

Project	<b>IEEE 802.16 Broadband Wireless Access Working Group</b> < <a href="http://ieee802.org/16">http://ieee802.org/16</a> >	
Title	<b>Remedy for relaying compressed DL-MAP/UL-MAP, HARQ-MAP and SUB-DL-UL-MAP</b>	
Date Submitted	<b>2007-07-18</b>	
Source(s)	Kanchei (Ken) Loa, Yi-Hsueh Tsai, Hua-Chiang Yin, Shiann Tsong Sheu, Yung-Ting Lee, Youn-Tai Lee	Voice: +886-2-27399616 Fax: +886-2-23782328 <a href="mailto:loa@iii.org.tw">loa@iii.org.tw</a>
	Institute for Information Industry 8F, No. 218, Sec. 2, Dunhua S. Rd., Taipei City 106, Taiwan	
	Hongyun Qu, Mary Chion ZTE Corporation	<a href="mailto:qu.hongyun@zte.com.cn">qu.hongyun@zte.com.cn</a> <a href="mailto:mchion@zteusa.com">mchion@zteusa.com</a>
Re:	IEEE 802.16j-07/019: "Call for Technical Comments Regarding IEEE Project 802.16j"	
Abstract	This contribution proposes the enhanced remedy of relaying compressed DL-MAP and UL-MAP, HARQ-MAP and SUB-DL-UL-MAP, which do not have MAC headers and management message types.	
Purpose	Text proposal for 802.16j Baseline Document.	
Notice	<i>This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups. It represents only the views of the participants listed in the "Source(s)" field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.</i>	
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.	
Patent Policy	The contributor is familiar with the IEEE-SA Patent Policy and Procedures: < <a href="http://standards.ieee.org/guides/bylaws/sect6-7.html#6">http://standards.ieee.org/guides/bylaws/sect6-7.html#6</a> > and < <a href="http://standards.ieee.org/guides/opman/sect6.html#6.3">http://standards.ieee.org/guides/opman/sect6.html#6.3</a> >. Further information is located at < <a href="http://standards.ieee.org/board/pat/pat-material.html">http://standards.ieee.org/board/pat/pat-material.html</a> > and < <a href="http://standards.ieee.org/board/pat">http://standards.ieee.org/board/pat</a> >.	

# Remedy for relaying compressed DL-MAP/UL-MAP, HARQ-MAP and SUB-DL-UL-MAP

*Kanchei (Ken) Loa, Yi-Hsueh Tsai, Hua-Chiang Yin,  
Shiann Tsong Sheu, Yung-Ting Lee, Youn-Tai Lee  
Institute for Information Industry (III)*

## 1. Introduction

In MR networks under centralized scheduling, the RS shall relay the FCH, compressed DL-MAP/UL-MAP, HARQ-MAP and SUB-DL-UL-MAP for the subordinated RSs to broadcast on the access links. However, the associated relaying schemes have not been defined in the baseline document IEEE 802.16j-06/026r4 yet.

This contribution proposes the remedy of relaying FCH, compressed DL-MAP/UL-MAP, HARQ-MAP and SUB-DL-UL-MAP in the centralized control and centralized scheduling scenario. Because there is no MAC header and management message type defined in these MAPs, we propose a new message to encapsulate these MAPs for relaying.

And because MR-BS has to do the scheduling for RSs with centralized scheduling for each frame, if every frame MR-BS sends MAP messages which include all the scheduling information and configuration information, it will cause very large overhead. So we also propose two RS scheduling messages for RS access zone and RS relay zone respectively which include only changed configuration information and scheduling information.

In order to facilitate the incorporation of this proposal into IEEE 802.16j standard, specific changes to the baseline working document IEEE 802.16j-06/026r4 are listed below. Moreover, the compressed DL-MAP/UL-MAP, HARQ-MAP, SUB-DL-UL-MAP, and HARQ and SUB-MAP Pointer IE defined in IEEE 802.16e-2005 are provided in Table 1~5 below for reference.

Table 1: Format of Compressed DL-MAP

Syntax	Size	Notes
Compressed DL-MAP () {	-	-
Compressed map indicator	3	Set to binary 110 to indicate a compressed map format
UL-MAP appended	1	
Reserved	1	Shall be set to zero
Map message length	11	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 <b>32-bit CRC</b> value
PHY Synchronization Field() {	-	-
Frame Duration Code	8 bits	
Frame Number	24 bits	
}	-	-

DCD Count	8 bits	
Operator ID	8 bits	
Sector ID	8 bits	
No. OFDMA symbols	8 bits	Number of OFDMA symbols in the DL subframe including all AAS/permutation zone.
DL IE count	8 bits	
for ( $n = 0; n < \text{DL IE count}; n++$ ) {	-	For each DL-MAP element 1 to $N$ .
DL-MAP_IE()	<i>variable</i>	-
}	-	-
if !(byte boundary) {		
Padding Nibble	4 bits	Padding to reach byte boundary.
}		
}	-	-

Table 2 Format of Compressed UL-MAP

Syntax	Size	Notes
Compressed UL-MAP() {		
UCD Count	8 bits	
Allocation Start Time	32 bits	
No. OFDMA symbols	8 bits	Number of OFDMA symbols in the UL subframe
while (map data remains){	-	
UL-MAP_IE()	<i>variable</i>	
}		
if !(byte boundary) {		
Padding Nibble	4 bits	Padding to reach byte boundary.
}		
}		

Table 3: Format of HARQ-MAP

Syntax	Size	Notes
HARQ_MAP message format() {	-	-
HARQ MAP Indicator = 111	3 bits	Set to 0b111
HARQ_UL-MAP appended	1 bit	
<i>reserved</i>	1 bit	Shall be zero
Map message length	9 bits	Length of HARQ MAP in bytes. (This value specifies the length of the HARQ MAP message beginning with the byte containing the HARQ MAP indicator and ending with the last byte of the HARQ MAP message. The length includes the computed <b>32-bit CRC</b> value.)
DL IE count	6 bits	Number of DL IE in the burst.
For ( $n = 0; n < \text{DL IE count}; n++$ ) {	-	For each DL-MAP element 1 to $N$ .
Compact DL-MAP IE ()	<i>variable</i>	-
}	-	-
If (Compact_UL-MAP appended == 1){		
while (map data remains){	-	
Compact UL-MAP_IE()	<i>variable</i>	

}		
}		
if !(byte boundary) {		
Padding Nibble	4 bits	Padding to reach byte boundary.
}		
}	-	-

Table 4: Format of Sub-DL-UL-MAP

Syntax	Size	Notes
Sub-DL-UL-MAP () {	-	-
Compressed map indicator	3 bits	Set to 0b111
Map message length	10 bits	The length of the submap message in bytes including the compressed map indicator and the <b>16-bit CRC</b> .
RCID_Type	2 bits	0b00 = Normal CID 0b01 = RCID11 0b10 = RCID7 0b11 = RCID3
HARQ ACK offset indicator	1 bit	
If (HARQ ACK offset indicator == 1){	-	
DL HARQ ACK offset	8 bits	
UL HARQ ACK offset	8 bits	
}	-	-
DL IE count	8 bits	
for ( $n = 0; n < \text{DL IE count}; n++$ ) {	-	For each DL-MAP element 1 to $N$ .
DL-MAP_IE()	<i>variable</i>	-
}	-	-
No. OFDMA symbols	8 bits	This value indicates start symbol offset of subsequent subbursts in this UL Allocation Start IE
Subchannel offset	7 bits	This value indicates start subchannel offset of subsequent subbursts in this UL Allocation Start IE
<i>reserved</i>	1 bit	Shall be zero
while (map data remains){	-	
UL-MAP_IE()	<i>variable</i>	
}		
if !(byte boundary) {		
Padding Nibble	4 bits	Padding to reach byte boundary.
}		
}	-	-

Table 5: HARQ and SUB-MAP Pointer IE format

Syntax	Size (bit)	Notes
HARQ and SUB-MAP Pointer IE () {	—	—
Extended DIUC	4	HARQ_P = 0x07
Length	4	—
While (data remains) {	—	—

DIUC	4	Indicates the AMC level of the burst containing a HARQ MAP message
No. Slots	8	The number of slots allocated for the burst containing a HARQ MAP message
Repetition Coding Indication	2	0b00: No repetition coding 0b01: Repetition coding of 2 used 0b10: Repetition coding of 4 used 0b10: Repetition coding of 6 used
MAP Version	2	0b00: HARQ MAPv1 0b01: Submap 0b10: Submap with CID mask included 0b11: Reserved
If (MAP Version == 0b10) {	—	—
Idle users	1	Bursts for idle users included in the submap
Sleep users	1	Bursts for sleep users included in the submap
CID Mask Length	2	0b00: 12 bits 0b01: 20 bits 0b10: 36 bits 0b11: 52 bits
CID mask	$N$	$n$ = 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 MS, the bit index corresponding to ((Basic CID of the MS) MOD $n$ ) in this CID Mask field shall be set to 1. Otherwise, it may be set to 0.
}	—	—
}	—	—
Reserved	0 or 4	For a byte alignment of IE. Shall be set to zero
}	—	—

## 2. Spec Changes

*[Insert the following subclauses 6.3.2.3.92 and 6.3.2.3.93 in line 53 of page 65]*

### 6.3.2.3.92 RS Access MAP (RS-Access-MAP) message

This message shall be generated by MR-BS for RS with centralized scheduling. This message contains allocation information for RS to transmit in RS access zone. This message shall be sent once per frame over RS's basic connection. After the reception of RS Access MAP message, RS shall compose FCH and possibly DL/UL MAP based on its RS-Access-MAP message and other related configuration messages.

Table 183xxx – RS Access MAP message format

<u>Syntax</u>	<u>Size</u>	<u>Notes</u>
<u>RS Access MAP Message Format{</u>		
<u>Management Message Type = 98</u>	<u>8 bits</u>	

<u>MAP Inclusion Indication</u>	<u>8 bits</u>	<u>bit #0 (LSB): DL Frame Prefix Changed</u> <u>bit #1: DL-MAP Included</u> <u>bit #2: UL-MAP Included</u> <u>bit #3-7:Reserved</u>
<u>If ( bit#0 of MAP Inclusion Indication = 1 ) {</u>		<u>0: All the parameters of DL Frame Prefix remain same with the latest Configuration.</u> <u>1: The parameters of DL Frame Prefix are updated.</u>
<u>Used Subchannel Bitmap in Access Zone</u>	<u>6 bits</u>	<u>Bit#0: Subchannel Group 0</u> <u>Bit#1: Subchannel Group 1</u> <u>Bit#2: Subchannel Group 2</u> <u>Bit#3: Subchannel Group 3</u> <u>Bit#4: Subchannel Group 4</u> <u>Bit#5: Subchannel Group 5</u>
<u>Repetition Coding Indication</u>	<u>2 bits</u>	<u>0b00: No repetition coding on DL-MAP</u> <u>0b01: Repetition coding of 2 used on DL-MAP</u> <u>0b10: Repetition coding of 4 used on DL-MAP</u> <u>0b11: Repetition coding of 6 used on DL-MAP</u>
<u>Coding Indication</u>	<u>3 bits</u>	<u>0b000: CC encoding used on DL-MAP</u> <u>0b001: BTC encoding used on DL-MAP</u> <u>0b010: CTC encoding used on DL-MAP</u> <u>0b011: ZT CC encoding used on DL-MAP</u> <u>0b100: CC encoding with optional interleaver</u> <u>0b101: LDPC encoding used on DL-MAP</u> <u>0b110 to 0b111 –Reserved</u>
<u>}</u>		
<u>If (bit#1 of MAP Inclusion Indication = 1 ) {</u>		
<u>Compressed MAP Used</u>	<u>1 bit</u>	<u>Indicates if Compressed map format shall be used by RS</u> <u>0b00: Regular MAP format</u> <u>0b01: Compressed MAP format</u>
<u>DCD Count</u>	<u>8 bits</u>	
<u>No. OFDMA Symbols</u>	<u>8 bits</u>	<u>Number of OFDMA symbols in the DL subframe including all AAS/permutation zone.</u>
<u>N_DL_MAP_IE</u>	<u>7 bits</u>	
<u>For (i=1; i&lt;=N_DL_MAP_IE; i++) {</u>		
<u>DL_MAP_IE ()</u>	<u>variable</u>	<u>These DL-MAP IEs indicate the allocation of RS DL access zone.</u>
<u>}</u>		
<u>}</u>		

<u>If (bit#2 of MAP Inclusion Indication = 1) {</u>		
<u>UCD Count</u>	<u>8 bits</u>	
<u>N_UL_MAP_IE</u>	<u>7 bits</u>	
<u>For (i=1; i&lt;=N_UL_MAP_IE; i++) {</u>		
<u>UL_MP_IE ()</u>	<u>variable</u>	<u>These UL-MAP IEs indicate the allocation of RS UL access zone.</u>
<u>}</u>		
<u>}</u>		
<u>If !(Byte Boundary) {</u>		
<u>Padding</u>	<u>variable</u>	<u>Padding to reach byte boundary</u>
<u>}</u>		
<u>TLV Encoded Information</u>	<u>Variable</u>	
<u>}</u>		

The RS-Access-MAP message may include the following parameter encoded as TLV tuples:

**HMAC/CMAC Tuple (See 11.1.2.)**

6.3.2.3.93 RS Relay MAP (RS-RLY-MAP) message

This message shall be generated by MR-BS for RS with centralized scheduling. This message contains allocation information for RS to transmit in RS relay zone. This message shall be sent once per frame over RS's basic connection in the case of more than 2 hops. After the reception of RS Relay MAP message, RS shall compose R-FCH and R-MAP based on its RS-RLY-MAP message and other related configuration messages.

Table 183yyy – RS Relay MAP message format

<u>Syntax</u>	<u>Size</u>	<u>Notes</u>
<u>RS RLY MAP Message Format{</u> <u>Management Message Type = 99</u>	<u>8 bits</u>	
<u>R_Zone_Prefix Change Indication</u>	<u>1 bit</u>	<u>R_Zone_Prefix is used for RS relay zone.</u> <u>0: All the parameters in R_Zone_Prefix remain same with the latest configuration.</u> <u>1: The Parameters in R_Zone_Prefix are updated.</u>
<u>If (R_Zone_Prefix Change Indication = 1) {</u>		
<u>R_Zone_Location</u>	<u>7 bits</u>	<u>The field indicates the DL relay zone position</u>

		<u>referenced to the beginning of next frame in unit</u> <u>of 1 OFDM symbol.</u>
<u>Used Subchannel Indication</u>	<u>1 bits</u>	<u>0: The subchannels used in relay zone are same with the subchannel used in access zone in the same frame.</u> <u>1: The subchannels used in between relay zone and access zone are different in the same frame.</u>
<u>If (Used Subchannel Indication = 1) {</u>		
<u>Used Subchannel Bitmap in Relay Zone</u>	<u>6 bits</u>	<u>Bit#0: Subchannel Group 0</u> <u>Bit#1: Subchannel Group 1</u> <u>Bit#2: Subchannel Group 2</u> <u>Bit#3: Subchannel Group 3</u> <u>Bit#4: Subchannel Group 4</u> <u>Bit#5: Subchannel Group 5</u>
<u>}</u>		
<u>FEC Code Type and Modulation Type</u> <u>Change Indication</u>	<u>1 bit</u>	<u>0: FEC code and modulation type is same with the latest configuration.</u> <u>1: FEC code and modulation type is updated.,</u>
<u>If (FEC Code Type and Modulation Type Change Indication = 1) {</u>		
<u>FEC Code Type and Modulation Type</u>	<u>5 bits</u>	<u>0b0000 = QPSK (CTC) 1/2</u> <u>0b0001 = QPSK (CTC) 3/4</u> <u>0b0010 = 16-QAM (CTC) 1/2</u> <u>0b0011 = 16-QAM (CTC) 3/4</u> <u>0b0100 = 64-QAM (CTC) 1/2</u> <u>0b0101 = 64-QAM (CTC) 2/3</u> <u>0b0111 = 64-QAM (CTC) 3/4</u> <u>0b1000 = 64-QAM (CTC) 5/6</u> <u>0b1001-0b1111 reserved</u>
<u>}</u>		
<u>Repetition Coding Indication</u>	<u>1 bit</u>	<u>0: No repetition coding on R-MAP</u> <u>1: Repetition coding of 2 used on R-MAP</u>
<u>}</u>		
<u>N_R_DL_MAP_IE</u>	<u>7 bits</u>	<u>Number of DL_MAP_IE</u>
<u>For (i=1; i&lt;=N_R_DL_MAP_IE, i++) {</u>		



<u>DL_MAP_IE ()</u>	<u>variable</u>	<u>These DL-MAP IEs indicate the allocation of RS DL relay zone.</u>
<u>}</u>		
<u>N_R_UL_MAP_IE</u>	<u>7 bits</u>	<u>Number of UL_MAP_IE</u>
<u>For (i=1; i&lt;=N_R_UL_MAP_IE, i++) {</u>		
<u>UL_MAP_IE ()</u>	<u>variable</u>	<u>These UL-MAP IEs indicate the allocation of RS UL relay zone.</u>
<u>}</u>		
<u>If !(Byte Boundary) {</u>		
<u>  <u>Padding Nibble</u></u>	<u>4 bits</u>	<u>Padding to reach byte boundary</u>
<u>}</u>		
<u>TLV Encoded Information</u>	<u>Variable</u>	
<u>}</u>		

The RS-RLY-MAP message may include the following parameter encoded as TLV tuples:

#### **HMAC/CMAC Tuple (See 11.1.2.)**

### 6.3.28 Messages and Data relaying

#### 6.3.28.1 RS broadcast messages relaying

*[Change the following text in line 25 of page 134]*

A non-transparent RS shall broadcast FCH, DCD, UCD, DL-MAP and UL-MAP messages in the DL access zone. In addition, a non-transparent RS shall also broadcast R-FCH, DCD, UCD, and R-MAP messages in the DL relay zone in the case of more than two hops. ~~which may be~~ When the messages are generated by the MR-BS, and be sent in the relay zone. ~~The MR-BS should send DCD and UCD messages for RS to broadcast on the access link and relay link with RS primary management CID, and DL-MAP and UL-MAP messages with RS basic CID to the RS.~~

Under centralized scheduling, the MR-BS shall generate and send RS-Access-MAP message to RS over RS basic connection once per frame. When RS receives RS-Access-MAP message, RS shall compose FCH, and possibly DL/UL MAP based on the RS-Access-MAP message. If the information to compose DL-MAP and UL-MAP is not included in RS-Access-MAP, the MR-BS shall send DL-MAP and UL-MAP messages with RS basic CID to the RS directly. In case of more than two hops, the MR-BS shall generate and send RS-RLY-MAP message to RS over RS basic connection once per frame. When RS receives RS-RLY-MAP message, RS shall compose R-FCH and R-MAP based on the RS RLY-MAP message.

Upon receiving the DCD/UCD message with RS primary CID, as shown in Figure xxx, the RS shall acknowledge the reception of DCD or UCD messages over primary management connection by sending an acknowledgment header (See 6.3.2.1.2.2.2.3). The Transaction ID of the ACK header shall be set to the

Configuration Change Count of DCD or UCD message. There shall be one ACK header per message. The RS may retransmit DCD/UCD message if the acknowledgment header is not received at the expiration of T52 timer.

Under centralized scheduling, as shown in Figure yyy, the RS should request bandwidth on the access link to broadcast the DCD/UCD message with fragmentable broadcast CID.

Under distributed scheduling, the RS shall autonomously broadcast DCD/UCD with fragmentable broadcast CID.

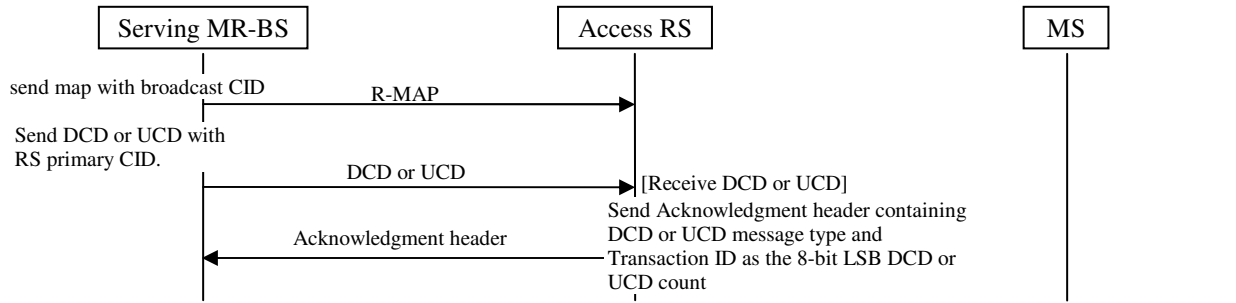


Figure xxx –Relaying DCD/UCD procedure

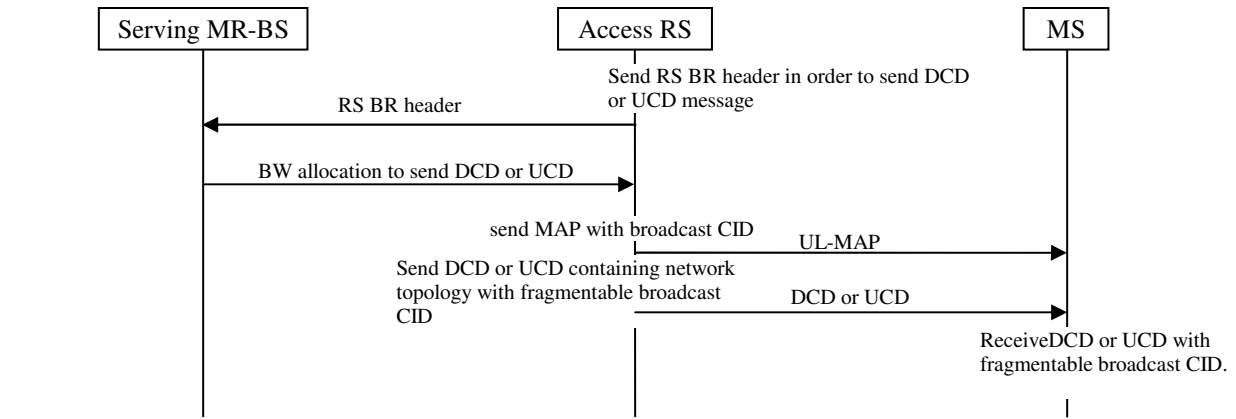


Figure yyy – DCD/UCD broadcasting with centralized scheduling

[ Add the following row at the end of table 583 in page 169 as indicated]

Table 583—Parameters and constants

System	Name	Time Reference	Minimum Value	Default value	Maximum value
<u>MR-BS</u>	<u>T52</u>	<u>Waiting for ACK from RS for DCD/UCD messages</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>