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Re:	
Abstract	Support for Closed-Loop MIMO in H-ARQ MAP IE
Purpose	Adoption of proposed changes into P802.16e ~~Crossed-out indicates deleted text,~~ underlined blue indicates new text change to the Standard
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Support for Closed-Loop MIMO in H-ARQ MAP IE

1. Introduction

There are two objectives that this document is prepared to achieve: one editorial and one technical. The editorial part is to provide the correct Section/Table numbers and the technical part is to provide an important feature with small amount of text changes.
The H-ARQ MAP IE for MIMO bursts was introduced in [2] and accepted by the Working Group in 35th meeting in Sanya, but it failed to be added to the current draft standard [1]. The same proposal is re-written with proper Section and Table numbers in line with the existing texts. This is the editorial part. Based on this accepted texts, a much needed closed-loop capability is proposed with a minimal impact to the spec, which is the technical part of the document. The CL-MIMO functionalities included in the text change are identical to the accepted CL-MIMO DL MAP IE (8.4.5.3.25) with additional H-ARQ features.

To clarify, the text change in underlined blue is what was accepted and that in underlined red is what is being proposed in this document.

2. Specific Text Changes

[Modify the text from line 27 on page 260 to line 30 on page 261 of [1] as follows]

---------- Start of Text Change ----------

Table 285m -- 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
While (data remains) {		
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	
Mode	4 bit	Indicates the mode of this IE 0000 = Chase H-ARQ 0001 = Inremental redundancy H-ARQ for CTC 0010 = Inremental redundancy H-ARQ for convolutional code 0011 = MIMO Chase H-ARQ 0100 = MIMO IR H-ARQ 0101 = MIMO IR H-ARQ for Convolutional

		Code 0110 = MIMO STC H-ARQ 0111-1111 *Reserved*
If (Mode==000) {		
DL H-ARQ Chase Sub-Burst IE ()	variable	
} else if (Mode==001) {		
DL H-ARQ IR Sub-Burst IE ()	variable	
} else if (Mode==010) {		
DL H-ARQ IR CC Sub-Burst IE ()	variable	
} else if (Mode==011) {		
MIMO DL Chase H-ARQ Sub-Burst IE ()	variable	
} else if (Mode==100) {		
MIMO DL IR H-ARQ Sub-Burst IE ()	variable	
} else if (Mode==101) {		
MIMO DL IR H-ARQ for CC Sub-Burst IE ()	variable	
} else if (Mode == 110) {		
MIMO DL STC H-ARQ Sub-Burst IE ()	variable	
}		
}		
Padding	Variable	Padding to byte; shall be set to 0
}		

---------- End of Text Change ----------

[Add the following text after line 65 on page 264]

---------- Start of Text Change ----------

Table 285q -- MIMO DL Chase H-ARQ Sub-Burst IE Format

MIMO DL Chase H-ARQ Sub-Burst IE {		
N sub burst	5	Number of sub-bursts in the 2D region
For (j=0; j< N sub burst; j++){		
MU Indicator	1 bit	Indicates whether this DL burst is intended for multiple SS
Dedicated MIMO DL Control Indicator	1 bit	
If (MU indicator == 0) {		
RCID IE()	Variable	
}		
If (Dedicated MIMO DL Control Indicator ==1) {		
Dedicated MIMO DL Control IE ()	variable	
}		
Length	10 bits	
For (i=0;i<N_layer;i++) {		
if (MU indicator == 1) {		
RCID IE()	Variable	

}		
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
ACID	4 bits	
AI_SN	1 bit	
}		
}		
}		

For each multi SS sub-burst (MU Indicator = 1), if the dedicated pilot bit is set to 1 in the STC_ZONE IE (section 8.4.5.3.4) for the zone in which the sub-burst allocations are being made, N_layer for this sub-burst selects the pilot format for the sub-burst by interpreting N_layer as the number of transmit antennas (as defined in 8.4.8), and the SS with the first RCID shall be assigned the pilot pattern corresponding to antenna 1, of section 8.4.8, the second to the pilot pattern corresponding to antenna 2, and so on.

Table 285r -- MIMO DL IR H-ARQ Sub-Burst IE Format

MIMO DL IR H-ARQ Sub-Burst IE {		
N sub burst	5	Number of sub-bursts in the 2D region
For (j=0; j< N sub burst; j++){		
MU Indicator	1 bit	Indicates whether this DL burst is intended for multiple SS
Dedicated MIMO DL Control Indicator	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.
If (MU indicator == 0) {		
RCID IE()	Variable	
}		
If (Dedicated MIMO DL Control Indicator ==1) {		
Dedicated MIMO DL Control IE ()	variable	
}		
Nsch	4 bits	
If (ACK Disable ==0) {		
SPID	2 bits	
ACID	4 bits	
AI_SN	1 bit	
}		
For (i=0;i<N_layer;i++) {		
if (MU indicator == 1) {		
RCID IE()	Variable	
}		
Nep	4 bits	
}		

}		
}		

Table 285s -- MIMO DL IR H-ARQ for CC Sub-Burst IE Format

MIMO DL IR H-ARQ for CC Sub-Burst IE {		
N sub burst	5	Number of sub-bursts in the 2D region
For (j=0; j< N sub burst; j++){		
MU Indicator	1 bit	Indicates whether this DL burst is intended for multiple SS
Dedicated MIMO DL Control Indicator	1 bit	
If (MU indicator == 0) {		
RCID IE()	Variable	
}		
If (Dedicated MIMO DL Control Indicator ==1) {		
Dedicated MIMO DL Control IE ()	variable	
}		
Length	10 bits	
For (i=0;i<N_layer;i++) {		
if (MU indicator == 1) {		
RCID IE()	Variable	
}		
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
ACID	4 bits	
AI_SN	1 bit	
SPID	2 bits	
}		
}		
}		

Table 285t -- MIMO DL STC H-ARQ Sub-Burst IE Format

MIMO DL STC H-ARQ Sub-Burst IE {		
N sub burst	5	Number of sub-bursts in the 2D region
For (j=0; j< N sub burst; j++){		
Tx count	2 bits	00: first transmission 01: second transmission 10: third transmission 11: fourth transmission
Length	10 bits	
if (Tx count ==00) {		
MU Indicator	1 bit	Indicates whether this DL burst is

		intended for multiple SS
Dedicated MIMO DL Control Indicator	1 bit	
If (MU indicator == 0) {		
RCID IE()	Variable	
}		
If (Dedicated MIMO DL Control Indicator ==1) {		
Dedicated MIMO DL Control IE ()	variable	
}		
For (i=0;i<N_layer;i++) {		
if (MU indicator == 1) {		
RCID IE()	Variable	
}		
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
}		
ACID	4 bits	
}		
}		
}		

8.4.5.3.22.1 Dedicated MIMO DL Control IE Format

Dedicated DL Control IE for MIMO contains additional control information for each sub-burst. Because each sub-burst may have its own control information format dependent on the MSS capability, the length of the Dedicated DL Control IE for MIMO is variable.

Table 285u -- Dedicated MIMO DL Control IE Format

Syntax	size	Note
Dedicated MIMO DL Control IE() {	-	-
Length	5 bits	Length of following control information in Nibble.
Control Header	3 bits	Bit #0 : MIMO Control Info Bit #1 : CQI Control Info Bit #2 : ~~Reserved~~ Closed MIMO Control Info
N_layer	2 bits	Number of coding/modulation layers 00 = 1 layer 01 = 2 layers 10 = 3 layers 11 = 4 layers
if(MIMO Control Info == 1){		
Matrix	2 bits	Indicates transmission matrix (See 8.4.8)
}		
If(CQICH Control Info == 1){		
Period	~~2~~3 bits	Period (in frame) = 2^period

Frame offset	3 bits	
Duration	4 bits	A CQI feedback is transmitted on the CQI channels indexed by the CQICH_ID for 10 x 2^d frames.
for (j=0;N_layer+1;j++) {		
Allocation index[1]	6 bits	Index to CQICH assigned to this layer.
}		
CQICH_Num	2 bits	Number of additional CQICHs assigned to this SS (0-3)
for (i=0; i<CQICH_Num; i++) {		
Feedback type	3 bits	Type of feedback on this CQICH
Allocation index	6 bits	
}		
}		
if(Closed MIMO Control Info == 1){		

If (MIMO mode == 00 or 01) {		If(MIMO Control Info==1)
		MIMO mode = Matrix
		else
		MIMO mode = Matrix in STC_Zone_IE()

Antenna Grouping Index }	3 bits	Indicates the index of antenna grouping
		See 8.4.8.3.4 and 8.4.8.3.5
		If((Matrix_indicator == 00)
		000~010 = 0b101110~0b110000 in Table 298c
		else
		000~101 = 0b110001~0b110110 in Table 298c

elseif (MIMO mode == 10) {		
Antenna Selection Index }	3 bits	Indicates the index of antenna selection See 8.4.8.3.4 and 8.4.8.3.5 000~110 = 0b110000~0b110101
elseif (MIMO mode == 11) {		
Codebook Precoding Index }	6 bits	Indicates the index of precoding matrix W in the codebook See 8.4.8.3.6
Matrix	2 bits	Indicates transmission matrix (See 8.4.8)
Num_stream	2 bits	Indicates number of out streams from the STC block (i.e. number of rows in the STC matrix).
}		
Padding	Variable	Padding to Nibble; shall be set to 0
}		

Control Header

4 bits are used to indicate the following control information. If the first bit is set to 1, this means that MIMO Control information follows. If the second bit is set to 1, this IE shall contain CQI control information. Other bits are reserved for future extension.

N_layer

Specifies the number of layers contained in this burst. The layer is defined as a separate coding/modulation path.

Matrix Indicator

This field indicates MIMO matrix for the burst.

Period

Informs the SS of the period of CQI reports. A CQI feedback is transmitted on the CQICH every 2^p frames

Frame Offset

Informs the SS when to start transmitting reports. The SS starts reporting at the frame number which has the same 3 LSBs as the specified Frame Offset. If the current frame is specified, the SS shall start reporting in 8 frames.

Duration

Indicates when the SS should stop reporting unless the CQICH allocation is refreshed beforehand. If Duration is set to 0b0000, the BS shall de-allocate the CQICH. If Duration is set to 0b1111, the CQICH is allocated indefinitely and the SS should report until it receives another MAP_IE with Duration set to 0b0000.

Allocation Index[1]

Indicates position from the start of the CQICH region.

Feedback Type

Indicates the type of feedback content on the allocated CQICH from SS. Its mapping shall be
000 = Fast DL measurement/Default Feedback
001 = Quantized precoding weight feedback
010-111 = Reserved

---------- End of Text Change ----------

[Modify the text from line 4 on page 348 to line 24 on page 349 of [1] as follows]

---------- Start of Text Change ----------

Table 302l -- H-ARQ UL MAP IE

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
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
}		
Mode	3 bit	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 = MIMO Chase H-ARQ 100 = MIMO IR H-ARQ 101 = MIMO IR H-ARQ for Convolutional Code 110 = MIMO STC H-ARQ 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 ()			
} else if (Mode== 011) {			
MIMO UL Chase HARQ Sub-Burst IE ()			
} else if (Mode== 100) {			
MIMO UL IR H-ARQ Sub-Burst IE ()			
} else if (Mode== 101) {			
MIMO UL IR HARQ for CC Sub-Burst IE ()			
} else if (Mode == 110) {			
MIMO UL STC HARQ Sub-Burst IE ()			
}			
}			
}			
Padding		Variable	Padding to byte; shall be set to 0
}			

---------- End of Text Change ----------

[Add the following text after line 27 on page 351]

---------- Start of Text Change ----------

Table 302p -- MIMO UL Chase HARQ Sub-Burst IE Format

MIMO UL Chase HARQ Sub-Burst IE{			
MU Indicator	1 bit	Indicates whether this UL burst is intended for multiple SS	
Dedicated MIMO UL Control Indicator	1 bit		
if (MU indicator == 0) {			
RCID IE()	Variable		
If (Dedicated MIMO UL Control Indicator ==1) {			
Dedicated MIMO UL Control IE ()	variable		
}			
}			
Duration	10 bits		
For (i=0;i<N_layer;i++) {			
if (MU indicator == 1) {			
RCID 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	
ACID	4 bits		
AI_SN	1 bit		

}					
}					

For each single SS sub-burst (MU indicator = 0) matrix and layer information shall be read from Dedicated MIMO UL Control IE, if set by the indicator bit, and be applied to the burst accordingly. For each multi SS sub-burst (MU Indicator = 1), N_layer for this sub-burst shall be set to 2 and the first SS with the first RCID shall use the pilot pattern A in 8.4.8.1.5 and the first UIUC, whereas the second SS with the second RCID shall use the pilot pattern B and the second UIUC.

Table 302q -- MIMO UL IR HARQ Sub-Burst IE Format

MIMO UL IR HARQ Sub-Burst IE{					
MU Indicator		1 bit		Indicates whether this UL burst is intended for multiple SS	
Dedicated MIMO UL Control Indicator		1 bit			
if (MU indicator == 0) {					
RCID IE()		Variable			
If (Dedicated MIMO UL Control Indicator ==1) {					
Dedicated MIMO UL Control IE ()		variable			
}					
}					
Nsch		4 bits			
SPID		2 bits			
ACID		4 bits			
AI_SN		1 bit			
For (i=0;i<N_layer;i++) {					
if (MU indicator == 1) {					
RCID IE()		Variable			
}					
Nep		4 bits			
}					
}					

Table 302r -- MIMO UL IR HARQ for CC Sub-Burst IE Format

MIMO UL IR HARQ for CC Sub-Burst IE{					
MU Indicator		1 bit		Indicates whether this UL burst is intended for multiple SS	
Dedicated MIMO UL Control Indicator		1 bit			
if (MU indicator == 0) {					
RCID IE()		Variable			
If (Dedicated MIMO UL Control Indicator ==1) {					
Dedicated MIMO UL Control IE ()		variable			
}					
}					
Duration		10 bits			
For (i=0;i<N_layer;i++) {					

if (MU indicator == 1) {		
RCID 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
ACID	4 bits	
AI_SN	1 bit	
SPID	2 bit	
}		
}		

Table 302s -- MIMO UL STC HARQ Sub-Burst IE Format

MIMO UL STC HARQ Sub-Burst IE{		
Tx count	2 bits	00: first transmission 01: second transmission 10: third transmission 11: fourth transmission
Duration	10 bits	
if (Tx count ==0) {		
if (MU indicator == 0) {		
RCID IE()	Variable	
If (Dedicated MIMO UL Control Indicator ==1) {		
Dedicated MIMO UL Control IE ()	variable	
}		
}		
For (i=0;i<N_layer;i++) {		
If (MU indicator == 1) {		
RCID 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
}		
ACID	4 bits	
}		
}		

---------- End of Text Change ----------

[Add the following text after line 61 on page 351]

---------- Start of Text Change ----------

8.4.5.4.25.2 Dedicated MIMO UL Control IE Format

Dedicated UL Control IE for MIMO contains additional control information for each sub bursts.

Table 302t -- Dedicated MIMO UL Control IE Format

Syntax	size	Note
Dedicated MIMO UL Control IE() {	-	-
Matrix	2 bits	Indicates transmission matrix (See 8.4.8) 00 = Matrix A (Transmit Diversity) 01 = Matrix B (Spatial Multiplexing) 10-11 = Reserved
N_layer	2 bits	Number of coding/modulation layers 00 = 1 layer 01 = 2 layers 10-11 = Reserved
}		

---------- End of Text Change ----------

[Add the following text after line 14 on page 335]

---------- Start of Text Change ----------

Table 302a. CQICH Enhanced allocation IE format

Syntax	**Size (bits)**	**Notes**
CQICH_Enhanced_Alloc_IE() {		
Extended UIUC	4	0x09
Length	4	Length in bytes of following fields
CQICH_ID	variable	Index to uniquely identify the CQICH resource assigned to the MSS
Period (=p)	3	A CQI feedback is transmitted on the CQICH every 2^p frames
Frame offset	3	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)	3	A CQI feedback is transmitted on the CQI channels indexed by the CQICH_ID for 10 x 2^d frames. If d==0, the CQICH is de-allocated. If d == 111, the MSS should report until the BS command for the MSS to stop.
CQICH_Num	4	Number of CQICHs assigned to this CQICH_ID is (CQICH_Num +1)
for (i=0;i<CQICH_Num+1;i++) {		
Feedback_type	3	000 = Fast DL measurement/Default Feedback with antenna grouping 001 = Fast DL measurement/Default Feedback with antenna selection 010 = Fast DL measurement/Default Feedback with reduced code

		book 011 = Quantized precoding weight feedback 100 = Index to precoding matrix in code book 101 = Channel Matrix Information 101 = Per stream power control 110 = Quantized precoding weight feedback with spatial rate equal to number of streams (i.e. using SISO or pure spatial multiplexing transmission) 111 = Reserved
Allocation index	6	Index to the fast feedback channel region marked by UIUC=0
CQICH Type	2	00 = 6 bit CQI, 01 = DIUC-CQI, 10 = 3 bit CQI (even), 11 = 3 bit CQI(odd)
}		
Band_AMC_Precoding_Mode	1	0 = One common precoder for all bands. 1 = Distinct precoders for the bands with the highest S/N values, up to the number of short term precoders fed back as specified by Nr_Precoders_feedback

If (Band_AMC_Precoding_Mode =1) {
 	
Nr_Precoders_feedback (=N)
}
	3	Nr of precoders feedback = N.

Padding	variable	The padding bits are used to ensure the IE size is integer number of bytes.
}		

---------- End of Text Change ----------

[Add the following text after line 33 on page 424]

---------- Start of Text Change ----------

Feeding back multiple precoder for band AMC operation

For band AMC the BS has the choice to request a common precoding matrix for all bands or can request a programmable number, N (see Table ~~298a~~302a), of precoding matrices to be fed back for the N best bands selected in an ordered fashion. In the latter case, the precoding matrices are associated with the bands with the highest S/N values. As a secondary selection criteria, in case the ordering according to highest S/N is not unique, the bands with the lowest band index are chosen first. ~~The index for each precoder is mapped to a CQICH channel of the corresponding size. The precoders for the different bands, in the order described above, is signaled in the corresponding CQICH channels.~~ The indices for the precoders are mapped onto the CQICH channels allocated for the precoding feedback. The indices are packed with the precoders for the bands with the highest S/N first. As a secondary ordering criteria, the precoders associated with the bands with the lowest band index are packed first in the CQICH channels. The MSB of each precoding index word is placed as leftmost as possible in the next non-filled CQICH word. The CQICH channel with the lowest index is filled first and then the CQICH channels are filled in increasing CQICH index order.

---------- End of Text Change ----------

References

[1] IEEE P802.16e/D6 Air Interface for Fixed and Mobile Broadband Wireless Access Systems – Amendment for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands

[2] IEEE C802.16e-05/038r1 “Normal MAP Extension for MIMO H-ARQ”, accepted at 35th 802.16 Meeting in Jan. 2005