

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	Definition of H-ARQ Compact DL/UL MAP IE extension type for Band AMC, OFDMA PHY mode	
Date Submitted	2004-08-17	
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Re:		
Abstract	Definition of H-ARQ Compact DL/UL_MAP IE extension type for Band AMC, OFDMA PHY mode	
Purpose	Adoption of proposed changes into P802.16e/D4	
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1 Motivation and explanation of changes

The compact DL (or UL)-MAP IE for Band AMC subchannel is defined in Table 95(or 101) of IEEE Standard 802.16-2004. The current definition provides continuous subchannel allocation showing only the relative position of the resources. It has its merits, but also there are some limitations. When it is necessary to leave some resources between allocated ones unallocated within a band, such an allocation pattern cannot be supported. Another limitation of the current definition is that MS must read all IEs before its information to locate the exact position of the its allocated resources.

To get rid of these limitations, a new complementary compact DL/UL-MAP IE extension format for band AMC subchannel is proposed. The new format shows the exact position of the allocated resources. To support each IE to be independent to other IEs, the concept of Allocation Unit is newly defined. Band AMC region is indexed by the Allocation Unit. A few types of Allocation Units with various sizes are defined, so if the appropriate Allocation Unit is used MAC overheads can be minimized. In order to ensure the backward compatibility the proposed IE uses the extension type in spite of some additional overheads.

In addition to the removal of the limitations, there is an attractive advantage of the new format. In case the same resources allocated to an MS last time is allocated to it again, it is possible to indicate the allocation information with small overheads, for example, using the Allocation Mode field (provided that MS and BS store the position of the resources allocated last time during the connection is maintained).

2 Proposed changes

[Add the following to sections to the end of 6.3.2.3.43.6.6:]

6.3.2.3.44.6.7 Compact DL-MAP IE extension for Band AMC Subchannel

When compact DL-MAP IE for Band AMC subchannel (DL-MAP type 1) and this extension are used in the same frame, all the type 1 IEs must be placed before the this extension due to the backward compatibility.

Table aaa Compact DL-MAP IE extension for band AMC

<u>Syntax</u>	<u>Size</u>	<u>Notes</u>
<u>Compact_DL-MAP_IE () {</u>		
<u>DL-MAP Type = 7</u>	<u>3 bits</u>	<u>Extension type</u>
<u>DL-MAP Sub-Type</u>	<u>5 bits</u>	<u>Extension for band AMC = 0x01</u>
<u>Length</u>	<u>4 bits</u>	<u>Length of the IE in Bytes</u>
<u>RCID_IE</u>	<u>variable</u>	
<u>N_{EP} code</u>	<u>4 bits</u>	<u>Code of encoder packet bits (see 8.4.9.2.3.5)</u>
<u>N_{SCH} code</u>	<u>4 bits</u>	<u>Code of allocated subchannels (see 8.4.9.2.3.5)</u>
<u>N_{AE}</u>	<u>4 bits</u>	<u>Number of allocation elements</u>
<u>Same AUT(Allocation Unit Type)</u>	<u>1 bit</u>	<u>Indicates whether all allocation elements use the same AUT</u> <u>0 = different AUT</u> <u>1 = same AUT</u>
<u>Same AM(Allocation Mode)</u>	<u>1 bit</u>	<u>Indicates whether all allocation elements use the same AM</u> <u>0 = different AM</u> <u>1 = same AM</u>
<u>reserved</u>	<u>2 bits</u>	<u>Shall be set to zero</u>
<u>If (Same AUT == 1) {</u>		
<u>AUT</u>	<u>4 bits</u>	<u>Indicates the allocation unit type (see Table bbb)</u>
<u>}</u>		
<u>If (Same AM == 1) {</u>		

<u>AM</u>	4 bits	Indicates the allocation mode (see Figure aaa) 0x00 = single allocation unit 0x01 = continuous allocation units 0x02 = rectangular area 0x03 = the same resources allocated to this RCID last time 0x04~0x0F = reserved
}		
for (i=0;i<N _{AE} ;i++) {		
If (Same AUT == 0) {		
<u>AUT</u>	4 bits	Indicates the allocation unit type (see Table bbb)
}		
If (Same AM == 0) {		
<u>AM</u>	4 bits	Indicates the allocation mode (see Figure aaa) 0x00 = single allocation unit 0x01 = continuous allocation units 0x02 = rectangular area 0x04~0x0F = reserved
}		
if(AM == 0x00){		
<u>Allocation Unit Index</u>	L _{AUT} bits	See table ccc
} else if(AM == 0x01){		
<u>Start Allocation Unit Index</u>	L _{AUT} bits	
<u>Number of Allocation Units</u>	4 bits	
} else if(AM == 0x10) {		
<u>Start Allocation Unit Index</u>	L _{AUT} bits	
<u>End Allocation Unit Index</u>	L _{AUT} bits	
}		
}		
<u>H-ARQ Control IE</u>	variable	
<u>COICH Control IE</u>	variable	
If !(byte boundary) {		
<u>Padding Nibble</u>	4 bits	Padding to reach byte boundary
}		
}		

DL-MAP Type

This value specifies the type of the compact DL-MAP IE. A value of 7 indicates the extension type.

DL-MAP Sub-Type

This value specifies the sub-type of the compact DL-MAP IE. A value of 0x01 indicates the extension for band AMC.

Length

This indicates the length of this IE in Bytes. If a SS can't recognize the DL-MAP Sub-Type, it skips the IE.

RCID IE

Represent the assignment of the IE.

N_{EP} code, N_{SCH} code

The combination of N_{EP} code and N_{SCH} code indicates the number of allocated subchannels and scheme of coding and modulation for the DL burst.

N_{AE} (Number of allocation elements)

More than one physically separated subchannels can be allocated to this burst. Each physically separated subchannel is represented by an allocation element. This value indicates the number of allocation elements.

Same AUT (Allocation Unit Type)

This value indicates whether all allocation elements use the same AUT. When different AUTs are used the value is set to 0, otherwise it is set to 1.

Same AM (Allocation Mode)

This value indicates whether all allocation elements use the same AM. When different AMs are used the value is set to 0 otherwise it is set to 1.

AUT (Allocation Unit Type)

This value indicates the allocation unit type. The allocation unit type variant is shown in Table bbb. The value of L_{AUT} (length of Allocation Unit Index, Start Allocation Unit Index and End Allocation Unit Index fields) is determined by allocation unit type. See Table ccc.

AM (Allocation Mode)

This value indicates the subchannel allocation mode.

The value is set to binary 0x00 when a single allocation unit is allocated. The following Allocation Unit Index field indicates the position of the allocated resources.

The value is set to 0x01 when continuous allocation units are allocated. The following Start Allocation Unit Index field indicates the starting position of the allocated resources and Number of Allocation Units field indicates the range of the allocated resources.

The value is set to 0x02 when resources of a rectangular area are allocated. The following Start Allocation Unit Index and End Allocation Unit Index fields indicate the diagonal starting position and ending position of the allocated rectangular area respectively.

The value is set to 0x03 when the same resources allocated to this RCID last time are allocated again. When this mode is used, both Same AUT and Same AM values are set to 1. To support this allocation mode, MS and BS must store the position of the resources allocated last time during the connection is maintained.

The allocation mode variant is shown in Figure aaa.

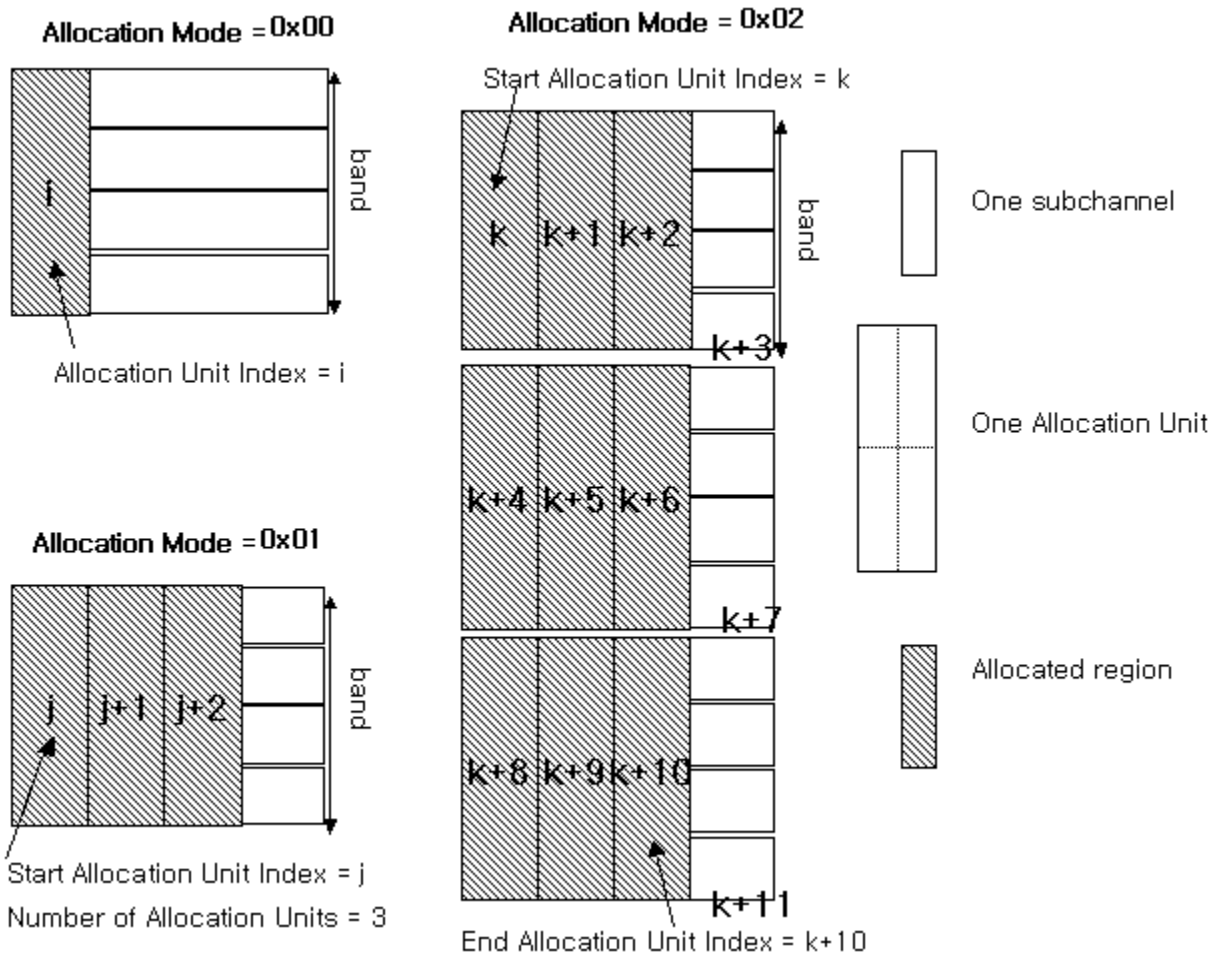


Figure aaa Examples of subchannel allocation modes of Compact DL/UL-MAP IE extension for Band AMC

Allocation Unit Index

This value indicates the index of the allocation unit for this allocation element. (Used when Allocation Mode is 0x00.)

Start Allocation Unit Index

This value indicates the index of starting point of the allocated area for this allocation element. (Used when Allocation Mode is 0x01 or 0x02.)

Number of Allocation Units

This value indicates the number of continuous allocation units for this allocation element. (Used when Allocation Mode is 0x01.)

End Allocation Unit Index

This value indicates the index of ending point of the allocated area for this allocation element. (Used when Allocation Mode is 0x02.)

Table bbb Allocation Unit Type for Band AMC MAP IE extension (Each AUT can be used if it is compatible with the configured subchannel type.)

Allocation Unit Type Value	Description
0x00	One subchannel (as indicated in the Format Configuration IE)
0x01	Two subchannels (2 bins x 6 symbols)
0x02	Two subchannels (4 bins x 3 symbols)
0x03	Three subchannels (3 bins x 6 symbols)
0x04	Four subchannels (4 bins x 6 symbols)
0x05	Half band (2 bins x all band AMC symbols)
0x06	One band (4 bins x all band AMC symbols)
0x07	Two bands (8 bins x all band AMC symbols)
0x08	Four bands (16 bins x all band AMC symbols)
0x09 ~ 0x0F	Reserved

Table ccc L_{AUI} Field length for Band AMC MAP IE extension (Assumption: Maximum supportable DL/UL Band AMC symbol length in one frame is 24 symbols.)

Allocation Unit Type	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07	0x08
L _{AUI} (2048 FFT)	12 bits	12 bits	12 bits	8 bits	8 bits	8 bits	8 bits	8 bits	4 bits
L _{AUI} (1024 FFT)	12 bits	8 bits	8 bits	8 bits	8 bits	8 bits	8 bits	4 bits	4 bits
L _{AUI} (512 FFT)	8 bits	8 bits	8 bits	8 bits	8 bits	8 bits	4 bits	4 bits	4 bits

[Add the following to sections to the end of 6.3.2.3.44.7.7:]

6.3.2.3.44.7.78 Compact UL-MAP IE extension for Band AMC Subchannel

When compact UL-MAP IE for Band AMC subchannel (UL-MAP type 1) and this extension are used in the same frame, all the type 1 IEs must be placed before the this extension due to the backward compatibility.

Table ddd Compact UL-MAP IE extension for band AMC

Syntax	Size	Notes
Compact_UL-MAP_IE () {	-	-
UL-MAP Type = 7	3 bits	Extension type
UL-MAP Sub-Type	5 bits	Extension for band AMC = 0x01

Length	4 bits	Length of the IE in Bytes
RCID_IE	variable	-
N_{EP_code}	4 bits	Code of encoder packet bits (see 8.4.9.2.3.5)
N_{SCH_code}	4 bits	Code of allocated subchannels (see 8.4.9.2.3.5)
N_{AE}	4 bits	Number of allocation elements
Same AUT(Allocation Unit Type)	1 bit	Indicates whether all allocation elements use the same AUT 0 = different AUT 1 = same AUT
Same AM(Allocation Mode)	1 bit	Indicates whether all allocation elements use the same AM 0 = different AM 1 = same AM
<i>reserved</i>	2 bits	Shall be set to zero
If (Same AUT == 1) {		
AUT	4 bits	Indicates the allocation unit type (see Table bbb)
}		
If (Same AM == 1) {		
AM	4 bits	Indicates the allocation mode (see Figure aaa) 0x00 = single allocation unit 0x01 = continuous allocation units 0x02 = rectangular area 0x03 = the same resources allocated to this RCID last time 0x04~0x0F = reserved
}		
for (i=0;i<N_{AE}; i++) {		
If (Same AUT == 0) {		
AUT	4 bits	Indicates the allocation unit type (see Table bbb)
}		
If (Same AM == 0) {		
AM	4 bits	Indicates the allocation mode (see Figure aaa) 0x00 = single allocation unit 0x01 = consecutive allocation units 0x02 = rectangular area 0x04~0x0F = reserved
}		
if(AM == 0x00){		
Allocation Unit Index	L_{AUI} bits	See table ccc
} else if(AM == 0x01){		
Start Allocation Unit Index	L_{AUI} bits	
Number of Allocation Units	4 bits	
} else if(AM == 0x10) {		
Start Allocation Unit Index	L_{AUI} bits	
End Allocation Unit Index	L_{AUI} bits	
}		
}		
H-ARQ Control IE	variable	
If !(byte boundary) {	-	-
Padding Nibble	4 bits	Padding to reach byte boundary
}		
}		

UL-MAP Type

This value specifies the type of the compact UL-MAP IE. A value of 7 indicates the extension type.

UL-MAP Sub-Type

This value specifies the sub-type of the compact UL-MAP IE. A value of 0x01 indicates the extension for band AMC.

Length

This indicates the length of this IE in Bytes. If a SS can't recognize the UL-MAP Sub-Type, it skips the IE.

RCID IE

Represent the assignment of the IE.

N_{EP} code, N_{SCH} code

The combination of N_{EP} code and N_{SCH} code indicates the number of allocated subchannels and scheme of coding and modulation for the UL burst.

N_{AE} (Number of allocation elements)

More than one physically separated subchannels can be allocated to this burst. Each physically separated subchannel is represented by an allocation element. This value indicates the number of allocation elements.

Same AUT (Allocation Unit Type)

This value indicates whether all allocation elements use the same AUT. When different AUTs are used the value is set to 0, otherwise it is set to 1.

Same AM (Allocation Mode)

This value indicates whether all allocation elements use the same AM. When different AMs are used the value is set to 0 otherwise it is set to 1.

AUT (Allocation Unit Type)

This value indicates the allocation unit type. The allocation unit type variant is shown in Table bbb. The value of L_{AUI} (length of Allocation Unit Index, Start Allocation Unit Index and End Allocation Unit Index fields) is determined by allocation unit type. See Table ccc.

AM (Allocation Mode)

This value indicates the subchannel allocation mode.

The value is set to binary 0x00 when a single allocation unit is allocated. The following Allocation Unit Index field indicates the position of the allocated resources.

The value is set to 0x01 when continuous allocation units are allocated. The following Start Allocation Unit Index field indicates the starting position of the allocated resources and Number of Allocation Units field indicates the range of the allocated resources.

The value is set to 0x02 when resources of a rectangular area are allocated. The following Start Allocation Unit Index and End Allocation Unit Index fields indicate the diagonal starting position and ending position of the allocated rectangular area respectively.

The value is set to 0x03 when the same resources allocated to this RCID last time are allocated again. When this mode is used, both Same AUT and Same AM values are set to 1. To support this allocation mode, MS and BS must store the position of the resources allocated last time during the connection is maintained.

The allocation mode variant is shown in Figure aaa.

Allocation Unit Index

This value indicates the index of the allocation unit for this allocation element. (Used when Allocation Mode is 0x00.)

Start Allocation Unit Index

This value indicates the index of starting point of the allocated area for this allocation element. (Used when Allocation Mode is 0x01 or 0x02.)

Number of Allocation Units

This value indicates the number of continuous allocation units for this allocation element. (Used when Allocation Mode is 0x01.)

End Allocation Unit Index

This value indicates the index of ending point of the allocated area for this allocation element. (Used when Allocation Mode is 0x02.)