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Re:	IEEE P802.16-REVd/D5		
Abstract	This contribution introduces corrections for support of AAS Diversity-Map Scan in the OFDMA PHY		
Purpose	Adopt into P802.16d/D5 corrigenda		
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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 diversity-map scan contains ambiguities and contradictions that need to be resolved:

1. 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.

2. The definitions of the “Downlink_preamble_config" and “Uplink_preamble_config” fields in the AAS-DLFP need to be clarified.

3. 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.

4. There is an assumption in the current design that the permutation used for the AAS-DLFP is the same as the permutation for the AAS UL Zone in any given frame. This restriction can be relaxed if the permutation of the AAS UL Zone is carried in the AAS-DLFP message.

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

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

7. The symbol offset definitions need to be clarified.

8. 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.

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

10. 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).

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

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

13. The text loosely infers that the DLFP message is optional.

2 Outline of proposed solution

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

1. 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.
   - Introducing 2 reserve bits

2. 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 or UL Comp IE in the DLFP, and must be consistent with the preamble lengths described in the extended DIUC AAS_DL_IE and extended UIUC AAS_UL_IE messages.

3. Clarify the initial ranging specification of the initial ranging/compressed UL allocations that are defined in the 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).

4. Add an UL Zone Permutation field to the DLFP message.

5. The location of the AAS Diversity Map zone is clarified.

6. AAS-DLFP refers to the allocations in the next frame.

7. The definition of the symbol offsets are clarified.

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

9. Add a repetition field to the AAS_Comp_DL_IE

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

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

12. Clarify that multiple AAS Zones may exist per frame

13. Clarify that the DLFP is optional.

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 an optional capability indicated by the AAS_DL_IE and AAS_UL_IE in the downlink and uplink broadcast maps. The AAS_IE defines 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. An AAS Zone may or may not contain a Diversity-Map Scan zone. AAS Operation without the 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

The AAS DL Zone begins on the specified symbol boundary and consists of all subchannels for the specified duration of the Zone. The two highest numbered subchannels of the 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, 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 symbols. When these subchannels are used for this purpose, 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 sub-channels 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. The inclusion of the AAS-Diversity MAP zone is defined in the DL-AAS-IE. Additionally, the SS may indicate to the BS, via a capabilities exchange message, if it supports the AAS diversity Map Zone.

[Modify section 8.4.4.6.2 as follows]

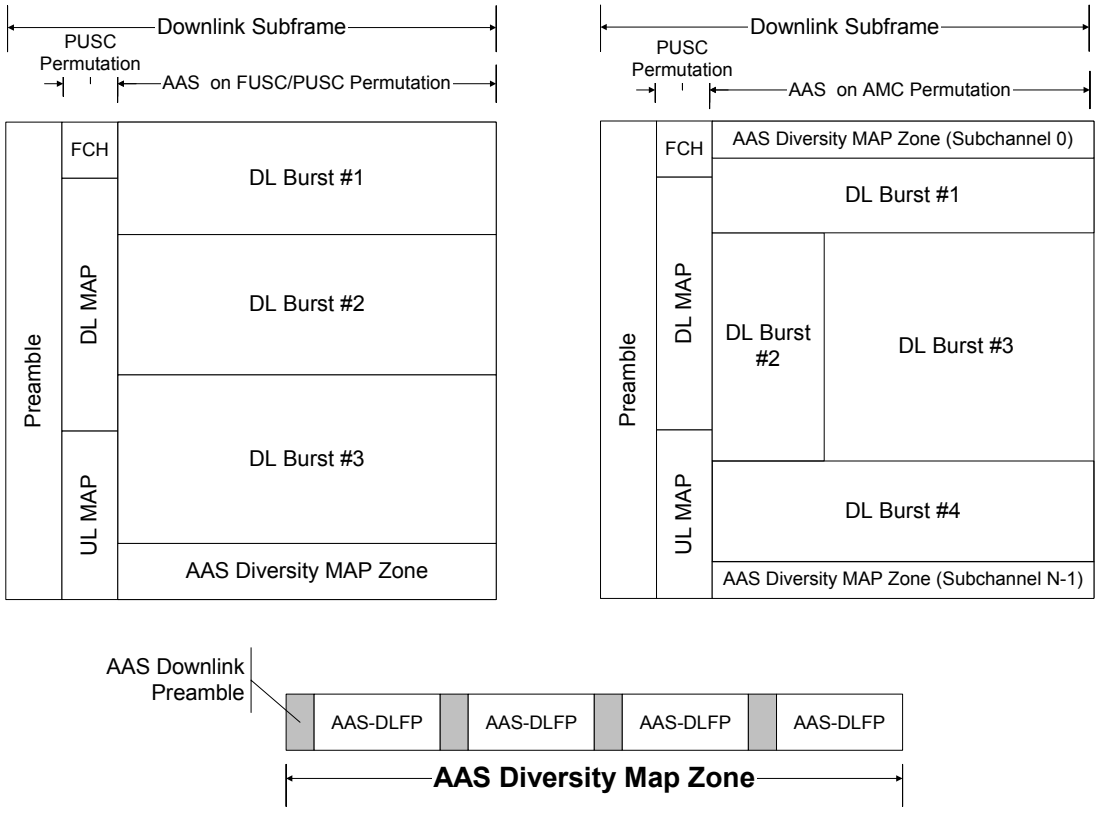
8.4.4.6.2 Optional Diversity-Map Scan

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 hear 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. The same IDcell shall be used as the DL_PermBase of the first zone in the AAS portion of the DL subframe. The UL_PermBase 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 the AAS DL Zone, 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 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~~ highest coding rate that can be supported by the link. Private DL-MAPs and UL-MAPs transmitted in the AAS DL zone may only reference allocations in the AAS DL and UL Zones respectively. As such, the UL_MAP_IE will always use the block subchannel-by-symbol mode for specifying BW allocations. The AAS-DLFP also has an uplink initial ranging allocation for AAS subscribers. The AAS-DLFP is not randomized.

In general, the Allocation Start Time field is restricted to a value that is between one and two frame periods. In any UL-MAP message that contains AAS-UL-zone allocations, this field shall have a value that is restricted to one frame period plus an integer number of symbols plus the TTG value. The AAS SS shall start transmission TTG time after this symbol offset, where the value of TTG is known from the latest received DCD message.

In private UL map messages that contain only AAS-UL-zone allocations, it shall be possible to specify an Allocation Start time that is larger than two frame periods. In this case, the Allocation Start Time field shall be restricted such that its offset relative to the start of the referenced frame is an integer ~~frame~~ symbol period plus TTG.

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

[Replace table 267-268 with the following tables:]

Syntax	**Size**	**Notes**
AAS-DLFP() {		
AAS beam index	4 ~~6~~ bits	This index is the index referred to by the AAS_Beam_Select message (see section 6.3.2.3.41).
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_Comp_UL_IE or 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()	50 bits	
Reserved	2 bits	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 ~~7~~ 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
}		

Syntax	Size	Notes
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	7 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 can 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. Transmit spatial weights optimized for the AAS-SS may be used for this AAS-DLFP and DL-MAP transmission.
- 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.

13.8.3.7.2 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."

Type	Length	Value	Scope
151	1	Bit #0: 64-QAM Bit #1: BTC Bit #2: CTC Bit #3: STC Bit #4: AAS Diversity Map Scan Bit #5: AAS Direct Signaling Bit #6: H-ARQ Bit #7: AAS Basic Mode	SBC-REQ (see 6.3.2.3.23) SBC-RSP (see 6.3.2.3.24)

AAS Diversity Map Scan – Indicates if the SS supports the DLFP message

AAS Basic Mode – Indicates if the SS Supports the basic AAS mode of operation

13.8.3.7.3 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."

Type	Length	Value	Scope
152	1	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	SBC-REQ (see 6.3.2.3.23) SBC-RSP (see 6.3.2.3.24)

AAS Basic Mode – Indicates if the SS Supports the basic AAS mode of operation