<table>
<thead>
<tr>
<th>Project</th>
<th>IEEE 802.16 Broadband Wireless Access Working Group [<a href="http://ieee802.org/16">http://ieee802.org/16</a>]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Figures accompanying ballot</td>
</tr>
<tr>
<td>Date Submitted</td>
<td>2002-1-4</td>
</tr>
<tr>
<td>Source(s)</td>
<td>Carl Eklund Voice: +358718036566</td>
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<tr>
<td></td>
<td>Nokia Fax: +358718036851</td>
</tr>
<tr>
<td></td>
<td>P.O. BOX 407 [<a href="mailto:carl.eklund@nokia.com">mailto:carl.eklund@nokia.com</a>]</td>
</tr>
<tr>
<td></td>
<td>FIN-00045 Nokia Group, Finland</td>
</tr>
<tr>
<td>Re:</td>
<td>Working group letter ballot on IEEE 802.16a/D1-2001</td>
</tr>
<tr>
<td>Abstract</td>
<td>The document contains figures referenced in comments by the author</td>
</tr>
<tr>
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</tr>
</tbody>
</table>
Figures referenced in comments

Carl Eklund
Nokia

1.

The Fragmentation sub-header (FSH) is shown in Table 1.

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fragmentation sub-header () {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>FSN</td>
<td>3 bits</td>
<td>Bits 2:0</td>
</tr>
<tr>
<td>reserved for CS use</td>
<td>3 bits</td>
<td></td>
</tr>
<tr>
<td>FCR</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>FSNR</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>FSN</td>
<td>3</td>
<td>Bits 5:3</td>
</tr>
<tr>
<td>reserved</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>TSN</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The fields of the Fragmentation sub-header are defined in Table 2.

### Table 2—Fragmentation Sub-header Fields

<table>
<thead>
<tr>
<th>Name</th>
<th>Length (bits)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC</td>
<td>2</td>
<td>Fragmentation Control indicates the fragmentation state of the payload: 00 = no fragmentation, 01 = last fragment, 10 = first fragment, 11 = continuing (middle) fragment</td>
</tr>
<tr>
<td>FSN</td>
<td>6</td>
<td>Fragmentation Sequence Number defines the sequence number of the current SDU fragment. This field increments by one (modulo 64) for each fragment, including unfragmented SDUs.</td>
</tr>
<tr>
<td>FCR</td>
<td>2</td>
<td>Replicates the value of the FC bits in the original transmission unit</td>
</tr>
<tr>
<td>FSNR</td>
<td>6</td>
<td>Replicates the FSN of the original transmission unit</td>
</tr>
<tr>
<td>TSN</td>
<td>11</td>
<td>Transmission Unit Sequence number</td>
</tr>
</tbody>
</table>

The Packing sub-header is defined in Table 3.

### Table 3—Packing Sub-header

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packing sub-header () {</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>FSN</td>
<td>3 bits</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>11 bits</td>
<td></td>
</tr>
<tr>
<td>FCR</td>
<td>2 bits</td>
<td></td>
</tr>
<tr>
<td>FSNR</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>FSN</td>
<td>3</td>
<td>Bits 5:3</td>
</tr>
<tr>
<td>reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSN</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The fields of the packing sub-header are defined in Table 4.
### Table 4—Packing Sub-header Fields

<table>
<thead>
<tr>
<th>Name</th>
<th>Length (bits)</th>
<th>Description</th>
</tr>
</thead>
</table>
| FC   | 2             | Fragmentation Control  
Indicates the fragmentation state of the payload:  
00 = no fragmentation  
01 = last fragment  
10 = first fragment  
11 = continuing (middle) fragment |
| FSN  | 6             | Fragmentation Sequence Number  
Defines the sequence number of the current SDU fragment. This field increments by one (modulo 64) for each fragment, including unfragmented SDUs. |
| Length | 11   | The length in bytes of the MAC SDU or SDU fragment, including the two-byte packing sub-header. |
| FCR  | 2             | Replicates the value of the FC bits in the original transmission unit |
| FSNR | 6             | Replicates the FSN of the original transmission unit |
| TSN  | 11            | Transmission Unit Sequence number |

### Table 5—ARQ Feedback Sub-header Fields

<table>
<thead>
<tr>
<th>Name</th>
<th>Length (bits)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSN</td>
<td>11</td>
<td>Transmission Unit Sequence number</td>
</tr>
<tr>
<td>reserved</td>
<td>5</td>
<td>Acknowledgement map</td>
</tr>
</tbody>
</table>

-
### Table 6—ARQ_feedback_IE

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARQ_feedback_IE()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CID</td>
<td>16 bits</td>
<td></td>
</tr>
<tr>
<td>TSN</td>
<td>11 bits</td>
<td></td>
</tr>
<tr>
<td>reserved</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>ACK MAP</td>
<td>16 bits</td>
<td></td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 7—ARQ Feedback Message Format

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARQ_Feedback_Message_Format()</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management Message Type = 34</td>
<td>8 bits</td>
<td></td>
</tr>
<tr>
<td>Number of ARQ_feedback_IEs</td>
<td>8 bits</td>
<td></td>
</tr>
<tr>
<td>for (i = 1; i &lt; n; i++)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARQ_feedback_IE</td>
<td>32 bits</td>
<td></td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
First transmissions (MAC PDUs):

- TSN=0xF2, FC=01, FCR=01, FSN=0x05, FSNR=0x05
- TSN=0xF3, FC=10, FCR=10, FSN=0x06, FSNR=0x06

The retransmission case when no refragmentation is needed.

Retransmission of 0xF2:

- TSN=0xF2, FC=00, FCR=01, FSN=0x09, FSNR=0x05

Figure 1—Retransmission without refragmentation

The last block of the MAC SDU#1 is lost during the transmission. The modulation is changed to more robust and the retransmitted MAC PDU has to be refragmented.

Retransmission of 0xF2:

- TSN=0xF2, FC=01, FCR=01, FSN=0x09, FSNR=0x05
- TSN=0xF2, FC=10, FCR=01, FSN=0x0A, FSNR=0x05
- TSN=0xF2, FC=11, FCR=01, FSN=0x0B, FSNR=0x05

Figure 2—Retransmission with refragmentation