Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	ARQ selective bitmap clarifications
Date Submitted	**2004-11-16**
Source(s)	David Ashkenazi, david.ashkenazi@intel.com Voice: +972-54-5551083 Assaf Mor, Assaf.Mor@intel.com +972-54-5551067 Yigal Eliaspur, yigal.eliaspur@intel.com Voice: +972-547-884877 Yuval Lomnitz Yuval.Lomnitz@intel.com Intel Corp.
Re:	IEEE P802.16d/D5-2004
Abstract	ARQ selective bitmap clarifications
Purpose	
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.
Patent Policy and Procedures	The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:chair@wirelessman.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.

ARQ selective bitmap clarifications

David Ashkenazi
Yigal Eliaspur

1. Motivation

ARQ selective bitmap size is in 16 bits resolution, the std does not specify an un-ambiguity way for the receiver to give feedback for number of blocks which are not a multiple of 16.

We suggest to left align the ACK bit MAP to the highest block number to be reported.

The two following example shows the ambiguity in the current scheme:

1.1. Example

Receiver would like to report success for blocks 100 to 117, failure for block 118 and success for block 119.
The receiver will fill the following values to the MAP Feedback IE:

- BSN=100
- Number of Ack Maps = 2
- Ack type = 0

The two MAPS will looks as follows:

MSB LSB

1	1	…													1
100	101														115

MSB LSB

1	1	0	1	?											?
116	117	118	119	120											131

There is an ambiguity on BSN 119 to 131. If zero will be used as a report does it indicate NACK or should it be ignored?

The line 54 at page 137 specifies:

"A bitmap entry not indicating acknowledgement shall be considered a NACK for the corresponding blocks."

2. Proposed solution No 1

In the selective ACK case (ACK type 0x0 and 0x2) BSN should be assign appropriately so that the last block to be reported is reported via the LSB of the last ACK Map .

The BSN field should be adjusted accordingly - BSN of last reported block number minus the total MAPs size.

The following shows how the suggestion solution been applied to the previous example:

2.1. Example's solution

Receiver would like to report success for blocks 100 to 117, failure for block 118 and success for block 119.
The receiver will fill the following values to the MAP Feedback IE:

- BSN= 86
- Number of Ack Maps = 2
- Ack type = 0

The two MAPS will looks as follows:

MSB LSB

Note1	Note1	...								...	Note1	1	1	1	1
87	88										99	100	101	102	103

MSB LSB

1	…										...	1	1	0	1
104												116	117	118	119

Note1: BSN 87 to 99 where reported in a previous IE, and are reported again.

3. Changes summary for solution No 1

[Make the following changes to the end of the third paragraph of section 6.3.4.2 "ARQ feedback IE format ":]

BSN
If (ACK Type == 0x0): BSN value corresponds to the most significant bit of the first 16-bit ARQ ACK map.
If (ACK Type == 0x1): BSN value indicates that its corresponding block and all blocks with lesser (see 6.3.4.6.1) values within the transmission window have been successfully received.
If (ACK Type == 0x2): Combines the functionality of types 0x0 and 0x1.
If (ACK Type == 0x3): Combines the functionality of type 0x1 with the ability to acknowledge reception of ARQ blocks in terms of block sequences. A block sequence is defined as a set of ARQ blocks with consecutive BSN values. With this option, members of block sequences are identified and associated with the same reception status indication.

Selective ACK Map
Each bit set to one indicates the corresponding ARQ block has been received without errors. The bit corresponding to the BSN value in the IE, is the most significant bit of the first map entry. The

bits for succeeding block numbers are assigned left-to-right (MSB to LSB) within the map entry. If the ACK Type is 0x2, then the most significant bit of the first map entry shall be set to one and the IE shall be interpreted as a cumulative ACK for the BSN value in the IE. The rest of the bitmap shall be interpreted similar to ACK Type 0x0.

In the selective ACK case (ACK type 0x0 and 0x2) BSN should be assign appropriately so that the last block to be reported is reported via the LSB of the last ACK Map.

[Add at the end of paragraph 6.3.4.2 add the following]

Examples for Selective ACK Map (ACK Type= 0x0 or 0x2) usage:

Receiver would like to report success for blocks 100 to 117, failure for block 118 and success for block 119.
The receiver will fill the following values to the MAP Feedback IE:

- BSN= 87
- Number of Ack Maps = 2
- Ack type = 0 /2

The two MAPs will look as follows:

MSB															LSB
Note1	Note1	...								...	Note1	1	1	1	1
87	88										99	100	101	102	103

MSB															LSB
1	…										...	1	1	0	1
104												116	117	118	119

Note1: BSN 87 to 99 where reported in a previous IE, and are reported again. In case those BSNs where not reported in a previous IE (i.e. block number 100 is the first block transmitted on this CID), the report bit of those blocks should be ignored by the transmitter.

4. Proposed solution No 2

This solution keeps the left adjustment originally defined, and states explicitly that all the zeros after the last reported 1 (ACK) should be ignored and don't represent a NACK but a 'not yet reported' condition.

This assumes that the receiver should always report in one single message up to the last ACKed BSN, and if necessary should include more than one ARQ_feedback_IE in the message. This is necessary if the bit 65 is to be reported as an ACK, this takes more than 4 maps.

5. Changes summary for solution No 2

[Add the following text after line 54 page 137 section 6.3.4.6.2]

A bit map entry not indicating acknowledgement shall be considered a NACK for the corresponding blocks.

For a **Selective ACK Map**, all ‘zero’ bits, after the last ‘one’ bit of the last **Selective ACK MAP** of the last **ARQ_feedback_IE** for a given CID should not be considered a NACK, but should be ignored.