<u>RCID_IE(i)</u>	<u>16 bits</u>	<u>The CIDs of the connections that RS shall monitor in the current frame</u>
<u>—}</u>		
<u>}</u>		

N_CID_encoded

This field specifies the number of CIDs to use the encoded ACK/NACK among CIDs list in this IE. The CIDs from the beginning of the list to the value of this field use the encoded ACK/NACK.

N_CID_direct

This field specifies the number of CIDs to use the direct ACK/NACK among CIDs list in this IE. The CIDs from the N_CID_encoded to the end of the list use the direct ACK/NACK.

8.4.5.4.13 UL ACK channel

[Insert the following text and add table:]

When MR-BS receives the ACK/NACK signal from MS through RS in the RS-assisted relay case, the new sequences based on Table 301a is used. RS notifies the status of HARQ sub-burst at both RS and MS with the encoded ACK/NACK signal defined in the table xxx. When RS receive ACK signal from MS then irrespective of whether RS receives the HARQ sub-burst correctly or not, the RS replies ACK to the MR-BS.

Table xxx: ACK / NACK Encoding

<u>Link Distance/Depth</u>	<u>ACK/NACK 1-bit symbol</u>	<u>Vector Indices per Tile Tile(0), Tile(1), Tile(2)</u>	<u>Code #</u>
<u>Any Distance</u>	<u>0 (ACK)</u>	<u>0, 0, 0</u>	<u>C₀</u>
<u>1</u>	<u>1 (NACK)</u>	<u>1, 1, 1</u>	<u>C₁</u>
<u>2</u>	<u>1 (NACK)</u>	<u>2, 2, 2</u>	<u>C₂</u>
<u>3</u>	<u>1 (NACK)</u>	<u>3, 3, 3</u>	<u>C₃</u>

<u>4</u>	<u>1(NACK)</u>	<u>4,4,4</u>	<u>C₄</u>
<u>5</u>	<u>1(NACK)</u>	<u>5,5,5</u>	<u>C₅</u>
<u>6</u>	<u>1(NACK)</u>	<u>6,6,6</u>	<u>C₆</u>
<u>7</u>	<u>1(NACK)</u>	<u>7,7,7</u>	<u>C₇</u>

[Insert new sub-clause 8.4.5.4.13.1]

8.4.5.4.13.1 UL Compact HARQ Report Channel

For saving the radio resource, MR-BS may allocate one ACK report channel shared by the RSs along a relay path. A HARQ status report of relay link is created by a RS only when the RS fails in decoding the received HARQ packet. It needs report the hop number of failure link to MR-BS for indicating the retransmission requirement. The physical channel for 3-bit HARQ report channel is the same as fast-feedback channel sub-carrier modulation defined in Table 298c in 8.4.5.4.10.5 and is called as 3-bit compact HARQ report channel. The physical channel for 6-bit HARQ report channel is the same as enhanced fast-feedback channel sub-carrier modulation defined in Table 298d in 8.4.5.4.10.5 and is called as 6-bit compact HARQ report channel.

The basic configuration of compact HARQ report channel is listed in Table yyy. The basic configuration of compact HARQ report channel is listed in Table yyy. The failure decoding of forwarding DL data packet and UL data packet at the kth hop is encoded for the specific hop number and the associated compact HARQ report channel is generated by the kth RS node and the (k-1)th RS respectively. The intermediate relaying RS(s) should decode and forward the compact HARQ report channel without modification of the encoding if the bits of compact HARQ channel are allocated for the upstream or downstream RS(s). Contrarily, the intermediate relaying RS(s) should decode, encode and forward the new encoding if it is scheduled to report its status to MR-BS through the compact HARQ report channel.

Table yyy - Encoding of Compact HARQ Report Channel for Normal UL HARQ report channel

<u>Compact HARQ Report Channel</u>	<u>3-bit</u>		<u>6-bit</u>			<u>6-bit</u>		
	<u>HARQ_CH#1</u>		<u>HARQ_CH#1</u>	<u>HARQ_CH#2</u>	<u>HARQ_CH#3</u>	<u>HARQ_CH#1</u>	<u>HARQ_CH#2</u>	
<u>Success</u>	<u>x00</u>	<u>000</u>	<u>xxxx00</u>	<u>xx00xx</u>	<u>00xxxx</u>	<u>xxx000</u>	<u>000xxx</u>	
<u>Failure Hop Number</u>	<u>1</u>	<u>x01</u>	<u>xxx01</u>	<u>xx01xx</u>	<u>01xxxx</u>	<u>xxx001</u>	<u>001xxx</u>	
	<u>2</u>	<u>x10</u>	<u>xxx10</u>	<u>xx10xx</u>	<u>10xxxx</u>	<u>xxx010</u>	<u>010xxx</u>	
	<u>3</u>	<u>x11</u>	<u>011</u>	<u>xxx11</u>	<u>xx11xx</u>	<u>11xxxx</u>	<u>xxx011</u>	<u>011xxx</u>
	<u>4</u>		<u>100</u>			<u>xxx100</u>	<u>100xxx</u>	
	<u>5</u>		<u>101</u>			<u>xxx101</u>	<u>101xxx</u>	
	<u>6</u>		<u>110</u>			<u>xxx110</u>	<u>110xxx</u>	
	<u>7</u>		<u>111</u>			<u>xxx111</u>	<u>111xxx</u>	

[Insert new sub-clause 8.4.5.4.13.1]

8.4.5.4.13.1 Dedicated HARQ Report Channel for Transparent RS

The purpose and usage scheme of dedicated HARQ report channel are the same as that designed for non-transparent RS as defined in section xxx.

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”
- [6] ~~C802.16-07_185r6, “HARQ in Multi-hop Relay System”~~ C802.16-07_185r6, “HARQ in Multi-hop Relay System”