Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**ARQ ACK Piggybacking for 802.16a**
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Re:	IEEE 802.16 Working Group Letter Ballot #4 (P802.16a/D1-2001)
Abstract	This document proposes an alternative method of piggybacking ARQ_feedback_IE () in 802.16a, instead of the sub-header approach. While the sub-header approach appears elegant, it also results in a variable size sub-header, which is not only a deviation from other sub-header definitions, but also complicates implementations.
Purpose	Incorporate the changes proposed in this document into P802.16a/D1-2001
Notice	
Release	
Patent Policy and Procedures	

1 Introduction and Summary

This document proposes an alternative method of piggybacking ARQ_feedback_IE () in 802.16a, instead of the sub-header approach. While the sub-header approach appears elegant, it also results in a variable size sub-header, which is not only a deviation from other sub-header definitions, but also complicates implementations. It is suggested that a fixed size ARQ feedback sub-header be used along with an alternative method to piggyback the actual ARQ feedback information.

The basic idea is to use the TYPE field to indicate the presence of ARQ-feedback sub-header (one byte) and use the one-byte sub-header to indicate the position of the ARQ-feedback_IE()s within the MAC PDU. Similar to the MSDU and MSDU fragments, the ARQ-feedback IEs are also preceded by a packing sub-header. Ideally, only the length field (11 bits) of the packing sub-header is required for this purpose, i.e., maximum of two bytes. This would require that we define an additional packing sub-header, with no BSN and FC fields. However, for consistency reasons, we propose that we use the existing 2-11 GHz packing sub-header, by ignoring the BSN and FC fields, when the packed payload is ARQ_feedback_IEs. Since a packing sub-header always precedes the ARQ_feedback_IEs, the TYPE "ARQ-feedback and 2-11 GHz Fragmentation sub-headers present" is no longer needed. Similarly, the feedback sub-header cannot be present in a PDU when no packing sub-headers are present

The following section describes the specific changes to be made to P802.16a/D1-2001.

2 Specific Changes to P802.16a/D1-2001

Page 42, Section 6.2.3.4.3 replace paragraph from lines 52-57 with the following:

The presence of sub-headers is indicated by the value of the TYPE field in the generic MAC header. Table 162 lists the encoding of the TYPE field. Figure 136 illustrates the generic structure of the MAC PDU with various sub-headers. 2 - 11 GHz systems use a fragmentation sub-header that also contains an ARQ ACK field. The ARQ ACK field shall be ignored when ARQ is neither used nor implemented. The 802.16a block-numbering scheme is detailed in clause 6.2.4.1.

Page 43, Section 6.2.3.4.3 replace Figure 136 with the following:

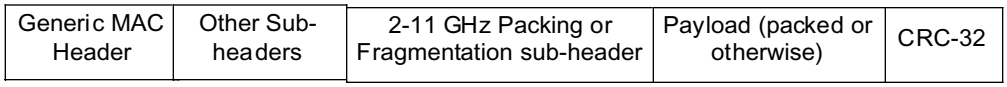

Figure 136: Example PDU with sub-headers

Page 43, Section 6.2.3.4.3, Table 162, Column 2, line 31:

Remove the comment for TYPE 0x08 and change it to Reserved

0x08 Reserved

Page 43, Section 6.2.3.4.3, Table 162, remove lines 38 and change line 40 to:

0x0C - 0x3F Reserved

Page 44, Section 6.2.3.4.3, Table 162, Column 2, line 24:

Remove the comment for TYPE 0x08 and change it to

0x08 Reserved

Page 44, Section 6.2.3.4.3, Table 163, remove lines 32-34 and change line 36 to:

0x0C – 0x3F Reserved

Page 44, Section 6.2.3.4.3.1 replace Figure 137 with the following:

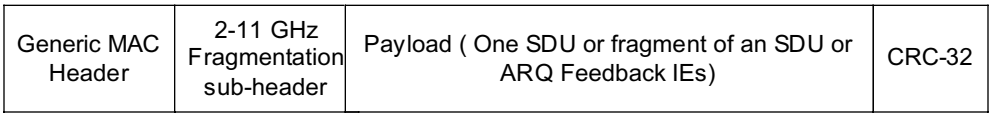

Figure 117: PDU with 2-11 GHz fragmentation sub-header(s)

Page 45, Section 6.2.3.4.3.2 replace first paragraph (text from lines 35-44) with the following:

In this case each PDU may contain multiple MAC SDUs or fragments thereof and ARQ feedback payload. Each of the packed MAC SDU or MAC SDU fragments or ARQ feedback payload requires its own packing sub-header as some of them may be transmissions while other are re-transmissions. The reader shall note that the BLOCK_SIZE parameter must be set even if ARQ is not in use. Knowledge of the BSN of the first block, the length of each MAC SDU fragment (conveyed in the packing sub-header) and the BLOCK_SIZE parameter enable the calculation of the range of blocks contained in each of the packed message. The position of 2 – 11 GHz Packing sub-header within a PDU and the contents of the packing sub-header are shown in Figure 138 and Table 165 respectively. Note that the A-bit is not present in the packing sub-header.

An ARQ feedback payload consists of one or more ARQ Feedback Information Elements defined in Table 166 and described in clause 6.2.4.2. Only one ARQ feedback payload shall be present within a single MAC PDU. The packing sub-header preceding the ARQ feedback payload indicates the total length of the payload including the three byte packing sub-header and all ARQ Feedback Information Elements within the payload. The position of the ARQ feedback payload within a MAC PDU is indicated within the ARQ Feedback sub-header, as described in clause 6.2.3.4.3.3. For example, if the value of ARQ feedback sub-header is 0, then the payload followed by the first packing sub-header contains the ARQ Feedback Information Elements, if the value is 1, then the payload followed by the second packing sub-header contains the ARQ Feedback Information Elements, and so on.

Page 45, Section 6.2.3.4.3.2 replace Figure 138 with the following:

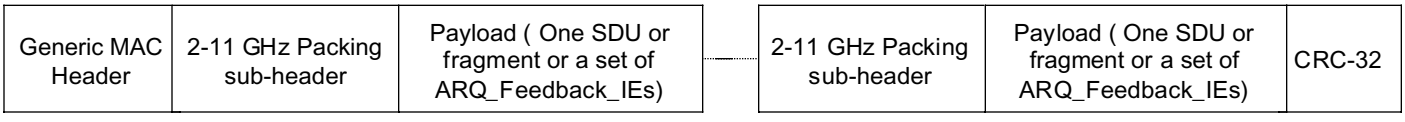

Figure 2: Structure of the MAC PDU with 2 – 11 GHz Packing sub-header

Page 46, Section 6.2.3.4.3.2 replace Table 165 with the following:

Table 161: Format of 2 – 11 GHz Packing sub-header

Syntax	Size	Notes
2_11_GHz_Packing _Sub_Header_Format() {	24 bits	
FC	2 bits	Fragmentation Control Indicates the fragmentation state of the payload: 00 = no fragmentation 01 = last fragment 10 = first fragment 11 = continuing (middle) fragment FC bits shall be ignored, if the payload followed by this packing sub-header is an ARQ feedback payload
Length	11 bits	The length in bytes of the MAC SDU or MAC SDU fragment or ARQ feedback payload, including the three-byte 2_11_GHz_Packing sub-header
BSN	11 bits	Block sequence number for the first ARQ block in the MAC SDU or MAC SDU fragment. The BSN shall be ignored, if the payload followed by this packing sub-header is an ARQ feedback payload.
}		

Page 46, line 28, add the following section on ARQ Feedback sub-header format:

6.2.3.4.3.3 2 – 11 GHz ARQ Feedback sub-header

The ARQ feedback sub-header is a one-byte field that contains the position of the ARQ Feedback payload within the MAC PDU. Table 166 shows the format of this sub-header.

Table 166: Format of 2 – 11 GHz ARQ Feedback sub-header

Syntax	Size	Notes
2_11_GHz_ARQ _Feedback_Sub_Header_Format() {	8 bits	
ARQ Payload Position	8 bits	The position of the ARQ Feedback payload (consists of one or more ARQ_feedback_IE ()s) within the MAC PDU. For example, 0 = Payload followed by the first packing-sub-header is the ARQ feedback payload 1 = Payload followed by the second packing-sub-header is the ARQ feedback payload And so on.
}		

Page 46, Section 6.2.4 change line 44 to:

"basic management connection, or piggybacked on an existing connection. ARQ feedback"

Page 47, Section 6.2.4.2 change line 9-12 to:

Table 166 shows the basic ARQ acknowledgment information element used by the receiver to signal positive or negative acknowledgments. This information element may be a transported as a piggybacked ARQ feedback payload or as a payload in a standalone PDU.