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Abstract	This contribution introduces clarifications for making allocations in an AAS zone in the OFDMA PHY		
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# 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.

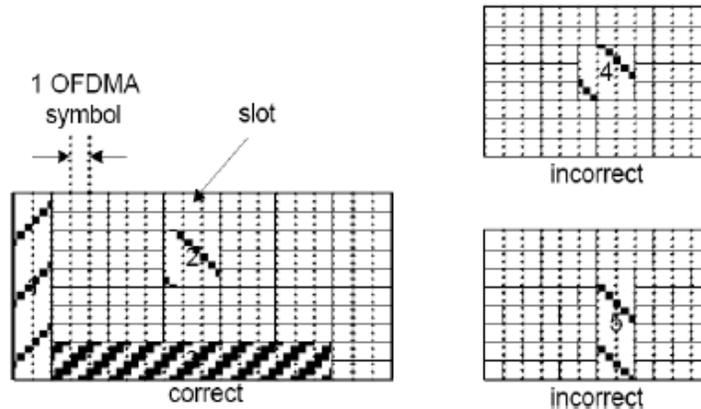


Figure 222a—Example of UIUC = 12,13 allocation rules

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.

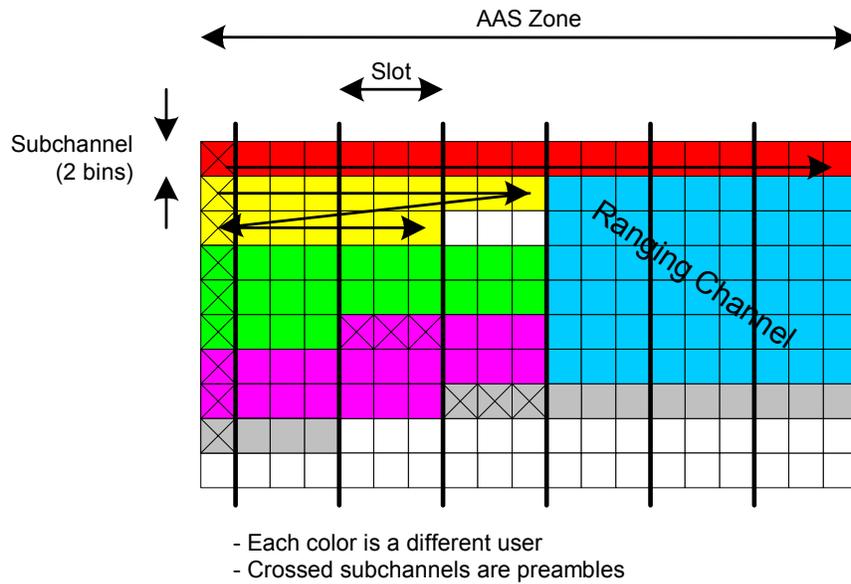
The proposed solution is summarized below:

- 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 =  $N*3 + \text{Uplink\_preamble\_config}$  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 =  $N*3 + \text{Uplink\_preamble\_config}$  symbols + UIUC 12,13 symbols

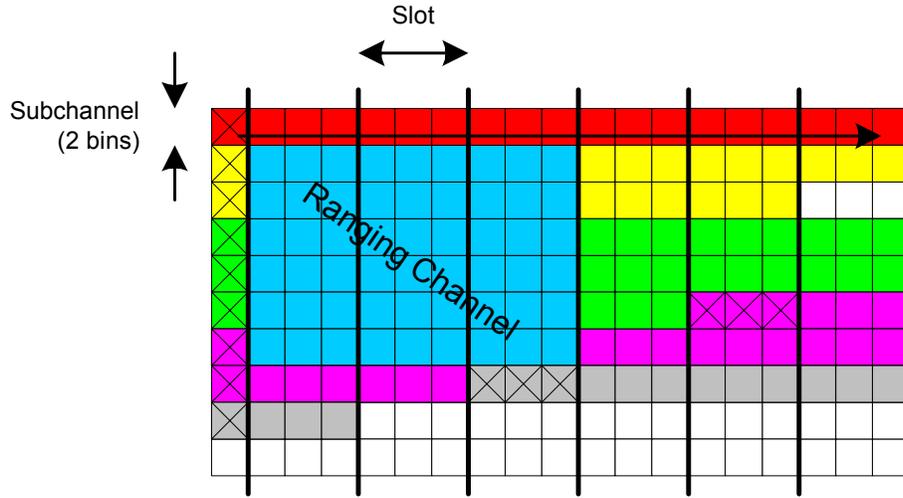
- 4) The first Uplink\_preamble\_config symbols of the UL AAS zone are reserved for UL AAS preambles. On a given subchannel, an UL AAS preamble will be inserted into these symbols by the SS devices who is allocated the slot following the preamble (or following a UIUC 12,13 region if it directly follows 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.
- 6) Fast feedback channels must be allocated an integer number of slots. If a fast feedback channel wraps at the end of an AAS zone, the first Uplink\_preamble\_config symbols of the UL AAS zone are skipped to maintain slot alignment.

The following figures show valid UL AAS Zones.

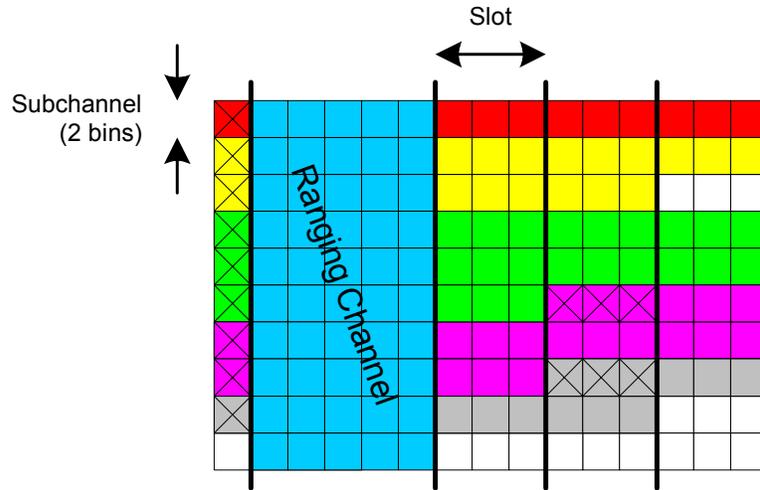
**Example 1 – UIUC 12 region is an integer number of slots**



**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.

UL and DL allocations are made exclusive of the AAS preamble. In the DL, a 2D allocation burst is preceded by the appropriate DL AAS preamble. In the UL, a 1D allocation is preceded by the appropriate AAS preamble. The absolute slot offset for the UL AAS allocation indicates the first data slot, which is preceded by the appropriate AAS preamble. If an UL allocation wraps at the end of the AAS zone, the data allocation does not include the symbols required for the initial AAS zone preambles.

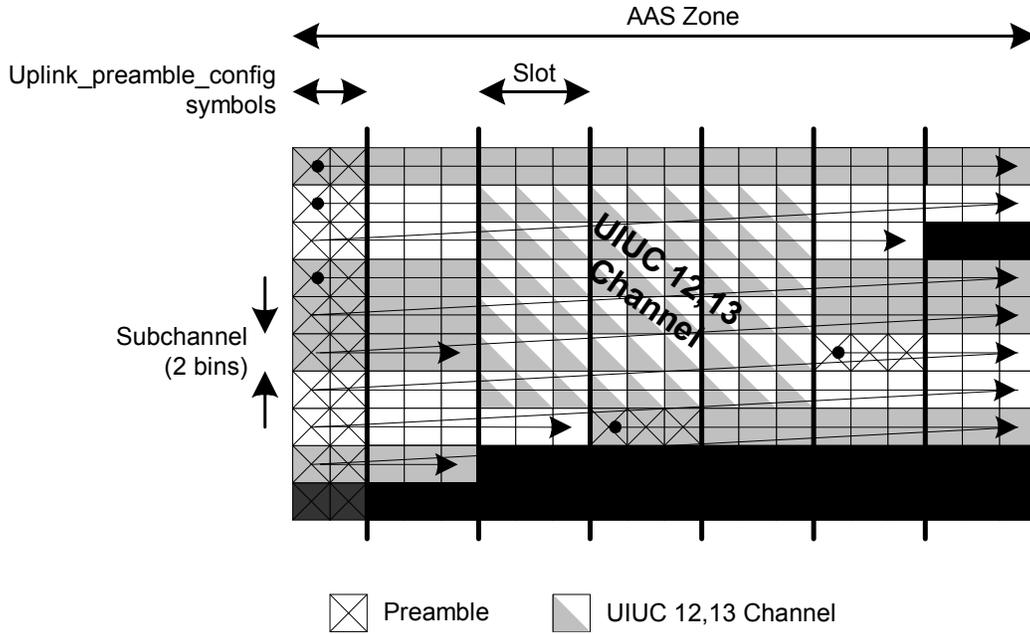
The optional AAS-DLFP is preceded by an AAS downlink preamble of one symbol duration. All other-DL DL bursts with UIUC 0-12 within the an AAS DL and UL zones have a preambles whose durations are specified by the “Uplink\_preamble\_config” field of the AAS\_UL\_IE and “Downlink\_preamble\_config” fields of the AAS\_DL\_IE. ~~These~~ This fields will be consistent with the same fields 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.

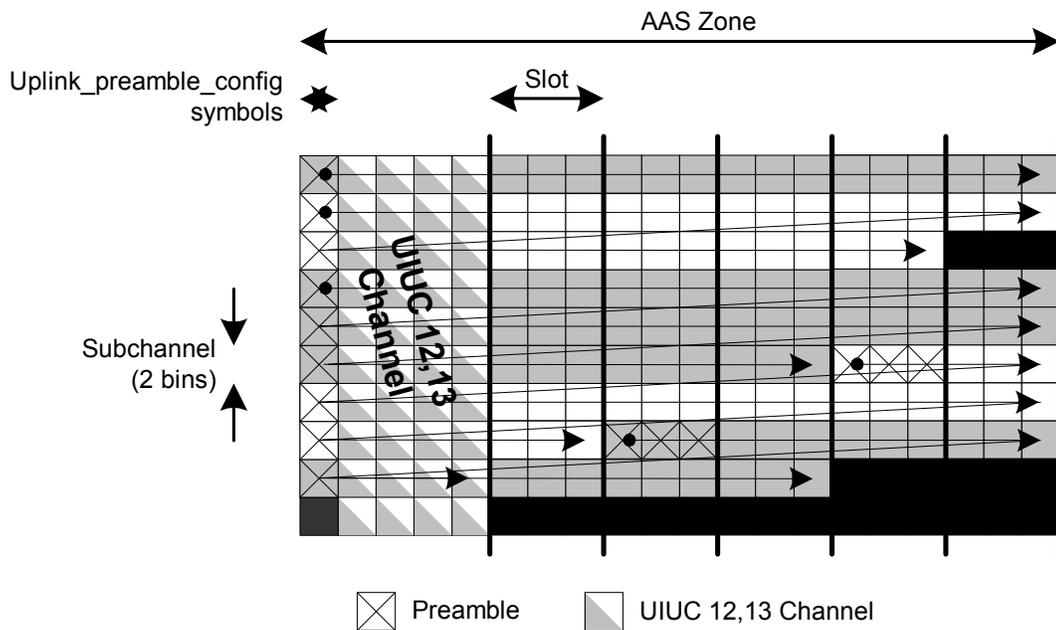
The duration of an UL AAS zone minus the reserved uplink preamble symbols and any UIUC 12,13 allocations shall be an integer number of slots. To insure that UL tile structures are not broken due to an allocation wrapping, the following restrictions hold:

- 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.
  - $UL\ AAS\ Zone\ Duration = N*3 + Uplink\_preamble\_config\ symbols + UIUC\ 12,13\ symbols$
- Fast feedback channels shall be allocated an integer number of slots. If a fast feedback channel wraps at the end of an AAS zone, the first Uplink\_preamble\_config symbols of the UL AAS zone are skipped to maintain slot alignment.

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 not 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  $m^{\text{th}}$  preamble carrier-set ( $m=0,1,2$ ) defined in section 8.4.6.1.1 have length  $N$  bits. The  $k^{\text{th}}$  bit of the basic AAS preamble sequence  $P$  is given by:

$$P_k = W_n(m(\bmod 3)) \quad (\text{aaa})$$

where  $m = \lfloor k / N \rfloor$ ,  $n = k - mN$ , and  $W_n(m)$  is the  $n^{\text{th}}$  bit of the PN sequence for the  $m^{\text{th}}$  preamble carrier-set defined in section 8.4.6.1.1. The preamble sequence will correspond to a cell ID equal to  $(DL\text{-Preamble IDcell} + 16) \bmod 32$ . 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.