Project	IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>		
Title	Clarifications for AAS Zone Allocations		
Date Submitted	2005-1-10		
Source(s)	Dave Pechner, Doug Dahlby, Todd Chauvin	ArrayComm Inc.	dpechner@arraycomm.com, dahlby@arraycomm.com, chauvin@arraycomm.com,
Re:	IEEE P802.16-REVd/D5		
Abstract	This contribution introduces clarifications for making allocations in an AAS zone in the OFDMA PHY		
Purpose	Adopt into P802.16d/D5 corrigenda		
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>.		

Clarifications for AAS Zone Allocations

Dave Pechner, Todd Chauvin, Doug Dahlby

1 Problems with the current AAS Zone Allocations

Corrections to the definitions of UL AAS preambles and UL AAS allocations were made in Session 34. However, these corrections did not fully define how UL allocations within an AAS zone are made. Specifically:

1. How UL allocations in an AAS zone interact with ranging and bandwidth request channels (UIUC 12,13) is not clearly defined

2. How the UL tile structure is maintained in the presence of AAS preambles is not clearly defined

2 Outline of proposed solution

The following changes were adopted during Session 34 to clarify how UIUC 12,13 allocations are allowed in UL frames:

8.4.4.5 Uplink transmission allocations

Insert the following text as the end of the section:

In the uplink, the BS shall not allocate to any SS more than one UL-MAP_IE with data burst profile UIUC (1-10) in a single frame. This limitation does not apply to H-ARQ data allocation regions.

Rectangular allocations made with UIUC = 12,13 (ranging and BW-request) shall not break the UL tile structure, and conform to the following rules:

1) In each subchannel, the size of each continuous group of OFDMA symbols remaining after allocation of UIUC = 12,13 regions shall be a multiple of 3 OFDMA symbols.
2) The slot boundaries in all subchannels shall be aligned, i.e. if a slot starts in symbol k in any subchannel, then no slots are allowed to start at symbols k+1, k+2 at any other subchannel.

The following figure depicts correct and incorrect allocations of UIUC = 12,13 regions. Each rectangle is an UL-subframe (or zone). Regions 1,2,3 are correct allocations, and 4,5 are incorrect allocations.

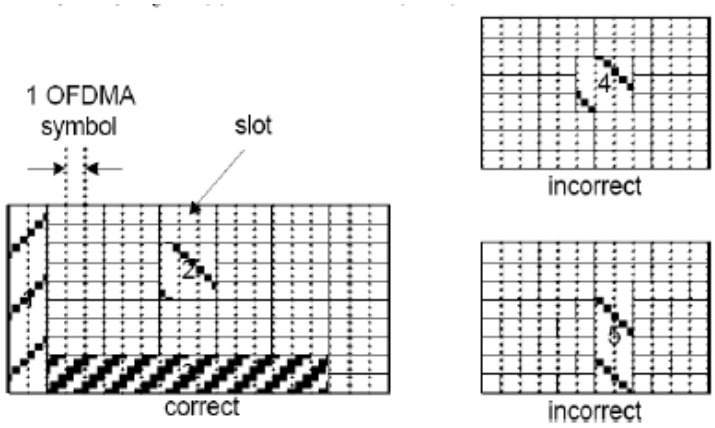


Figure 222a—Example of UIUC = 12,13 allocation rules

This clarifies that UIUC 12, 13 allocations are not allowed to break the UL tile structures. A similar strategy is followed to define restrictions in the UL AAS zone to insure that the tile structures are not broken in the presence of AAS UL preambles.

Currently, UL AAS preambles can be either 0,1,2 or 3 symbols long as defined in the UL AAS IE or the AAS DLFP messages. An UL preamble is inserted at the start of an UL allocation and whenever an UL allocation wraps from the end of an AAS to the beginning. With arbitrary length preambles inserted before any UL allocation, it is not possible to insure that UL tiles are not broken when an allocation wraps.

The proposed solution is summarized below:

1) When used in an AAS zone, a UIUC 12,13 region shall either span all subchannels and consist of an arbitrary number of symbols, or be constrained to be a multiple of 3 symbols in duration.

2) In the absence of a UIUC 12,13 region that spans all subchannels, an UL AAS Zone shall consist of an integer number of slots plus the number of UL AAS preamble symbols as defined in by the “Uplink_preamble_config” field of the UL_AAS_IE and AAS_DLFP.

   - UL AAS Zone Duration = N*3 + Uplink_preamble_config symbols

3) In the presence of one or more UIUC 12,13 regions that span all subchannels, an UL AAS Zone shall consist of an integer number of slots plus the number of UL AAS preamble symbols as defined in by the “Uplink_preamble_config” field of the UL_AAS_IE and AAS_DLFP plus the number of UIUC 12,13 symbols.

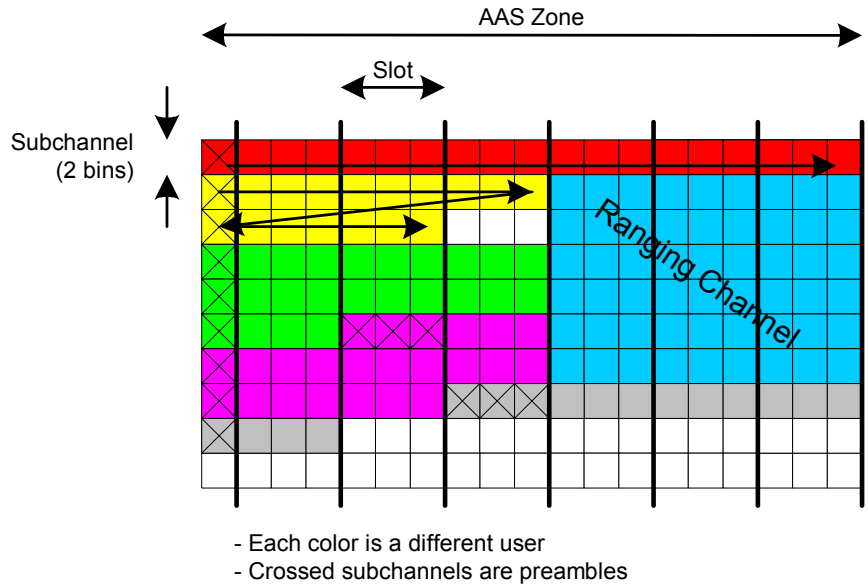
   - UL AAS Zone Duration = N*3 + Uplink_preamble_config symbols + UIUC 12,13 symbols

4) The first Uplink_preamble_config symbols of the UL AAS zone are reserved for UL AAS preambles. On a given subchannel, an UL AAS preamble will be inserted into these symbols by the SS devices who is allocated the slot following the preamble (or following a UIUC 12,13 region if it directly follows the preamble).

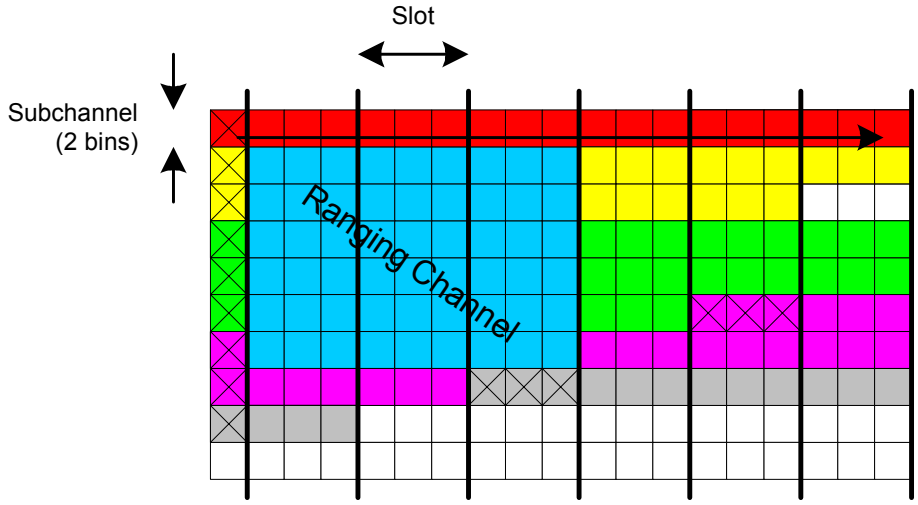
5) Any preamble inserted in an AAS zone in a location other than the first Uplink_preamble_config symbols shall be 3 symbols in duration.

The following figures show valid UL AAS Zones.

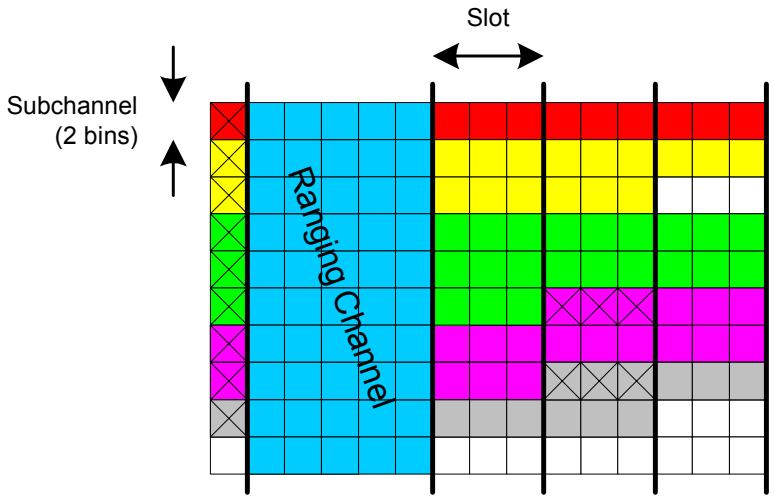
Example 1 – UIUC 12 region is an integer number of slots



Example 2 – UIUC 12 region directly follows preambles



Example 3 – UIUC 12 region spans all subchannels and duration is not an integer number of slots.



3 Proposed Text Changes

[Note that the changes described below are based upon contribution C80216maint-04_53r3 that was accepted at session 34 but was not incorporated into the working document.]

8.4.4.6.3 AAS Preambles

AAS Preambles are used to provide training information in both UL and DL AAS zones. All data allocations (UIUC 1-10, DIUC 0-12) and the optional AAS DLFP in an AAS zone are preceded by an AAS preamble.

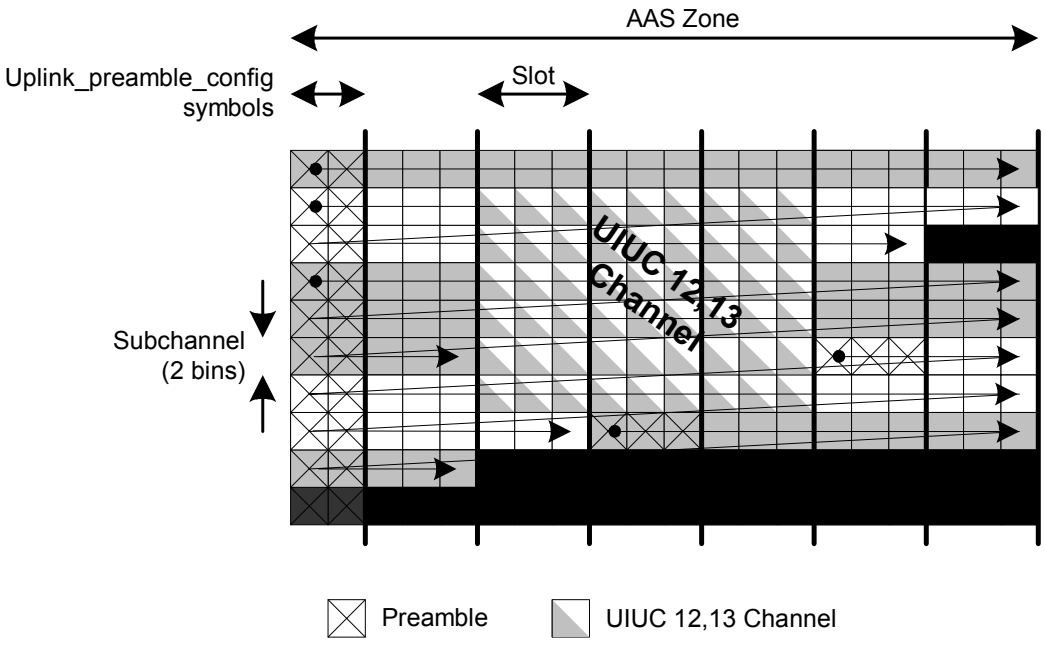
The optional AAS-DLFP is preceded by an AAS downlink preamble of one symbol duration. All other D DL bursts with DIUC 0-12 within ~~the~~ an AAS DL ~~and UL~~ zone~~s~~ have a preamble~~s~~ whose durations ~~are~~ is specified by the ~~"Uplink_preamble_config" field of the AAS_UL_IE and~~ "Downlink_preamble_config" field~~s~~ of the AAS_DL_IE. ~~These~~ This field~~s~~ will be consistent with the same field~~s~~ of the AAS_DLFP if present. In the case the AAS DL Zone is using the PUSC permutation, the "Downlink_preamble_config" shall always be set to an integer number of slot durations (i.e. 0 or 2 symbols).

An UL preamble is inserted at the start of an UL data allocation with UIUC 1-10 and whenever such an UL allocation wraps from the end of an AAS zone to the beginning. The first Uplink_preamble_config symbols of the UL AAS zone are reserved for UL AAS preambles. On a given subchannel, an UL AAS preamble will be inserted into these symbols by the SS devices who is allocated the slot following the preamble (or following a UIUC 12,13 region if it directly follows the preamble). Any UL preamble inserted in an AAS zone in a location other than the first Uplink_preamble_config symbols shall be 3 symbols in duration.

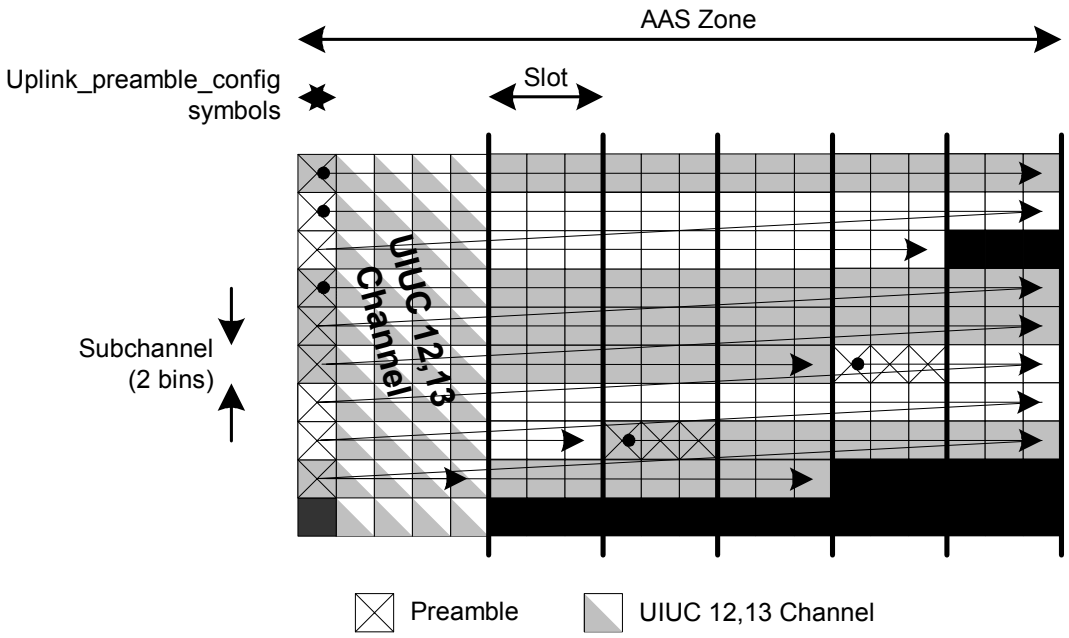
The duration of an UL AAS zone minus the reserved uplink preamble symbols and any UIUC 12,13 allocations shall be an integer number of slots. To insure that UL tile structures are not broken due to an allocation wrapping, the following restrictions hold:

- When used in an AAS zone, a UIUC 12,13 region shall either span all subchannels and consist of an arbitrary number of symbols, or be constrained to be a multiple of 3 symbols in duration.
- In the absence of a UIUC 12,13 region that spans all subchannels, an UL AAS Zone shall consist of an integer number of slots plus the number of UL AAS preamble symbols as defined in by the "Uplink_preamble_config" field of the UL_AAS_IE and AAS_DLFP.
    - UL AAS Zone Duration = N*3 + Uplink_preamble_config symbols
- In the presence of one or more UIUC 12,13 regions that span all subchannels, an UL AAS Zone shall consist of an integer number of slots plus the number of UL AAS preamble symbols as defined in by the "Uplink_preamble_config" field of the UL_AAS_IE and AAS_DLFP plus the number of UIUC 12,13 symbols.
    - UL AAS Zone Duration = N*3 + Uplink_preamble_config symbols + UIUC 12,13 symbols

The figure below shows a legal UL AAS zone with an UIUC 12,13 allocation that is an integer number of slots in duration.



The figure below shows a legal UL AAS zone with an UIUC 12,13 allocation that spans all subchannels and is no an integer number of slots in duration.



[Move the last part of the original 8.4.4.6.3 paragraph here]

The structure of the preambles is as specified in sections 8.4.4.6.3.1 and 8.4.4.6.3.2 for the downlink and uplink, respectively. The preamble may be either time or frequency shifted according to a preamble shift index as defined in sections 8.4.5.3.11 and 8.4.5.4.14. The preamble shift index shall be set by the PHY_MOD_DL_IE and PHY_MOD_UL_IE, for downlink and uplink, respectively. The preamble shift index shall also be set by the AAS beam index carried by the AAS-DLFP(), in which case it shall apply to all subsequent downlink allocations until a PHY_MOD_DL_IE is received. The BS shall ensure that all shift index specifications for an allocation (in private maps, AAS-DLFP, broadcast maps, etc.) are consistent. When using the cyclic time / frequency shifted preamble defined in 8.4.5.3.11 and 8.4.5.4.14, beams which use the same subchannels at the same time instance shall be configured to use a different preamble shift index.

8.4.4.6.3.1 AAS Downlink Preamble

A basic AAS downlink preamble is formed by concatenating the sequences from the three carrier sets defined in section 8.4.6.1.1. Let the PN sequence for the m^{th} preamble carrier-set (m=0,1,2) defined in section 8.4.6.1.1 have length N bits. The k^{th} bit of the basic AAS preamble sequence P is given by:

$$P_k = W_n(m(\mathrm{mod}\,3)) \quad \text{(aaa)}$$

where $m = \lfloor k/N \rfloor$, $n = k - mN$, and $W_n(m)$ is the n^{th} bit of the PN sequence for the m^{th} preamble carrier-set defined in section 8.4.6.1.1. The preamble sequence will correspond to a cell ID equal to *(DL-Preamble IDcell + 16) mod 32*. The bits P_k shall be mapped to values consistent with the specification in 8.4.6.1.1 (0 mapped to +1, 1 mapped to –1).

The AAS preamble used for the burst shall be a subset of this basic preamble sequence corresponding to the subcarriers used by the burst's subchannels. In the AMC allocation, the basic AAS preamble occupies 9 subcarriers in each bin of the subchannels. The number of symbols occupied by the preamble is set by the

'Downlink preamble_config' field in the AAS_DL_IE(). The AAS preamble is formed by copying the basic preamble onto the consecutive preamble symbols. The AAS preamble shall be placed, for each subchannel, starting from the first OFDMA symbol for that subchannel that belongs to the burst.

Downlink pilot locations are shifted forward with the burst allocation in time in the AMC zone. Otherwise they are overwritten with the DL AAS preamble symbols.

8.4.4.6.3.2 AAS Uplink Preamble

The basic AAS uplink preamble is formed by taking a subset of the appropriate preamble sequence as defined in section 8.4.6.1.1 using the UL_IDcell transmitted in the UCD. This subset shall correspond to the subcarriers used by the burst's subchannels. In the AMC allocation, the basic AAS preamble occupies 9 subcarriers in each bin of the subchannels. The number of symbols occupied by the preamble is set by the 'Uplink preamble_config' field in the AAS_UL_IE(). The AAS preamble is formed by copying the basic preamble onto the consecutive preamble symbols. The AAS preamble shall be placed, for each subchannel, starting from the first OFDMA symbol for that subchannel that belongs to the burst.

~~Uplink pilot locations are shifted forward with the burst allocation in time in the AMC and PUSC zones. Otherwise they are overwritten with the UL AAS preamble symbols~~. Any UL allocation that wraps from the last OFDMA symbol of the AAS zone to the first OFDMA symbol shall have a preamble inserted in the first N OFDMA symbols of the AAS zone, where N is the number of AAS preamble symbols for the burst defined by the Uplink_Preamble_Config field of either the AAS_UL_IE or the AAS_DLFP.