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Source(s)	Yossi Segal, Yigal Leiba, Zion Hadad, Runcom Technologies Ltd. Panyuh Joo, Seungjoo Maeng, Jaeho Jeon, Soonyoung Yoon, Jaehee Cho, Geunhwi Lim, JungWon Kim, Hong Sung Chang, Yong Chang, TaeWon Kim panyuh@samsung.com Samsung Electronics Co. Ltd. Chulsik Yoon, Byung-Han Ryu ETRI
Re:	Sponsor re-circulation Ballot
Abstract	H-ARQ support corrections, for OFDMA PHY mode from MAC perspective
Purpose	Adoption of proposed changes into P802.16-REVd/D4-2004
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1 INTRODUCTION

H-ARQ can be used to mitigate the effect of channel and interference fluctuation. H-ARQ renders performance improvement due to SNR gain and time diversity achieved by combining previously erroneously decoded packet and retransmitted packet, and due to additional coding gain by IR(Incremental Redundancy).

The physical operation of H-ARQ and its parameters are described in the contribution "H-ARQ support corrections, for OFDMA PHY mode".

This contribution shows what changes on the standard 'P802.16-REVd/D4-2004' are required for support of H-ARQ from MAC perspective.

2 Changes to Chapter 6 : General MAC description of H-ARQ

6.4.1~~6~~7 MAC support for HARQ

Hybrid automatic repeat request (H-ARQ) scheme is an optional part of the MAC and can be enabled on a per-terminal basis. The per-terminal H-ARQ and associated parameters shall be specified and negotiated during initialization procedure. A terminal cannot have a mixture of H-ARQ and non-H-ARQ traffic.

One or more MAC PDUs can be concatenated and an H-ARQ packet formed by adding a CRC to the PHY burst. Figure 125 shows how the H-ARQ encoder packet is constructed.
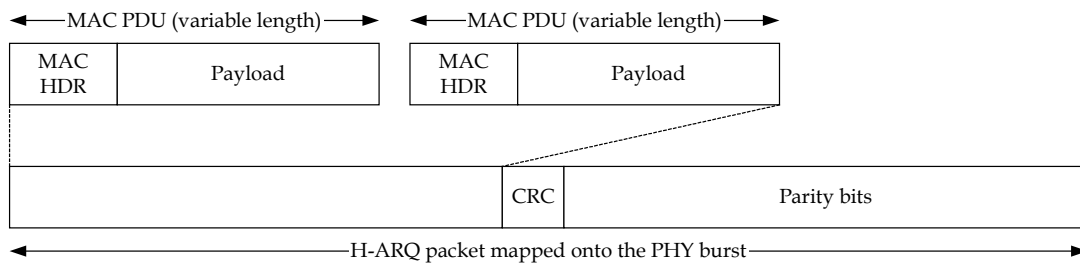

Figure 125—Construction of H-ARQ encoder packet

Each encoder packet is encoded according to the PHY specification, and four subpackets are generated from the encoded result. A subpacket identifier (SPID) is used to distinguish the four subpackets. In case of downlink communication, a BS can send one of the subpackets in a burst transmission. Because of the redundancy among the subpackets, SS can correctly decode the original encoder packet even before it receives all four subpackets. Whenever receiving the first subpacket, the SS attempts to decode the original encoder packet from it. If it succeeds, the SS sends an ACK to the BS, so that the BS stops sending additional subpackets of the encoder packet. Otherwise, the SS sends a NAK, which causes the BS to transmit one subpacket selected from the four. These procedures go on until the SS successfully decodes the encoder packet. When the SS receives more than one subpacket, it tries to decode the encoder packet from ever-received subpackets.

The rule of subpacket transmission is as follows~~.~~

1. At the first transmission, BS shall send the subpacket labeled '00'.
2. BS may send one among subpackets labeled '00', '01', '10', or '11' in any order~~, as long as the total number of transmitted subpackets does not exceed the maximum number of H-ARQ retransmission specified in CD message~~ .
3. BS can send more than one copy of any subpacket, and can omit any subpacket except the subpacket labeled '00' .

In order to specify the start of a new transmission, one-bit H-ARQ identifier sequence number (AI_SN) is toggled on every successful transmission of an encoder packet on the same H-ARQ channel. If the AI_SN changes, the receiver treats the corresponding subpacket as a subpacket belongs to a new encoder packet, and discards ever-received subpackets with the same ARQ identifier.

The H-ARQ scheme is basically a stop-and-wait protocol. The ACK is sent by the SS after a fixed delay (synchronous ACK) defined by ~~H-ARQ_ACK_DELAY~~ HARQ DL ACK delay offset which is specified in ~~D~~CD message. Timing of retransmission is, however, flexible and corresponds to the asynchronous part of the H-ARQ. The ACK/NAK is ~~a differential binary PSK modulated signal sent by the SS~~ sent by the BS using the HARQ Bitmap IE, and sent by a SS using the fast feedback UL subchannel.

The H-ARQ scheme supports multiple H-ARQ channels per a connection, each of which may have an encoder packet transaction pending. The number of H-ARQ channels in use is determined by BS. These ARQ channels are distinguished by an H-ARQ channel identifier (ACID). The ACID for any subpackets can be uniquely identified by the control information carried in the MAPs.

H-ARQ (Hybrid Automatic Repeat reQuest) can be used to mitigate the effect of channel and interference fluctuation. H-ARQ renders performance improvement due to SNR gain and time diversity achieved by combining previously erroneously decoded packet and retransmitted packet, and due to additional coding gain by IR (Incremental Redundancy).

6.4.17.1 Subpacket generation

HARQ operates at the FEC block level. The FEC encoder is responsible for generating the HARQ subpackets, as defined in the relevant PHY section. The subpackets are combined by the receiver FEC decoder as part of the decoding process.

6.4.17.~~1~~2 DL/UL ACK/NAK signaling

For DL/UL H-ARQ, ACK/NAK signaling is necessary. For the ACK/NAK signaling of DL H-ARQ channel, a ACK/NAK channel is allocated by UL-MAP. For the ACK/NAK signaling of UL H-ARQ channel, ACK/NACK bitmap information is transmitted by DL-MAP.

6.4.17.3 H-ARQ parameter signaling

The parameters for each subpacket should be signaled independent of the subpacket burst itself. The parameters for each subpacket include SPID (Subpacket Identifier. The BS shall set this field to the subpacket identifier for the subpacket transmission.), ACID (ARQ Channel Identifier. The BS shall set this field to the ARQ channel identifier for the subpacket transmission.), and AI_SN (ARQ identifier sequence number. This toggles between '0' and '1' on successfully transmitting each encoder packet with the same ARQ channel.). For the signaling of those parameters, H-ARQ Allocation IE is defined and the IE is to be placed in a DL-MAP or UL-MAP for a burst where H-ARQ is used.

3 Changes to Chapter 8 : OFDMA

MAP extension for hybrid ARQ is required.

Add following text:

3.1 H-ARQ Control IE

The HARQ_Control_IE format is presented in H.0. This IE should be located after CID in the DL/UL MAP_IE when hybrid ARQ function is enabled by the HARQ_Indication field in the Format Configuration_IE.

Table H.0 HARQ_Control_IE format

Syntax	Size	Notes
HARQ_Control_IE () {		In DL/UL-MAP
Prefix	1 bit	0: Temporary disable HARQ 1: enable HARQ
if (Prefix ==1){		
AI_SN	1 bits	ARQ ID Seq. No
SPID	2 bits	Subpacket ID
ACID	4 bits	ARQ CH ID
} else{		
reserved	3 bit	
}		
}		

3.2 H-ARQ Ack IE

8.4.5.3.9 Compact DL-MAP_IE() for HARQ_ACK_Bitmap
The HARQ_ACK_Bitmap is located in the DL-MAP. BS should transmit acknowledgement signal for the HARQ enabled UL bursts using the one bit in the bitmap. The bit offset in the bitmap is determined by the order of the HARQ enabled UL bursts in the UL-MAP. The frame offset between the UL burst and the HARQ-ACK-BITMAP is specified by the BS using DCD message.
For example, when a SS transmits a HARQ enabled burst at i-th frame and the burst is j-th HARQ enabled burst in the MAP, the SS should receive HARQ ACK at j-th bit of the BITMAP which is sent by the BS at i+(frame offset)-th frame.

Should be located in the Compact-MAP

Table H.1

Syntax	Size	Notes
Compact DL-MAP_IE () {		
DL-MAP Type = 5	3 bits	HARQ-ACK-BITMAP
Length	4 bits	length
BITMAP	variable	
}		

BITMAP
   BS transmits one HARQ ACK bit per a HARQ enabled UL-burst of previous frame. The size of BITMAP should be equal or larger than the number of HARQ enabled UL-bursts.

3.3 CQICH(Channel Quality Information Channel)

8.4.5.x.x CQI-CH

This section describes the operation scenarios and requirements of CQI-CH. Reporting CQI enables SS and BS to determine modulation/coding (M/C) levels adaptively, which results in maximizing the throughput of the system.

This section consists of three components of CQI reporting. First, we will describe how to report the initial channel status and establish a CQI-CH at the network entry procedure. Second, how to maintain the CQI-CH will be later explained. Finally, we will discuss the support procedure of BAND AMC

  I. Network Entry and CQI-CH establishment

    1. Operation scenarios
    In the network entry procedure, many messages should be exchanged for a connection to be established. Employing the correct M/C level is essential to minimize this overhead.

    As per the network entry procedure described the current standard draft, after initial ranging for the adjustment of the TX parameters, the RNG-REQ/RSP should be exchanged. At this point, since the SS and the BS do not know how fast the channel response changes, the only appropriate subchannels that can be allocated are diversity ones. To determine the M/C level of diversity subchannels, the only parameter for the SS to report the BS is the CINR measurement of the whole channel. Since the RNG-REQ message has a CINR measurement among the TLV parameters, the SS reports the BS using the message so that it can determine the M/C level from then on.

    The next message to be transmitted by the BS is the RNG-RSP. Unless a CQI-CH has been allocated to the SS previously, the BS may allocate a CQI-CH using a CQI-CH allocation MAP IE in the DL MAP (Note that the BS may allocate or de-allocate a CQI-CH to the SS anytime later if necessary using the CQI-CH allocation MAP-IE). As it will be shown later in this section, the BS can make the SS report for a specified duration and can also specify the location and time of a CQI-CH

using its index, frame offset, and period. The SS keeps reporting the measured CINR using the allocated CQI-CH so that the BS has up-to-date CINR information and enables to determine the M/C level using the information accordingly.

The following messages and information elements are used for the operation described above.

    i.   RNG-REQ
          Unless the CQI-CH is established a priori, the TLV field of RNG-REQ should contain the average CINR report.

    ii.   RNG-RSP
          Unless the CQI-CH is allocated a priori, the CQI-CH allocation subheader should be attached in front of the message or the CQI-CH allocation MAP IE should be included in the DL-MAP.

    iii.   Definition of CQI-CH region in UL-MAP (should be added in 8.4.5.4)

          The UL-MAP should have a MAP IE defining a CQI channel region that indicates how many subchannels are allocated for it. For efficiency, the CQI-CH region allocation IE is merged with HARQ region allocation IE as HARQ and CQI-CH region allocation IE which is presented in Table H.3.

    iv.   Definition of CQI-CH allocation MAP IE

Table H.2.

Syntax	Size	Notes
CQI-CH-allocation-MAP_IE () {		
CQI-CH indicator if CQI-CH indicator == 1 {	1	If the indicator == 1, the CQI-CH allocation MAP_IE follows. If the indicator == 0, no CQI-CH allocation MAP_IE is present for the SS.
Allocation offset	5 bits	Index to the channel in a frame the CQI report should be transmitted by the SS.
Period (=p)	2 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 SS 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 SS should start reporting in 8 frames
Duration (=d)	3 bits	A CQI feedback is transmitted on the CQI channels indexed by the (CQI Channel Index) by the SS for 10 x 2^d frames. If d == 0, the CQI-CH is de-allocated. If d == 111, the SS should report until the BS command for the SS to stop.
}		
}		

Each field of the IE represents the following parameters:

Allocation Index
      It indicates its position from the start of the CQI-CH region

Period

It informs the SS of the period of CQI reports

Frame offset

It informs the SS of when to start. The SS 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 SS should start reporting in 8 frames

Duration

It indicates when the SS should stop reporting unless the CQI-CH allocation is refreshed beforehand. If duration d == 000, the BS is intended to de-allocate the CQI-CH. If d == 111, the CQI-CH is allocated indefinitely and the SS should report until the BS commands the SS to stop, which happens it receives the de-allocation MAP_IE.

II.   CQI-CH Maintenance

1.   Operation scenario I: Renewing CQI-CH

As mentioned above, the SS should report until the CQI-CH timer expires (the CQI report duration is given when it is allocated). If the data to be transmitted by either the BS or the SS are left, the BS should renew the timer by putting a CQI-CH allocation IE in the UL-MAP. In addition to renewing the timer, the BS can also put a CQI-CH allocation MAP IE in the UL-MAP when it should be de-allocated (d == 000) for some reasons, or re-allocated to a different location or with a different offset or period.

2.   Operation scenario II: De-allocation of a CQI-CH

As shown in the definition of the CQI-CH allocation MAP IE, if the duration is set '000', the CQI-CH is de-allocated. The BS knows if the CQI-CH is de-allocated by checking if any codeword is transmitted on it. Otherwise, the BS keeps sending the de-allocation MAP-IE until the SS stops using the channel. To prevent two or more SS from occupying the same channel at the same, the BS should allocate the channel after making sure that it has been de-allocated.

3.   Operation scenario III: CQI report and Sleep mode

Obviously, if the SS enters into sleep mode, the CQI-CH is automatically de-allocated. Hence, the SS stops reporting its CQI, and the BS assumes it is released and it may be re-allocated to another SS.

III. BAND AMC Support

1.   Operation scenario: Requesting transition to BAND AMC mode from diversity

The SS sends the REP-RSP message in an unsolicited fashion to BS to trigger Band AMC operation. The triggering conditions are given by TLV encodings in UCD messages.

In order for the BS to allocate BAND AMC subchannels to the SS, it should know the CINR measurements of all bands. Although this information would be carried by the message (REP-RSP), reporting the CINR measurements of all bands requires huge overhead. Hence, the SS selects the five best bands and reports the measurements of only the selected bands. If the SS sends the REP-RSP message with CINR measurements of the selected bands, the BS implicitly knows that the SS wants to use BAND AMC subchannels.

Currently, the number of bands can be up to 48 (2k FFT in 20 MHz BW). However, to minimize the overhead, the definitions of a band of 1k and 2k FFT systems are altered. In a 1k FFT system (24 bands), we assume there are only 12 bands. In this case, the quotient of a band index divided by 2 is the band index for CQI reporting. In a 2k FFT system (48 bands), the bands are paired the same as the 1k system. Then, again, the SS only uses the odd numbered band and renumbers the band indices ranging from 0 to 11 if the LSB of its MAC address is 1. Otherwise, it uses the even numbered ones and renumbers similarly.

2.   Operation Scenario II: Requesting to diversity mode from BAND AMC

While the SS uses BAND AMC subchannels, it may want to use diversity ones again. In this case, the SS sends a REP-RSP message in an unsolicited fashion. The REP-RSP message should carry the CINR measurement of the whole band. If the BS receives the message, it allocates diversity subchannels from then on.

TLV parameters of REP-REQ and REP-RSP (should be edited to support the CQI-CH) are shown in 11.11 and 11.12

IV.　Reporting the CQ using the CQI-CH

1.　Encoding

If the SS uses diversity subchannels, it measures the average CINR of the whole channel and encodes it into 5 information bits. If the SS uses BAND AMC subchannels, each bit of 5 information bits represents the differential increment (1) or decrement (0) of the received CINR of the corresponding selected band.

2.　Maximum capacity of CQI-CH

Currently, up to 32 SS may report their CQI in a single frame. However, the more SS report and the BS keeps track of them, the better the performance is. Here is the tradeoff between the overhead of the CQI report and the number of supportable SS. To expand the capacity, the BS may allocate the CQI-CH by adjusting the period of the CQI report. The maximum period in the current setting is 8 frames (The algorithm to determine the period is out of the scope of the specification). Hence, the maximum number of SS supported by one BS is 256.

3.4 H-ARQ and CQICH Region IE

8.4.5.4.9 HARQ_CQI_Region_IE
The HARQ_CQI_Region_IE format is presented in Table H.3. This IE is located in the UL-MAP. Hybrid ARQ enabled SS should transmit acknowledgement signal for the HARQ enabled DL burst in a slot of the region specified by the HARQ_CQI_Region_IE. And the CQI report enabled SS should transmit CQI signal in a region specified also. Refer CQI section for the detailed operation of CQI.
The slot offset in the region is determined by the order of the HARQ enabled DL bursts in the DL-MAP. The frame offset between the DL burst and the HARQ acknowledgement region is specified by the BS using the UCD message.

Table H.3

Syntax	Size	Notes
Compact UL-MAP_IE () {		
UL-MAP Type = 4	3 bits	HARQ_CQI_Region
HARQ Region Change Indication	1 bit	0: no region change 1: region changed
CQI Region Change Indication	1 bits	0: no region change 1: region changed
Reserved	3 bits	
if(HARQ Region Change Indication == 1) {		
OFDMA Symbol offset for HARQ	8 bits	
Subchannel offset for HARQ	8 bits	
No. OFDMA Symbols for HARQ	8 bits	
No. Subchannels for HARQ	8 bits	
}		
if(CQI Region Change Indication == 1) {		
OFDMA Symbol offset for CQI	8 bits	
Subchannel offset for CQI	8 bits	

No. OFDMA Symbols for CQI	8 bits	
No. Subchannels for CQI	8 bits	
}		
}		

HARQ Region Change Indication
> This value indicates the change of ARQ acknowledgement region. Set to 1 when ARQ acknowledgement region is changed. Otherwise it set to 0.

CQI Region Change Indication
> This value indicates the change of CQI report region. Set to 1 when CQI report region is changed. Otherwise it set to 0.

OFDMA Symbol offset for HARQ
Subchannel offset for HARQ
No. OFDMA Symbols for HARQ
No. Subchannels for HARQ
> These fields specify the start symbol offset, the start subchannel offset, the number of allocated symbols and the number of subchannels for the HARQ acknowledgement region respectively.

OFDMA Symbol offset for CQI
Subchannel offset for CQI
No. OFDMA Symbols for CQI
No. Subchannels for CQI
> These fields specify the start symbol offset, the start subchannel offset, the number of allocated symbols and the number of subchannels for the CQI report region respectively.

3.5 Reduced CID

When the HARQ is enabled, the MAP size increases because each HARQ enabled burst should include CID field. The proposed Reduced CID scheme reduces the CID overhead.

Add following section and text:

8.4.5.6.4 RCID_IE

Table H4 presents the format of reduced CID. BS may use reduced CID instead of basic CID or multicast CID to reduce the size of compact MAP message. The type of reduced CID is determined by BS considering the range of basic CIDs of SS connected with the BS and specified by the RCID_Type field of the Format Configuration IE.
The reduced CID is composed of 1 bit of prefix and n-bits of LSB of CID of SS. The prefix is set to 1 for the broadcast CID or multicast CID and set to 0 for basic CID. The reduced CID can not be used instead of transport CID, primary management CID or secondary management CID.

Figure C.1 shows the decoding of reduced CID when the RCID_Type is set to 3.

Prefix = 0, basic CID

RCID 11 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |

CID | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |

Prefix = 1, Multicast or Broadcast CID

RCID 11 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |

CID | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
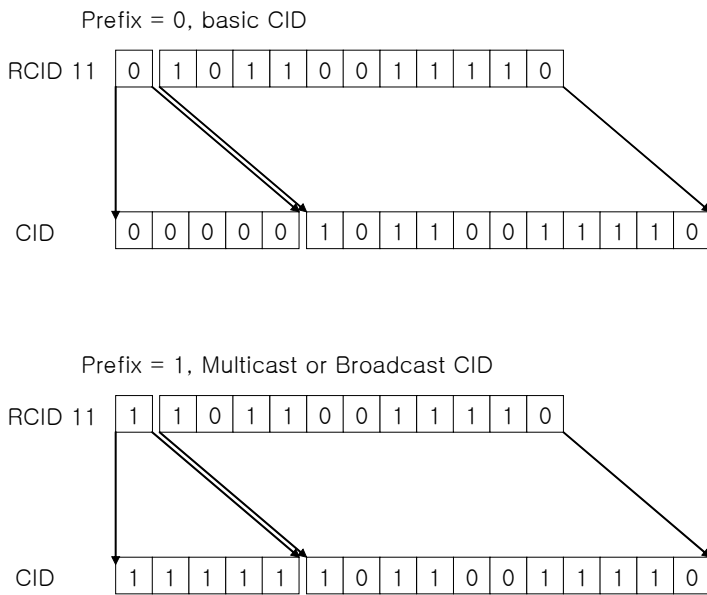
Figure C.1 Reduced CID Decoding

Table H.4 RCID_IE format

Syntax	Size	Notes
RCID_IE ( ) {		Support of Reduced CID
if (RCID_Type == 0){		RCID_Type is specified in Format Configuration_IE
CID	16	normal CID
}else{		
Prefix	1	for multicast, AAS, Padding & broadcast burst temporary disable RCID
if (Prefix == 1){		
Reduced CID 11	11	11 LSB of multicast, AAS or broadcast CID
}else{		
if (RCID_Type == 0){		RCID_Type is specified in Format Configuration_IE
Reduced CID 16	16	11 LSB of basic CID
} else if (RCID_Type == 1){		
Reduced CID 13	13	9 LSB of basic CID
} else if (RCID_Type == 2){		
Reduced CID 11	11	7 LSB of basic CID
} else if (RCID_Type == 3){		
Reduced CID 9	9	7 LSB of basic CID
} else if (RCID_Type == 4){		
Reduced CID 7	7	7 LSB of basic CID
} else if (RCID_Type == 5){		
Reduced CID 5	5	7 LSB of basic CID
}		
}		
}		

}		

3.6 Format Configuration

The Format_Configuration_IE configures format of compact MAP_IE and CID type. The format should be set to default value when the frame start.

Table H.6. Format_Configuration_IE

Syntax	Size	Notes
Compact DL-MAP_IE( ) {		Change Sub-MAP_IE format
DL-MAP Type = 4	3 bits	Format_Configuration_IE
New Format Indication	1 bits	0: Use latest format configured by the latest Format_Configuration_IE 1: New format
if (New Format Indication == 1) {		
CID Type	3 bits	0: Normal CID 1: RCID13, 2: RCID11, (default) 3: RCID9, 4: RCID7, 5: RCID5 6~7: Reserved
Safety Pattern	5 bits	Range of value 0~23
Reserved	2 bit	
Max Logical Bands	2 bits	0: 3 bands, 1: 6 bands, 2:12 bands, 3: 24 bands (default)
No. Symbols for DL Subchannel	4 bits	No. Symbol
No. Symbols for DL Band	4 bits	No. Symbol
No. Symbols for Broadcast	4 bits	No. Symbol
No. Symbols for UL Subchannel	4 bits	No. Symbol
No. Symbols for UL Bands	4 bits	No. Symbol
}		
}		

New Format Indication
> If this value set to 0, the format should be configured by the latest Format Configuration_IE in the previous frames. Otherwise, whole parameters in Format Configuration IE should be configured. The configured parameters are valid for the following compact MAP_IE.
> At the start of each frame all parameters is set to default values.

CID Type
> This value specifies CID type used in MAP_IE. The CID type should be set to single CID for the HARQ enabled MAP_IE.

No. Symbols for DL Subchannel
> This specifies the frame structure of DL Subchannel

No. Symbols for DL Band
> This specifies the frame structure of DL Band

No. Symbols for Broadcast
> This specifies the frame structure of Broadcast

No. Symbols for UL Subchannel
> This specifies the frame structure of UL Subchannel

No. Symbols for UL Band
> This specifies the frame structure of UL Band

Safety Pattern

If this value is less than 16, the number of safety bins is 12 and the indices of allocated bins for safety are 16m+x, where x is the value of Safety Pattern and m = 0 ~ 11. If this value is not less than 16, the number of safety bins is 24 and the indices of allocated bins for safety are 16m+x' and 16m+(x'+8), where x' = x – 16 and m = 0~11.

Table H.7 Field length for Band AMC MAP_IE

Max Logical Bands field	3	2	1	0
Bands	24	12	6	3
# of bits for No. Selected Bands	4	2	2	0
# of bits for Band BITMAP	24	12	6	4
# of bits for Band Index	6	4	4	0

3.7 Compact MAP

8.4.5.6.3 Compact MAP
The Compact MAP format, which includes Compact DL/UL-MAP IE(), is presented in Table H.8. This message defines the access to the downlink information of HARQ enabled SS. BS may broadcast multiple compact MAP messages using multiple burst after MAP message. Each burst may have a different coding and modulation scheme.
Every burst defined by MAP message should have a MAC header.

Table H.8 Format of Compact MAP

Syntax	Size	Notes
Compact_MAP_Message_Format ( ) {		
Compact MAP Indicator = 111	3 bits	set to binary 111
Compact_UL-MAP appended	1 bit	
CRC appended	1 bit	
Length	11 bit	
DL IE count	4	Number of IEs in the burst
for (i=0; i < DL IE count; i++){		
Compact_ DL-MAP_IE()	variable	
}		
If (Compact_UL-MAP appended ==1){		
while (map data remains) {		
Compact_UL-MAP_IE()	variable	
}		
}		
if !(byte boundary) {		
Padding bits	1	
}		
}		

Compact MAP Indicator : The value of binary 111means this message is a Compact MAP Message while the value of binary 110 represents a Compressed MAP.
Compact UL-MAP appended
A value of 1 indicates a compact UL-MAP is appended to the current compact
DL-MAP data structure
CRC appended
A value of one indicates a CRC-32 value is appended to the end of the compact map(s) data.
The CRC is computed across all bytes of the compact map(s) starting with the byte containing
the Compact map indicator through the last byte of the map(s) as specified by the Map message
length field. The CRC calculation is the same as that used for standard MAC messages. A value of
zero indicates that no CRC is appended.

Map message length
This value specifies the length of the compact map message(s) beginning with the byte containing the compact map indicator and ending with the last byte of the compact MAP message
DL IE count
This field holds the number of IE entries in the following list of DL-MAP IEs.

Table H.9 and Table H.10 represent types of compact DL/UL MAP.

Table H.9 Compact DL-MAP Types

Compact DL-MAP Type	Description
0	Normal Subchannel
1	Band AMC
2	Safety
3	DIUC
4	Format_Configuration_IE
5	HARQ_ACK_BITMAP_IE
6	reserved
7	Extension

Table H.10 Compact UL-MAP Types

Compact UL-MAP Type	Description
0	Normal Subchannel
1	Band AMC
2	Safety
3	UIUC
4	HARQ_CQI_Region_IE
5	reserved
6	reserved
7	Extension

3.7.1 DL-MAP IE

3.7.1.1 Normal Subchannel

Table H.11 Compact DL-MAP_IE for normal subchannel

Syntax	Size	Notes
Compact DL-MAP_IE () {		
DL-MAP Type =0	3 bits	
UL-MAP append	1 bits	
RCID_IE	variable	
Nep code	4 bits	# of encoder packet bits (see FEC & CTC section)
Nsch code	4 bits	(see FEC & CTC section)
HARQ_Control_IE	variable	
CQI-CH-allocation-MAP_IE	variable	
if(UL-MAP append){		
Nep code	4 bits	# of encoder packet bits
Nsch code	4 bits	

HARQ_Control_IE	variable	
}		
}		

3.7.1.2 Band-AMC

Table H.12 Compact DL-MAP_IE for band AMC

Syntax	Size	Notes
Compact DL-MAP_IE () {		
DL-MAP Type =1	3 bits	
Reserved	1 bit	
RCID_IE	variable	
Nep code	4 bits	
Nsch code	4 bits	
Nband	Nb-Band bits	number of bands, 0: use BITMAP instead
if(Nband == 0){		
Band BITMAP	Nb-BITMAP bits	n-th LSB is 1 if n-th band is selected
}else {		
for (i=0;i<Nband;i++)		
Band Index	Nb-Index bits	Band selection.
}		
Allocation Mode	2 bit	0: same No. subchannel for the selected bands 1: different No. subchannel for the selected bands 2: total No. subchannels for the selected bands determined by Nsch code
if(Allocation Mode == 0){		
No. Subchannels	6 bits	
} else if(Allocation Mode == 1){		
for (i=0;i< # of selected bands;i++){		If Nband==0 , # of selected bands = # of '1' in BITMAP. Otherwise # of selected bands = Nband.
No. Subchannels	4 bits	Number of subchannels per band
}		
}		
HARQ_Control_IE	variable	
CQI-CH_allocation_IE	variable	
}		

3.7.1.3 Safety Channel

Table H.13 Compact DL-MAP_IE for safety

Syntax	Size	Notes
Compact DL-MAP_IE () {		

DL-MAP Type =2	3 bits	
UL-MAP append	1 bit	
RCID_IE	variable	
Nep code	4 bits	# of encoder packet bits
Nsch code	4 bits	
BIN Offset	8 bits	
HARQ_Control_IE	variable	
CQI-CH-allocation-MAP_IE	variable	
if (UL-MAP append) {		
No. EP	4 bits	
BIN Offset	8 bits	
No. Subchannels	4 bits	
HARQ_Control_IE	variable	
}		
}		

3.7.1.4 DL-MAP extension

Table H.14 Compact DL-MAP_IE for extension

Syntax	Size	Notes
Compact DL-MAP_IE () {		
DL-MAP Type = 7	3 bits	
DL-MAP Sub-Type	5 bits	
Length	4 bits	length of payload in bytes
payload	variable	sub-type dependent payload
}		
Total		

Table H.15 Compact DL-MAP_IE for diversity DIUC

Syntax	Size	Notes
Compact DL-MAP_IE () {		
DL-MAP Type = 3	3 bits	
reserve	1 bits	
DIUC	4 bits	
RCID_IE	variable	
No. Subchannels	8 bits	
}		

3.7.2 UL-MAP IE

3.7.2.1 Normal Subchannel

8.4.5.3 UL-MAP IE format

Table H.16 Compact UL-MAP_IE for normal subchannel

Syntax	Size	Notes
Compact UL-MAP_IE () {		
UL-MAP Type = 0	3 bits	
reserved	1 bit	
RCID_IE	variable	
Nep code	4 bits	Number of encapsulate packet
Nsch code.	4 bits	
HARQ_Control_IE		
}		

3.7.2.2 Band-AMC

Table H.17 Compact UL-MAP_IE for band AMC

Syntax	Size	Notes
Compact UL-MAP_IE () {		
UL-MAP Type = band	3 bits	
reserved	1 bit	
RCID_IE	variable	
Nep code	4 bits	Number of encapsulate packet
Nsch code	4 bits	
Nband	Nb-Band bits	number of bands, 0: use BITMAP instead
if(Nband == 0){		
Band BITMAP	Nb-BITMAP bits	n-th LSB is 1 if n-th band is selected
}else {		
for (i=0;i<Nband;i++)		
Band Index	Nb-Index bits	Band selection.
}		
Allocation Mode	2 bit	0: same No. subchannel for the selected bands 1: different No. subchannel for the selected bands 2: total No. subchannels for the selected bands determined by Nsch code
if(Allocation Mode == 0){		
No. Subchannels	6 bits	
} else if(Allocation Mode == 1){		
for (i=0;i< # of selected bands;i++){		If Nband==0 , # of selected bands = # of '1' in BITMAP. Otherwise # of selected bands = Nband.
No. Subchannels	6 bits	Number of subchannels per band
}		
}		
HARQ_Control_IE	variable	
}		

3.7.2.3 Safety Channel

Table H.18 Compact UL-MAP_IE for safety

Syntax	Size	Notes
Compact UL-MAP_IE () {		
UL-MAP Type = 2	3 bits	
reserved	1 bit	
RCID_IE	variable	
Nep code	4 bits	Number of encapsulate packet

Nsch code		
BIN Offset	8 bits	
HARQ_Control_IE	variable	
}		

3.7.2.4 UL-MAP Extension

Table H.19 Compact UL-MAP_IE for extension

Syntax	Size	Notes
Compact UL-MAP_IE () {		
UL-MAP Type = 7	3 bits	0: normal subchannel, 1: Band, 2: Safety, 3: Extension
UL-MAP Sub-Type	5 bits	
Length	4 bits	length of payload in bytes
Payload		sub-type dependent payload
}		

Table H. 20. Compact UL-MAP_IE for diversity UIUC

Syntax	Size	Notes
Compact UL-MAP_IE () {		
UL-MAP Type = 4	3 bits	
reserve	1 bits	
UIUC	4 bits	
RCID_IE	variable	
No. Subchannels	8 bits	
}		

4 Changes to Chapter 11:

4.1 Related TLVs

11.3.1 UCD channel encodings

[Add the folllwing rows to table 365:]

Name	Type	Length	Value
Band AMC Allocation Threshold	157	1	dB unit
Band AMC Release Threshold	158	1	dB unit
Band AMC_Allocation Timer	159	1	Frame unit

Band AMC Release Timer	160	1	Frame unit
Band Status Reporting MAX Period	161	1	Frame unit
Band AMC Backoff Start	162	1	Frame unit
Band AMC Backoff End	163	1	Frame unit
Safety Channel Allocation Threshold	164	1	dB unit
Safety Channel Release Threshold	165	1	dB unit
Safety Channel Allocation Timer	166	1	Frame unit
Safety Channel Release Timer	167	1	Frame unit
Bin Status Reporting MAX Period	168	1	Frame unit
Safety Channel Backoff Start	169	1	Frame unit
Safety Channel Backoff End	170	1	Frame unit

11.3.1.1 Uplink burst profile encodings

[Add the folllwing rows to table 365:]

Table 365—UCD burst profile encodings—WirelessMAN-OFDMA??

Name	Type	Length	Value
HARQ ACK delay offset frame for DL burst	153	1	0 = 0 frame offset 1 = 1 frame offset 2 = 2 frame offset

11.3.4.1 Downlink burst profile encodings

[Add the folllwing rows to table 374:]

Table 374—DCD burst profile encodings—WirelessMAN-OFDMA

Name	Type	Length	Value
HARQ ACK delay offset frame for UL burst	154	1	0 = 0 frame offset 1 = 1 frame offset 2 = 2 frame offset

11.8.3.7.2 OFDMA SS demodulator

Type	Length	Value	Scope
5.12.2	1	bit #0: 64-QAM bit #1: BTC bit #2: CTC bit #3: STC bit #4: AAS ~~bit #5-7: Reserved~~ bit #5: H-ARQ bit #6-7: Reserved, shall be set to 0	SBC-REQ (see 6.4.2.3.23) SBC-RSP (see 6.4.2.3.24)

11.8.3.7.3 OFDMA SS modulator

Type	Length	Value	Scope
5.12.2	1	bit #0: 64-QAM bit #1: BTC bit #2: CTC ~~bit #3-7: Reserved, set to 0~~ bit #3: H-ARQ bit #4-7: Reserved, shall be set to 0	SBC-REQ (see 6.4.2.3.23) SBC-RSP (see 6.4.2.3.24)

11.11 TLV of REP-REQ
Add the following parameters:

Name	Type	Length	Value
Channel Type request	2.1	1	00 = normal subchannel, 01 = Band AMC Channel, 10 = Safety Channel, 11 = Reserved for future

11.12 TLV of REP-RSP
Add the following parameters:

REP-REQ	Name	Type	Length	Value
Channel Type request in WirelessMAN-OFDMA PHY				
	Reported Channel Type	2.1	1	00 = normal subchannel, 01 = Band AMC Channel, 10 = Safety Channel, 11 = Reserved for future

Channel Type type in WirelessMAN-OFDMA PHY = 00	normal subchannel Report	2.2	1	First 5 bits for the CINR measurement report and the rest for don't care
Channel Type type in WirelessMAN-OFDMA PHY = 01	Band AMC Report	2.3	4	First 12 bits for the band indicating bitmap and Next 25 bits for CINR reports (5 bits per each band)
Channel Type type in WirelessMAN-OFDMA PHY = 10	Safety Channel Report	2.3	5	The first 20 bits for the reported bin indices and the next 20 bits for CINR reports (5 bits for each bin)