<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>Corrections for AAS Diversity-Map Scan in OFDMA PHY</td>
</tr>
<tr>
<td>Date Submitted</td>
<td>2004-11-12</td>
</tr>
<tr>
<td>Source(s)</td>
<td>Yuval Lomnitz, Hassan Yaghoobi, Intel Corp, <a href="mailto:yuval.lomnitz@intel.com">yuval.lomnitz@intel.com</a>, <a href="mailto:hassan.yaghoobi@intel.com">hassan.yaghoobi@intel.com</a></td>
</tr>
<tr>
<td></td>
<td>Tal Kaitz, Ran Yaniv, Alvarion, <a href="mailto:tal.kaitz@alvarion.com">tal.kaitz@alvarion.com</a>, <a href="mailto:ran.yaniv@alvarion.com">ran.yaniv@alvarion.com</a></td>
</tr>
<tr>
<td></td>
<td>Dave Pechner, Todd Chauvin, Doug Dahlby, Adam Kerr, ArrayComm Inc., <a href="mailto:dpechner@arraycomm.com">dpechner@arraycomm.com</a>, <a href="mailto:dahlby@arraycomm.com">dahlby@arraycomm.com</a>, <a href="mailto:adam@arraycomm.com">adam@arraycomm.com</a>, <a href="mailto:chauvin@arraycomm.com">chauvin@arraycomm.com</a></td>
</tr>
<tr>
<td>Re:</td>
<td>IEEE P802.16-REVd/D5</td>
</tr>
<tr>
<td>Abstract</td>
<td>This contribution introduces corrections for support of AAS Diversity-Map Scan in the OFDMA PHY</td>
</tr>
<tr>
<td>Purpose</td>
<td>Adopt into P802.16d/D5 corrigenda</td>
</tr>
<tr>
<td>Notice</td>
<td>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.</td>
</tr>
<tr>
<td>Release</td>
<td>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.</td>
</tr>
</tbody>
</table>
| 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>.
Corrections for AAS Diversity-Map Scan in OFDMA PHY
Dave Pechner, Todd Chauvin, Doug Dahlby

1 Problems with the current AAS Diversity-Map Scan definition

The definition of AAS zone and AAS operation is unclear.

1. From the text, it is not clear if more that one AAS Zone may exist per frame.

2. The text loosely infers that the AAS-DLFP message is optional, but this is not explicitly called out.

3. The AMC tile structure used in the AAS zone permutation is undefined

4. The meaning of the AAS Diversity Map Scan capability bits (11.8.3.7.3 and 11.8.3.7.4) are unclear.

In addition, the AAS diversity-map scan contains ambiguities and contradictions that need to be resolved:

5. The number of bits allocated to the AAS-DLFP is 98 bits, while at most 96 bits can fit into the AAS-DLFP slot without adding another symbol.

6. The use of “Downlink_preamble_config” and “Uplink_preamble_config” fields in the AAS-DLFP with PUSC permutation needs to be clarified.

7. The initial ranging allocation in the AAS-DLFP is insufficient to specify the allocation to subscribers which cannot detect the Allocation Start Time (starting time of the UL frame) in the UL-MAP.

8. The UL zone permutation is missing from the AAS-DLFP. This field is required for an SS that needs to send a CDMA ranging code based on the ranging IE that exists in the AAS-DLFP.

9. The location of the AAS Diversity Map zone within the AAS Zone needs to be clarified.

10. The frame period to which AAS-DLFP allocations can reference must be clarified.

11. The symbol offset definitions need to be clarified.
12. It is not clearly stated that the randomizer must have a seed of 0 for application to the AAS-DLFP. This is necessary to enable soft combining of the multiple AAS-DLFP repetitions when the AAS-DLFP content is constant across repetitions.

13. The AAS_Comp_DL_IE does not indicate the repetition for the referenced allocation.

14. The ‘subchannel offset’ field of the initial ranging allocation IE in the AAS-DLFP has 6 bits. This does not span the complete set of subchannels in UL PUSC (70 subchannels, and 6 bits can only span 64 subchannels).

2 Outline of proposed solution

The following changes are proposed. Specific text changes are presented in the next section.

1. Clarify that multiple AAS Zones may exist per frame

2. Clarify that the AAS-DLFP is optional.

3. Clarify the AMC tile structure in the AAS zone is 2x3.

4. Clarify the SS capabilities bit for Diversity Map Scan and basic AAS support

5. The AAS-DLFP should be reorganized to reduce its size to less than 96 bits. This can be achieved by:
   • Reducing the number of bits used for the beam index to 4 bits
   • Reducing the initial ranging allocation IE size to 25 bits.
   • Introducing 2 bits that describes the permutation of the AAS UL zone.
   • Introduce 1 reserve bit

6. The preamble length specified by the Downlink_preamble_config field should be limited to an integer number of slot durations for the DL PUSC permutation. Further, this field determines the preamble duration for the allocation pointed to by the DL Comp IE in the AAS-DLFP, and must be consistent with the preamble lengths described in the AAS_DL_IE and AAS_UL_IE messages.

7. Clarify the specification of the initial ranging allocation that is defined in the AAS-DLFP, so that AAS subscribers know that these allocations are referenced to the start of the DL frame, and not the Allocation Start Time. Specify that in the case of such allocations, transmission shall start TTG time after the specified integer symbol offset (BS’s TTG is known to the SS through DCD messages).

8. Add an UL Zone Permutation field to the AAS-DLFP message.

9. The location of the AAS Diversity Map zone is clarified.
10. AAS-DLFP refers to the allocations in the next frame.

11. The definition of the symbol offsets is clarified.

12. Clarify that the randomizer must have a seed of 0 for transmission of the AAS-DLFP.

13. Add a repetition field to the AAS_Comp_DL_IE

14. Increase ‘subchannel offset’ field in the ranging_allocation_IE from 6 to 7 bits.

15. Modify the structure of section 8.4.4.6 to more clearly define the AAS zone (editorial).

3 Proposed Text Changes

[Modify section 8.4.4.6 as follows]

8.4.4.6 Optional Diversity-Map Scan

8.4.4.6 Optional AAS Support

AAS support is indicated by the AAS_DL_IE and AAS_UL_IE in the downlink and uplink broadcast maps. The AAS_IE specifies an AAS zone, which is defined as a contiguous block of OFDMA symbols that has a defined permutation and preamble structure. Multiple AAS zones can be supported within a frame. Each AAS Zone may or may not contain an optional Diversity-Map Scan zone. AAS Operation without the optional Diversity-Map Scan zone is referred to as Basic AAS Mode.

Section 8.4.4.6.1:

[Modify section 8.4.4.6.1 as follows]

8.4.4.6.1 AAS frame structure

An AAS DL Zone begins on the specified symbol boundary and consists of all subchannels until the start of the next Zone or end of frame. The two highest numbered subchannels of an AAS DL Zone may be dedicated at the discretion of the BS for the AAS Diversity-Map Zone in the PUSC, FUSC and optional FUSC permutation. For the PUSC permutation, it is assumed that all AAS subscribers can decode the FCH in order to know the Used Subchannel Bitmap.

In the AMC permutation zone, the same antenna beam pattern shall be used for all pilot subcarriers and data subcarriers in a given AMC subchannel.

In the AMC permutation, the 4th and (N-4)th first and last subchannels of the total N subchannels of the AAS DL Zone may be dedicated at the discretion of the BS for the AAS Diversity-Map Zone. For AMC permutation, each subchannel for the AAS diversity MAP consists of 3 bins by 2 bins by 3 symbols. A 2 bin by 3 symbol tile structure shall be used for all AMC permutations in an AAS zone.
When these subchannels are used for this purpose a Diversity-Map zone, they shall not be allocated in the normal DL-MAP message and shall be used only on the AAS portion of the DL sub-frame. These subchannels will be used to transmit the AAS-DLFP() whose physical construction is shown in Figure 223. In the case that the AAS Diversity-Map zone is not included in the AAS zone, these subchannels may be used for ordinary traffic and may be allocated in DL_MAP messages.

[Modify section 8.4.4.6.2 as follows]

8.4.4.6.2 Optional Diversity-Map Scan

The purpose of the AAS Diversity-Map Zone is to provide a robust transmission of the required base station parameters to enable SS initial ranging, as well as SS paging and access allocation. This is achieved through transmitting the AAS-DLFP message using a highly robust form of modulation and coding (namely QPSK-1/2 rate with 2 repetitions). The start of an AAS-DLFP is marked by an AAS DL preamble. The AAS-DLFPs transmitted within the AAS Diversity Map Zone may, but need not, carry the same information. Different beams may be used within the AAS Diversity Map Zone, however each AAS Downlink Preamble and associated AAS-DLFP must be transmitted on the same beam.

The UL and DL AAS Zones are defined by the uplink and downlink extended AAS-IE in the broadcast map. In the case that a SS cannot successfully decode the broadcast maps, the SS will scan for the DLFP messages and utilize private maps within the AAS zone.

It is assumed that all AAS subscribers will be able to determine the IDcell used in the selection of the DL preamble at the beginning of the DL frame. This IDcell shall be used as the DL_PermsBase for the AAS zone. The UL_PermsBase for the UL zone referred to by the initial ranging allocation in the AAS-DLFP shall be that provided in the UCD message. For AAS subscribers that cannot detect the AAS_DL_IE transmitted in the DL-MAP which specifies the boundaries and permutation of AAS DL zones, they must search over the possible permutations (PUSC/FUSC/AMC) and starting symbol to detect the AAS-DLFP. The permutation for the AAS UL Zone is specified by a field in the AAS-DLFP.

[Replace figure 224 with the following]
Section 8.4.4.6.2.1:

Add Section 8.4.4.6.2.1 as follows:

8.4.4.6.2.1 AAS-DLFP Format

The AAS-DLFP supports the ability to transmit a MAP IE that carries either a compressed DL-MAP IE or compressed UL-MAP. This allocation message can point to a broadcast DL-MAP that is beamformed or can be used to “page” a specific SS who cannot receive the normal DL-MAP. Once the initial allocations are provided to the user, private DL-MAPs and UL-MAPs can be sent on a beamformed transmission to the user at the highest modulation and lowest coding rate that can be supported by the link. The AAS-DLFP also has an uplink initial ranging allocation for AAS subscribers. The AAS-DLFP is not randomized.

The preamble length specified by the Downlink_preamble_config field should be limited to an integer number of slot durations for the DL PUSC permutation. Further, this field determines the preamble duration for the allocation pointed to by the DL Comp IE in the AAS-DLFP, and must be consistent with the preamble lengths described in the AAS_DL_IE messages.

The contents of the AAS-DLFP() payload is described by Table 267.

Replace table 267-268 with the following table:

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAS-DLFP() {}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AAS beam index</td>
<td>4 6 bits</td>
<td>This index is the index referred to by the AAS_Beam_Select message (see</td>
</tr>
</tbody>
</table>
Preamble select 1 bit 0 - Frequency shifted preamble
1 - Time shifted preamble

Uplink preamble_config 2 bits 00 - 0 symbols
01 - 1 symbols
10 - 2 symbols
11 - 3 symbols

Downlink preamble_config 2 bits 00 - 0 symbols
01 - 1 symbols
10 - 2 symbols
11 - 3 symbols

AAS_UL_Zone_Permutation 2 bits
This field describes the permutation
used by the allocation pointed to by
the AAS_ranging_allocation_IE.
0b00 = PUSC permutation
0b01 = Optional PUSC permutation
0b10 = adjacent-subcarrier
permutation
0b11 = Reserved

AAS_Ranging_Allocation_IE() 25 28 bits
AAS_Comp_DL_IE() 51 bits
Reserved 1 bit Set to zero
HCS 8 bits

Syntax Size Notes

AAS_Ranging_Allocation_IE() {
  OFDMA symbol offset 8 bits
  The offset to the starting location of
  the ranging allocation is referenced
  to the DL preamble of the
  subsequent frame, and consists of an
  integer symbol offset specified here,
  as well as the addition of the TTG
  known from DCD messages. If
  TTG is not present in the DCD (for
  FDD) it is assumed to be zero.

  Subchannel offset 7 6 bits
  No of OFDMA symbols 4 2 bits
  No of subchannels 4 6 bits
  Ranging method 2 bits
  00 – Initial ranging over two
  symbols
  01 – Initial Ranging over four
  symbols
  10 – BW request/periodic ranging
  over one symbol
  11 – BW request/periodic ranging
  over three symbols
}

AAS_Comp_DL_IE() {
CID | 16 bits
---|---
DIUC | 4 bits Specify DIUC=15 to indicate the well known modulation of QPSK, encoded with the mandatory CC at rate ½.
OFDMA symbol offset | 8 bits Referenced to the DL frame start preamble of the next frame.
Subchannel offset | 8 bits
No of OFDMA symbols | 7 bits
No of subchannels | 6 bits
Boosting | 3 bits As specified in 8.4.5.3
Repetition Coding Indication | 2 bits As specified in 8.4.5.3

[Introduce a new section after 8.4.4.6.3.]

8.4.4.6.4 AAS Diversity-Scan Map Network Entry Procedure

The AAS network entry utilizing the DLFP involves the following procedure:

- The AAS-SS synchronizes frame timing and frequency to the frame-start DL preamble.
- For AAS-SS at cell edge, which cannot decode the FCH or broadcast DL-MAP and UL-MAP messages, they will search for the AAS-DLFP on the AAS Diversity Map Zone. This search will need to span the possible subchannel permutations.
- The AAS-SS may receive necessary messages such as the DCD and UCD pointed to by allocations made from the AAS-DLFP using the broadcast CID. These messages may be transmitted using beam-pattern diversity to increase the link budget.
- Once the AAS-SS decodes the DCD and UCD it should perform initial ranging on the interval pointed to by the best-received AAS-DLFP.
- The AAS-SS may receive a ranging response message through a DL-MAP allocation pointed to by an AAS-DLFP with the broadcast CID.
- The AAS-SS may receive initial downlink allocations through a DL-MAP allocation pointed to by the AAS-DLFP with either broadcast CID or specific CID.
- Subsequent allocations can be managed with private DL-MAP and UL-MAP allocations.

14.8.3.7.2 OFDMA SS demodulator

[Modify the table and test as follows:]

This field indicates the different demodulator options supported by a WirelessMAN-OFDMA PHY SS for downlink reception. This field is not used for other PHY specifications. A bit value of 0 indicates “not supported” while 1 indicates “supported.”
<table>
<thead>
<tr>
<th>Type</th>
<th>Length</th>
<th>Value</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>151</td>
<td>1</td>
<td>Bit #0: 64-QAM Bit #1: BTC Bit #2: CTC Bit #3: STC Bit #4: AAS with Diversity Map Scan zone Bit #5: AAS Direct Signaling Bit #6: H-ARQ Bit #7: AAS Basic Mode</td>
<td>SBC-REQ (see 6.3.2.3.23)  SBC-RSP (see 6.3.2.3.24)</td>
</tr>
</tbody>
</table>

14.8.3.7.3 OFDMA SS modulator

[Modify the table and test as follows:]

This field indicates the different modulator options supported by a WirelessMAN-OFDMA PHY SS for downlink reception. This field is not used for other PHY specifications. A bit value of 0 indicates “not supported” while 1 indicates “supported.”

<table>
<thead>
<tr>
<th>Type</th>
<th>Length</th>
<th>Value</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>152</td>
<td>1</td>
<td>Bit #0: 64-QAM Bit #1: BTC Bit #2: CTC Bit #3: AAS Basic Mode Diversity Map Scan Bit #4: AAS Direct Signaling Bit #5: H-ARQ Bits# 6–7: Reserved; shall be set to zero</td>
<td>SBC-REQ (see 6.3.2.3.23)  SBC-RSP (see 6.3.2.3.24)</td>
</tr>
</tbody>
</table>