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Abstract	This contribution introduces compressed private maps for OFDM PHY		
Purpose	Adopt into P802.16d/D5 corrigenda		
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AAS Private maps for OFDM PHY

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1 Introduction

The purpose of this contribution is to introduce efficient private maps. The private maps are useful for use in conjunction with the DL-Subchannelization mode and with the AAS mode.

The 802.16REVd OFDM PHY supports the use of regular DL-MAP and UL-MAP messages as private maps in AAS mode. These messages result in a large amount of overhead. For example, in addition to the MAC and map headers, a DL-MAP_IE for describing a data burst requires 32 bits for DL and 48 bits for UL, and a PHYMOD_IE for specifying the preamble shift requires 48 bits for DL and 64 bits for UL. These overheads can be significantly reduced by adding support for compressed private maps and by defining certain rules and assumptions for their operation.

In this contribution we present two types of compressed private maps – standard and reduced. In both types, the generic MAC header is omitted. The standard compressed private map follows the scheme used in the OFDMA PHY and eliminates some of the map header fields. The reduced private map is a lean form of the standard compressed format that supports a single IE. This single IE may describe an allocation in a future frame other than the next frame.

2 Proposed Solution

It is proposed to add support for optional compressed private maps ~~that may exist anywhere within an AAS Zone.~~ These maps may be used in AAS zone and in the optional DL-subchannelization zone. In these compressed private maps, the generic MAC header is omitted and a reduced form of the Base-Station ID is used. A broadcast map, a DLFP message, or another private map in a previous frame can point to the private map. If the private map shares an allocation with other management messages or a data PDU, then the private map must be the first element in the allocation. Private maps are only allowed to use unicast CID values. Both UL and DL allocations are relative to the next frame.

In addition, a dedicated single-IE private map is defined that eliminates excess overhead from the regular compressed private map. This single IE map is pointed to by a broadcast map or private compressed map which defines the values of several fields that

will be constant for the duration of the private map chain. The following overhead is removed:

1. Map Length – Not required due to deterministic map length
2. DCD Count – Optionally included. Only required if DCD count changes
3. Base Station ID – Acquired by the map that initiated the private map chain. Assumed constant for the duration of the private map chain.
4. CID – Only required in first map of private map chain.
5. UCD Count – Optionally included. Only required in first UL map of private map chain.
6. Allocation Start Time – UL start time relative to TTG plus an integer number of symbol times.

3 Proposed Text Changes

[Modify section 8.3.6.2, page 463 lines 50-57 as follows]

Start Time

If transmitted in the frame broadcast DL-MAP message, this field indicates the start time, in units of symbol duration, relative to the start of the first symbol of the PHY PDU (including preamble) where the DL-MAP message is transmitted. If transmitted in a compressed AAS-private map (see section 8.3.6.6), this field indicates the start time, in units of symbol duration, relative to the beginning of the subsequent downlink frame (including preamble). The end of the last allocated burst is indicated by allocating an End of Map burst (DIUC = 14) with zero duration. The time instants indicated by the Start Time values are the transmission times of the first symbol of the burst including preamble (if present).

[Add new section 8.3.6.6]

8.3.6.6 Compressed AAS-Private Maps

When appearing in a private map message within an AAS zone, or within the DL subchannelization zone. the standard DL-MAP and UL-MAP formats described in 6.3.2.3.2 and 6.3.2.3.4 may conform to the format presented in the following subclauses. The presence of the compressed DL-MAP format is indicated by the contents of the most significant two bits of the first data byte. These bytes overlay the HT and EC bits of a generic MAC header. When these bits are both set to 1 (an invalid combination for a standard header), the compressed DL-MAP format is present. A compressed UL-MAP shall only appear after a compressed DL-MAP. The presence of a compressed UL-MAP is indicated by a bit in the compressed DL-MAP data structure.

A broadcast map, an AAS-DLFP message, a SBCH_DL_MAP_IE, or another private map in a previous frame can point to the compressed private map. Other restrictions of compressed private maps include:

- The private map must be the first message in a PHY burst
- Private maps are only allowed to use unicast CID values.
- Private maps may only describe allocations within the AAS portion of the sub-frame, within the DL subchannelization zone.
- Both UL and DL allocations included in the private map are relative to the next frame, + frame offset value negotiated with the SS (see 11.8.3.6.6).
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A modification to the ‘Preamble Time Shift’ (as defined by in 8.3.6.2.7 and 8.3.6.3.7) shall also apply to allocations in subsequent private maps in the private map chain, until modified again or until the end of the private map chain.

The compressed private map is an optional feature that can be negotiated between the SS and BS.

8.3.6.6.1 Compressed DL-MAP

The compressed private DL-MAP format is presented in Table AAA. The message presents the same information as the standard format with one exception. In place of the DL-MAP's 48-bit Base Station ID, the compressed format provides a subset of the full value. When the compressed format is used, the full 48-bit Base Station ID shall be published in the DCD.

Table AAA—Compressed DL-MAP message format

Syntax	Size	Notes
Compressed_DL-MAP() {		
Compressed map indicator	2 bits	Set to binary 11 for compressed format
<i>Reserved</i>	1 bit	Shall be set to zero
UL-MAP appended	1 bit	
Compressed Map Type	1 bit	Shall be set to 0 for compressed private map
Map message length	11 bits	
DCD Count	8 bits	
Base Station ID	4 bits	4 LSB of BS ID. The burst specified by the DLFP shall not be decoded if these bits do not match those of the BS on which it is registered
Sector ID	8 bits	
DL IE Count	8 bits	
for (<i>i</i> = 1; <i>i</i> <= DL IE count; <i>i</i> ++) {		
DL-MAP IE()	<i>variable</i>	
}		
if !(byte boundary) {		
Padding Nibble	4 bits	Padding to reach byte boundary
}		
HCS	8 bits	
}		

Compressed map indicator

A value of binary 11 in this field indicates the map message conforms to the compressed format described here. A value of binary 00 in this field indicates the map message conforms to the standard format described in 6.3.2.3.2. Any other value is an error.

UL-MAP appended

A value of 1 indicates a compressed UL-MAP (see 8.3.6.6.2) is appended to the current compressed DL-MAP data structure

Map message length

This value specifies the length of the compressed map message(s) beginning with the byte containing the Compressed map indicator and ending with the last byte of the compressed DL-MAP message if the UL-MAP appended bit is not set or the last byte of the UL-MAP compressed message if the UL-MAP appended bit is set. The length includes the computed 8-bit HCS value.

DCD Count

Matches the value of the configuration change count of the DCD, which describes the downlink burst profiles that apply to this map.

DL IE count

This field holds the number of IE entries in the following list of DL-MAP IEs.

HCS

A HCS value, as defined in 6.3.2.1.1, is appended to the end of the compressed map(s) data. The HCS is computed across all bytes of the compressed map(s) starting with the byte containing the Compressed map indicator, and including appended UL-MAP, if present.

8.3.6.6.2 Compressed UL-MAP

The compressed UL-MAP format is presented in Table BBB. The message may only appear after a compressed DL-MAP message to which it shall be appended. The message presents the same information as the standard format with the exception that the Generic MAC header and the Uplink Channel ID are omitted.

Table BBB—Compressed UL-MAP message format

Syntax	Size	Notes
Compressed_UL-MAP() {		
UCD Count	8 bits	
Allocation Start Time	32 bits	
while (map data remains) {		
UL-MAP_IE()	<i>variable</i>	
}		
If !(byte boundary) {		
Padding Nibble	4 bits	Padding to reach byte boundary
}		
}		

UCD Count

Matches the value of the Configuration Change Count of the UCD which describes the uplink burst profiles which apply to this map.

Allocation Start Time

Effective start time of the uplink allocation defined by the UL-MAP.

[Add new section 8.3.6.7]

8.3.6.7 Reduced Compressed AAS-Private Maps

Reduced compressed AAS-private maps are based upon the compressed map format, however they are specifically designed to support a single unicast IE per map. Their use is identical to standard compressed private maps, however, fields have been removed that are not required to support a single IE. The reduced AAS-private map will be pointed to by a broadcast map or private compressed map which will define the values of several fields that will be constant for the duration of the private map chain. The behavior of the compressed map fields that are not present in the reduced AAS-private map are described below:

1. DCD Count – Optionally included. Only required if DCD count changes
2. Base Station ID – Acquired by the map that initiated the private map chain. Assumed constant for the duration of the private map chain.
3. CID – Only required in first map of private map chain.
4. UCD Count – Optionally included. Only required in first UL map of private map chain.
5. Allocation Start Time – UL start time relative to TTG plus an integer number of symbol times.

8.3.6.7.1 Reduced AAS-Private DL-MAP

The Reduced AAS-private DL-MAP format is presented in Table XXX. The reduced AAS-private DL-MAP message eliminates the fields that are not relevant since the message is targeted to a single CID.

Table XXX—Reduced AAS-private DL-MAP message format

Syntax	Size	Notes
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Reduced <u>AAS</u> Private DL-MAP() {		
Compressed map indicator	2 bits	Set to binary 11 for compressed format
<i>Reserved</i>	1 bit	Shall be set to zero
UL-MAP appended	1 bit	
Compressed Map Type	1 bit	Shall be set to 1 for <u>AAS</u> -reduced private map
CID Included	1 bit	1 = CID included The CID shall be included in the first compressed private MAP if it was pointed to by a DL-MAP IE with a multicast CID.
DCD Count Included	1 bit	1 = DCD Count included The DCD count is expected to be the same as in the broadcast map that initiated the private map chain. The DCD count can be included in the private map if it changes.
PHY modification Included	1 bit	1 = included.
If (CID Included) {		
CID	16 bits	
}		
If (DCD Count Included) {		
DCD Count	8 bits	
}		
If (PHY modification Included) {		
Preamble Time Shift	8 bits	Updated preamble time shift to be used starting with the <u>frame specified by the Frame Offset</u> <u>next frame.</u>
}		
DIUC	4 bits	
Preamble Present	1 bit	
Start Time	11 bits	
Duration	10 bits	
Frame Offset	<u>3</u> bits	
<i>Reserved</i>	<u>3</u> <u>2</u> bits	
HCS	8 bits	
}		

Compressed map indicator

A value of binary 11 in this field indicates the presence of a compressed map.

UL-MAP appended

A value of 1 indicates a reduced compressed private UL-MAP (see 8.3.6.7.2) is appended to the current private DL-MAP data structure.

CID Included

Specifies if a CID is included. The CID shall be included in the first compressed private MAP if it was pointed to by a DL-MAP IE with a multicast CID.

DCD Count Included

Specifies if a DCD count is included. DCD Count is only required if the DCD count is changed.

PHY Modification Included

Indicates if a preamble modifier is included

Connection Identifier (CID)

Represents the assignment of the IE to a unicast address.

Preamble Time Shift

The preamble time shift for subsequent DL allocations, as defined in 8.6.3.2.7.

DCD Count

Matches the value of the configuration change count of the DCD, which describes the downlink burst profiles that apply to this map.

DIUC

DIUC used for the burst.

Preamble Present

If set, the indicated burst shall start with the short preamble.

Start Time

Indicates the start time, in units of symbol duration, relative to the beginning of the [next](#) downlink frame ~~referred to by the 'Frame Offset' field~~ (including preamble). The time instants indicated by the Start Time values are the transmission times of the first symbol of the burst including preamble (if present).

Duration

Indicates the duration, in units of OFDM symbols, of the allocation. The duration is inclusive of the preamble contained in the allocation.

~~Frame Offset~~

~~The frame in which the burst is located. A value of zero indicates an allocation in the subsequent frame.~~

HCS

A HCS value, as defined in 6.3.2.1.1, is appended to the end of the compressed map(s) data. The HCS is computed across all bytes of the compressed map(s) starting with the byte containing the Compressed map indicator and including appended UL-MAP, if present.

8.3.6.7.2 Reduced AAS-Private UL-MAP

The Reduced AAS-private UL-MAP format is presented in Table YYY. The message may only appear after a Reduced AAS-private DL-MAP message to which it shall be appended.

Table YYY— Reduced AAS-private UL-MAP message format

Syntax	Size	Notes
Reduced AAS Private UL-MAP() {		
UCD Count Included	1 bit	1 = UCD Count included. The UCD count should be included in the first allocation of a private map chain.
PHY modification Included	1 bit	1 = Preamble time shift included.
Power Control Included	1 bit	1 = Power control value included
if (UCD Count Included) {		
UCD Count	8 bits	
}		
if (PHY modification Included) {		
Preamble Time Shift	8 bits	Updated preamble time shift to be used starting with the next frame , specified by the Frame Offset .
}		
if (Power Control Included) {		
Power Control	8 bits	Signed integer in 0.25 dB units
}		
UIUC	4 bits	
Start Time	11 bits	
Duration	10 bits	
Subchannel Index	5 bits	
Midamble Repetition Interval	2 bits	
Frame Offset	3 bits	
<i>Reserved</i>	2-1 bits	Set to zero
}		
}		

UCD Count Included

Indicates if UCD Count is included. This should be included in the first UL map of a private map chain.

Phy Modification Included

Indicates if a preamble modifier is included

Power Control Included

Indicates if a SS power control byte is included

Preamble Time Shift

The preamble time shift for subsequent UL allocations, as defined in 8.6.3.2.7.

Power Control

The change in transmit power level that the SS should apply starting on the next frame, specified by the Frame Offset.

UCD Count

Matches the value of the configuration change count of the UCD, which describes the uplink burst profiles that apply to this map.

UIUC

UIUC used for the burst.

Start Time

Indicates the start time of the allocation, in units of symbol duration. ~~This is~~ referenced to the beginning of the next frame that is defined by the 'Frame Offset' field, 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.

Duration

Indicates the duration, in units of OFDM symbols, of the allocation. The duration is inclusive of the preamble contained in the allocation.

Subchannel Index

See table 211.

Midamble Repetition Interval

Indicates the preamble repetition interval in OFDM symbols, as defined in 8.3.6.3.

~~Frame Offset~~

~~The frame in which the burst is located. A value of zero indicates an allocation in the subsequent frame.~~

[Add new section 11.8.3.6.6]

11.8.3.6.6 OFDM AAS private map support

This field indicates the AAS private map parameters supported by a WirelessMAN-OFDM SS.

Type	Length	Value	Scope
155	1	bit #0: regular private map support bit #1: compressed and reduced private map support bit #2: Private Map DL frame offset — 0: support compressed private maps with Frame Offset = 0 — 1: support compressed private maps with Frame Offset = 1 bit #3: Private Map UL frame offset — 0: support compressed private maps with Frame Offset = 0 — 1: support compressed private maps with Frame Offset = 1 Bits #4-6: private map chain concurrency — 0 indicates no limit — 1-7 indicate maximum concurrent private map chains -Bit #2-7: reserved	SBC-REQ (see 6.3.2.3.23) SBC-RSP (see 6.3.2.3.24)

- ~~• The frame offset value indicates the frame offset the SS can support with private maps. A value of 0 indicates the private map allocations are for the subsequent frame (one frame in the future), a value of 1 indicates it is for two frames in the future.~~
- ~~• The concurrency field indicates how many parallel private map chains can be supported by a SS.~~