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Source(s)	Yigal Eliaspur, Ilia Bosis, Yuval Lomnitz, Sharon Ben-Porath, Noam Kagan **Intel Corp**. yigal.eliapsur@intel.com, yuval.lomnitz@intel.com,
Re:	IEEE P802.16e/D6
Abstract	.Refinements and corrections for HARQ in Normal MAP feature
Purpose	Adoption of proposed changes into P802.16e /D6
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HARQ Refinements

Yigal Eliaspur, Bosis Ilia, Sharon Ben-Porath, Yuval Lomnitz
Intel Corp

1 Motivation

This contribution presents some fixes and refinements to the MAP/HARQ harmonization contribution from last session.

The changes include the following:

1. Alignments for the new/changed IEs
2. MAC ordering refinements
3. Text refinements
4. Additional text clarifications.

2 Overview of the proposed solution

[change the following tables as follows]

Table 306a H-ARQ DL MAP IE Format

Syntax	Size	Note
H-ARQ DL MAP IE {		
Extended DIUC 2	4	Set to 0x1
Length	8	Length of the IE in bytes
RCID_Type	2 bits	00 = Normal CID 01 = RCID11 10 = RCID7 11 = RCID3
Reserved	2bits	
While (data remains) {		Number of allocations is deducted from the length field.
OFDMA Symbol offset	8 bits	Offset from the start symbol of DL sub-frame
Subchannel offset	6 bits	
Boosting	3 bits	000: normal (not boosted); 001: +6dB; 010: -6dB; 011: +9dB; 100: +3dB; 101: -3dB; 110: -9dB; 111: -12dB;
No. OFDMA Symbols	7 bits	
No. Subchannels	6 bits	
Reserved	2 bits	
Mode	4 bits	Indicates the mode of this IE 0 = Chase H-ARQ 1 = Inremental redundancy H-ARQ for CTC 2 = Inremental redundancy H-ARQ for convolutional code

			3 – 15 *Reserved*
If (Mode== 0) {			
DL H-ARQ Chase Sub-Burst IE ()		Variable	
} else if (Mode== 1) {			
DL H-ARQ IR CTC Sub-Burst IE ()		Variable	
} else if (Mode== 2) {			
DL H-ARQ IR CC Sub-Burst IE ()		Variable	
}			
Padding		Variable	Padding to byte; shall be set to 0
}			

Table 306c DL H-ARQ Chase Sub-Burst IE Format

DL H-ARQ Chase Sub-Burst IE {				
DIUC		4 bits		
Repetition Coding Indication		2 bits		0b00 – No repetition coding 0b01 – Repetition coding of 2 used 0b10 – Repetition coding of 4 used 0b11 – Repetition coding of 6 used
N sub burst		5 bits		Number of sub-bursts in 2D region
Reserved		1 bits		
For (j=0; j< N sub burst; j++){				
RCID_IE()		Variable		
Duration		10 bits		Duration in slots
ACID		4 bits		
AI_SN		1 bit		
Reserved		3 bits		
CQICH Control Indicator		1 bits		
If(CQICH Control Indicator == 1){				
Allocation Index		6 bits		Index to the channel in a frame the CQI report should be transmitted by the SS
Period (p)		3 bits		A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS in every 2^p frames.
Frame offset		3 bits		The MSS starts reporting at the frame of which the number has the same 3 LSB as the specified frame offset. If the current frame is specified, the MSS should start reporting in 8 frames.
Duration (d)		4 bits		A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS for $2^{(d-1)}$ frames. If d is 0b0000, the CQICH is de-allocated. If d is 0b1111, the MSS should report until the BS command for the MSS to stop
}				
Dedicated DL Control Indicator		1 bit		
If (Dedicated DL Control Indicator ==1) {				
Dedicated DL Control IE ()		Variable		
}				

}		
}		

Table 306d DL H-ARQ IR CTC Sub-Burst IE Format

DL H-ARQ IR Sub-Burst IE {		
N sub burst	5 bits	
Reserved	3 bits	
For (j=0; j< N sub burst; j++){		
RCID_IE()	Variable	
Nep	4 bits	
Nsch	4 bits	
SPID	2 bits	
ACID	4 bits	
AI_SN	1 bit	
ACK disable	1 bit	When this bit is "1" no ACK channel is allocated and the SS shall not reply with an ACK.
Reserved	2 bit	
CQICH Control Indicator	1 bits	
If(CQICH Control Indicator == 1){		
Allocation Index	6 bits	Index to the channel in a frame the CQI report should be transmitted by the SS
Period (p)	3 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS in every 2^p frames.
Frame offset	3 bits	The MSS starts reporting at the frame of which the number has the same 3 LSB as the specified frame offset. If the current frame is specified, the MSS should start reporting in 8 frames.
Duration (d)	4 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS for $2^{(d-1)}$ frames. If d is 0b0000, the CQICH is de-allocated. If d is 0b1111, the MSS should report until the BS command for the MSS to stop
}		
Dedicated DL Control Indicator	1 bit	
If (Dedicated DL Control Indicator ==1) {		
Dedicated DL Control IE ()	Variable	
}		
}		
}		

Table 306e DL H-ARQ IR CC Sub-Burst IE Format

DL H-ARQ IR CC Sub-Burst IE {		
DIUC	4 bits	
Repetition Coding Indication	2 bits	0b00 – No repetition coding 0b01 – Repetition coding of 2 used 0b10 – Repetition coding of 4 used

		0b11 – Repetition coding of 6 used
N sub burst	5 bits	
Reserved	1 bits	
For (j=0; j< N sub burst; j++){		
RCID_IE()	Variable	
Duration	10 bits	Duration in slots
ACID	4 bits	
AI_SN	1 bit	
SPID	2 bits	
Reserved	1 bit	
CQICH Control Indicator	1 bits	
If(CQICH Control Indicator == 1){		
Allocation Index	6 bits	Index to the channel in a frame the CQI report should be transmitted by the SS
Period (p)	3 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS in every 2^p frames.
Frame offset	3 bits	The MSS starts reporting at the frame of which the number has the same 3 LSB as the specified frame offset. If the current frame is specified, the MSS should start reporting in 8 frames.
Duration (d)	4 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS for $2^{(d-1)}$ frames. If d is 0b0000, the CQICH is de-allocated. If d is 0b1111, the MSS should report until the BS command for the MSS to stop
}		
Dedicated DL Control Indicator	1 bit	
If (Dedicated DL Control Indicator ==1) {		
Dedicated DL Control IE ()	Variable	
}		
}		
}		

Table 306l H-ARQ UL MAP IE[IS1]

Syntax	Size	Note
H-ARQ UL MAP IE() {		
Extended UIUC	4	Set to 0x1
Length	8	Indicates the length of the IE in bytes
RCID_Type	2 bits	00 = Normal CID 01 = RCID11 10 = RCID7 11 = RCID3
Reserved	2 bits	

while (data remains) {		
Allocation Start Indication	1 bit	0: No allocation start information 1: Allocation start information follows
If (Allocation Start Indication == 1) {		
OFDMA Symbol offset	8 bits	This value indicates start Symbol offset of subsequent sub-bursts in this H-ARQ UL MAP IE
Subchannel offset	7 bits	This value indicates start Subchannel offset of subsequent sub-bursts in this H-ARQ UL MAP IE
Reserved	1 bits	
}		
Mode	3 bits	Indicates the mode of this IE 000 = Chase H-ARQ 001 = Inremental redundancy H-ARQ for CTC 010 = Inremental redundancy H-ARQ for convolutional code 011 – 111 *Reserved*
N sub Burst	4 bits	This field indicates the number of bursts in this UL MAP IE
For (i =0 ;i < N Sub-burst; i++){		
If (Mode == 000) {		
UL HARQ Chase Sub-Burst IE ()		
} else if (Mode== 001) {		
UL HARQ IR CTC Sub-Burst IE ()		
} else if (Mode== 010) {		
UL HARQ IR CC Sub-Burst IE ()		
}		
}		
}		
Padding	Variable	Padding to byte; shall be set to 0
}		

Table 306n UL HARQ Chase Sub-Burst IE Format

HARQ Chase UL Sub-Burst IE {		
RCID IE()	Variable	
Dedicated UL Control Indicator	1 bit	
If (Dedicated UL Control Indicator ==1) {		
Dedicated UL Control IE ()	Variable	
}		
UIUC	4 bits	
Repetition Coding Indication	2 bits	0b00 – No repetition coding 0b01 – Repetition coding of 2 used 0b10 – Repetition coding of 4 used 0b11 – Repetition coding of 6 used
Duration	10 bits	

ACID	4 bits		
AI_SN	1 bit		
Reserved	2 bits		
}			

Table 107f—SUB-DL-UL-MAP message format

Syntax	Size	Notes
SUB-DL-UL-MAP () {		
Compressed map indicator	3 bits	Set to binary 111
Map message length	10 bits	
Reserved	2 bits	Shall be set to 0
H-ARQ ACK offset indicator	1 bit	
If (H-ARQ ACK offset indicator == 1){		
DL H-ARQ ACK offset	8 bits	
UL H-ARQ ACK offset	8 bits	
}		
DL IE Count	8 bits	
For (i=1; i <= DL IE Count; i++)		
DL-MAP_IE()	Variable	
}		
UL starting slot offset	11 bits	
Reserved	1 bits	Shall be set to 0
while (map data remains){		
UL-MAP_IE()	Variable	
}		
If !(byte boundary) {		
Padding Nibble	Variable	Padding to reach byte boundary.
}		
}		

[Add to section 8.4.15.1 the following sub section between 8.4.15.1.1 H-ARQ Retransmission process & 8.4.15.1.2 CRC]

8.4.15.1.2 Frame number index

Bursts transmitted using Chase H-ARQ shall include the 4 least significant bits of the frame number, this index is used as reference time stamp of the first burst transition (may be used as a reference time for MAC Management information carried within the burst – e.g. fast feedback).

The frame number index appended to MAC data before padding (before partitioning to FEC blocks and encoding as defined in 8.4.9). Padding is done so that the total length after CRC concatenation matches the size of the burst indicated by the map.

[change the following in table 283]

Table 283 H-ARQ MAP or Sub-MAP Pointer IE Format

Syntax	**Size**	**Note**
H-ARQ and Sub- MAP Pointer IE {		
Extended DIUC	4 bits	H-ARQ MAP Pointer = 0x07

Length ~~=2xN~~	4 bits	~~N is the number of HARQ MAP or Sub-MAP bursts~~
While (data remains) {		
DIUC	4 bits	
No. Slots	8 bits	
Repetition Coding Indication	2 bits	
MAP Version	2 bits	0b00 – H-ARQ MAP v1 0b01 – Sub-MAP 0b02 – Sub-MAP with CID Mask included
~~CID mask included~~	~~1 bits~~	~~0 – CID mask not included~~ ~~1 – CID mask included~~
If (CID mask included) {		
Idle users	1 bit	Bursts for Idle users included in the Sub MAP
Sleep users	1 bit	Bursts for Sleep users included in the Sub MAP
CID Mask Length	2 bits	00: 11 bits 01: 19 bits 10: 35 bits 11: 51 bits
CID mask	n bits	n = The number of bits of CID mask is determined by CID Mask Length. When the MAP message pointed by this pointer IE includes any MAP IE for an awake mode MSS, the ((Basic CID of the MSS) MOD n)-the LSB of CID mask shall be set to 1. Otherwise, it may be set to 0..
}		
}		
}		

[Change the following text to section 11.7.8.14]

When aggregation flag is clear, the number of bits that ~~were~~ **are** allocated ~~in~~ **for** each HARQ channel **burst** in **a frame** ~~the last transmission~~ must not exceed "Number of bits per channel".
When aggregation flag is set, the sum over all HARQ channels, of the number of bits that ~~were~~ **are** allocated ~~in~~ **for** the HARQ channel in the **frame** ~~last transmission~~, must not exceed the "Number of bits per channel" multiplied by the maximum number channels supported by the SS. Note that sum total of the data bits supported is the same in both cases ~~is the same~~. The number of channels supported by the SS is indicated in 11.8.3.7.3.

[Change the following text to section 11.8.3.7.12]

The maximal number of uplink data burst allocations for the SS in a single UL subframe (note that the number of non-HARQ burst is always limited to1 ~~this is limited to 1 in case H-ARQ is disabled~~)

[Delete in section 6.3.17]

~~HARQ is enabled on a CID basis. An HARQ enabled CID must have ARQ enabled as well for this CID. See section 6.3.17.6~~

[Add to the end of section 11.13.32]

HARQ is enabled on a CID basis. ~~An HARQ enabled CID must have ARQ enabled as well for this CID. See section 6.3.17.6~~
To deal with ordering implication of HARQ, each connection may enable ARQ or PDU SN mechanisms on top of the enabled HARQ connection.
Time stamp of first HARQ burst transmission is used as a the time relevance for all MAC specific Management messages and Sub headers (such as BW requests, Fast feedback, ARQ feadbacks etc..) that been transmitted in this burst.

[Change in section 11.13.31]

11.13.31 HARQ Service Flows

Specifies whether the connection uses HARQ or not.
The relevance connections of this parameter when appears in REG-REQ/RSP messages are Basic, Primary and Secondary CIDs.

Type	Length	Value	Scope
~~44~~ [145/146].xx	1	0 = Non HARQ (default) 1 = HARQ Connection	DSA-REQ, DSA-RSP, REG-REQ, REG-RSP

[Add section 11.13.3x]

11.13.3x HARQ Channel mapping

This TLV is valid only in HARQ enabled connection. It specifies a HARQ channel number that may be used to carry data from this connection. This TLV may be used more then once to specify more then one channel per connection. HARQ channels may share more then one connection. An absent of this TLV means all HARQ channels can be used by this connection.
The relevance connections of this parameter when appears in REG-REQ/RSP messages are Basic, Primary and Secondary CIDs.

Type	Length	Value	Scope
[145/146].XX	1	HARQ channel number	DSA-REQ, DSA-RSP, REG-REQ, REG-RSP

[add the following section at the end of section 6.3.2.2]

6.3.2.2.x PDU SN Extended Subheader

Specify the PDU sequence number in a monotonic increasing manner.

Table 13xx—PDU (short) SN extended subheader

Name	Length(bits)	Description
PDU SN (short)	8	Specify the PDU SN number

Table 13xx—PDU SN (long) extended subheader

Name	Length(bits)	Description
PDU SN (long)	16	Specify the PDU SN number

[add to table 13b&c two bits 3&4 referring to the two new TLVs above]

[Add section 11.13.3x]

11.13.3x PDU SN Extended Subheader for HARQ reordering

This TLV is valid only in HARQ enabled connection. It specifies whether PDU SN extended subheader should be applied by the transmitter on every PDU on this connection. This SN may be used by the receiver to ensure PDU ordering.
This counter should start at 0 and should be reset after HHO/FBSS operations
The relevance connections of this parameter when appears in REG-REQ/RSP messages are Basic, Primary and Secondary CIDs (each should have its own PDU numbering)

Type	Length	Value	Scope
[145/146].XX	1	0 – No PDU SN extended SH (default) 1 - PDU SN (short) extended SH 2 - PDU SN (long) extended SH 3-256 – reserved.	DSA-REQ, DSA-RSP, REG-REQ, REG-RSP