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Title	**Support for Miscellaneous Functions in Relay MAC Header**
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Re:	Response to the IEEE 802.16 Working Group Letter Ballot #28 (i.e., IEEE 802.16j-07/043).
Abstract	This contribution proposes more detailed bit assignment in relay MAC header.
Purpose	To adopt the bit assignment proposed herein into IEEE 802.16j.
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Support for Miscellaneous Functions in Relay MAC Header

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1. Introduction

According to the current 802.16j baseline [1], there are totally 4 bits set as "reserved" in the relay MAC header, the actual usage of which is still subject to future discussion. Figure 1 illustrates the relay MAC header specified in the current baseline [1].

HT = 0 (1)	RSV (1)	RMI (1)	ALC (1)	RSV (1)	FSH (1)	PSH (1)	CE (1)
ESF (1)	RSV (2)		QSH (1)	LEN MSB (4)			
LEN LSB (8)							
CID #0 (MSB) (8)							
CID #0 (LSB) (8)							
HCS (8)							

Figure 1: Relay MAC header specified in the current baseline.

This contribution intends to further discuss and suggest the usage of a few "reserved" bits in order to support some features that have already been accepted into the current 802.16j baseline [1].

2. Summary of Proposal

There are still a few functions whose support in relay MAC header is absent.

- **Security support**
  Note that in legacy 802.16d/e system, since subheaders are considered a part of payload, they and payload would be encrypted together, if at all. The ***encryption control (EC)*** bit and the 2-bit ***encryption key sequence (EKS)*** field are used in the generic MAC header (GMH) to support security operation.

  On relay link, a few subheaders (e.g., fragmentation, packing, QoS, allocation) may appear immediately after the relay MAC header and before the concatenated individual MPDUs. We call them *relay subheaders*. This is illustrated in Figure 2.

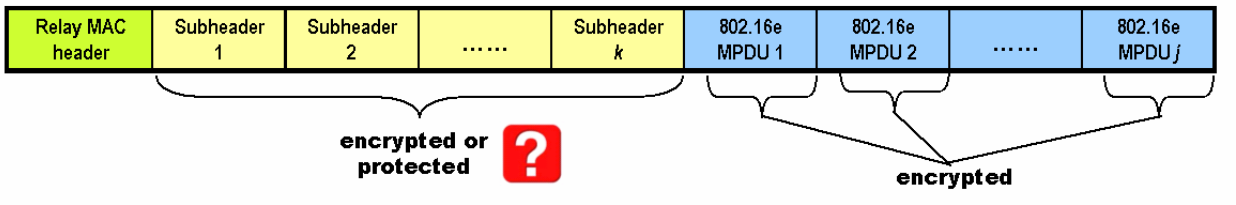


Figure 2: MPDU on relay link.

Each individual MPDU in the concatenation may have been encrypted. However, it is not clear from the current baseline whether the relay subheaders are protected.

The final design decision regarding the protection of subheader has implication not only on key distribution protocol, but also on relay MAC header design.

- If relay subheaders can be encrypted, the intermediate RS may need to have the key, because it needs to read the content of the subheader (e.g., fragmentation subheader, QoS subheader, allocation subheader, etc.).
- If relay subheaders can be encrypted, the relay MAC header then need to indicate whether the encryption is applied on the ensuing subheaders or not, and what the encryption key sequence is.

That is, in order to support encryption of relay subheaders, we will need to bring ***EC bit*** and ***EKS field*** back into the relay MAC header.

- **Fragment Sequence Number (FSN) Support**

  In 802.16d/e [2], the length of the fragment sequence number (FSN) field in the packing and fragmentation subheader may be of 11-bit or 3-bit, depending on the value of a bit called ***Extended Type*** in the generic MAC header.

  If 802.16j allows FSN to assume two possible values, an ***Extended Type*** bit will then also be needed in the relay MAC header.

  Alternatively, if FSN is fixed to be 11-bit long in 802.16j, then no such ***Extended Type*** bit would be needed in the relay MAC header.

- **Bandwidth Request Support**

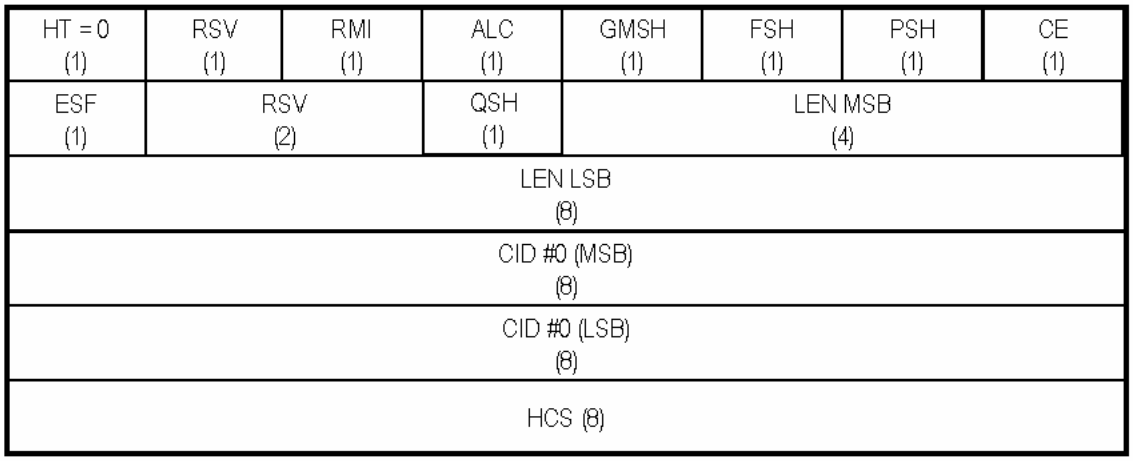
  In 802.16d/e, the grant management subheader is used to convey bandwidth management needs. According to the current version of the 16j baseline [1], the same subheader can also be used on the relay link after the relay MAC header as a *relay subheader*. In this case, a bit will be needed in the relay MAC header in the uplink direction to indicate the presence or absence of this grant management subheader.

3. Proposed Text Changes

6. MAC Common Part Sublayer

6.3.2.1.1.1 Relay MAC header format

[Change Figure 22a as follows]



[Change Table 7a as follows]

Table 7a—Description of relay MAC header fields

Syntax	Size	Notes
MAC Header() {		
HT	1 bit	
if (HT == 0) {		
Reserved	1 bit	Currently reserved. Content is subject to further discussion
RMI	1 bit	Relay mode indication (RMI) is used to indicate whether this MAC header is GMH or Relay MAC header RMI = 0: use GMH RMI = 1: use relay MAC header
ALC	1 bits	Allocation subheader 1=present; 0=absent
GMSH	*1 bits*	*Uplink, grant management subheader (GMSH)* *1=present; 0=absent*
Fragmentation subheader	1 bit	Fragmentation subheader (FSH) 1 = present, 0 = absent
Packing subheader	1 bit	Packing subheader (PSH) 1 = present, 0 = absent
CE	1 bit	CID encapsulation 1 = present, 0 = absent
ESF	1 bit	Extended subheader field. If ESF = 0, the extended subheader is absent. If ESF = 1, the extended subheader is present and will

		follow the GMH immediately. The ESF is applicable both in the DL and in the UL.
Reserved	2 bits	Currently reserved. Content is subject to further discussion
QoS subheader	1 bit	QoS subheader (QSH) 1 = present, 0 = absent
LEN	12 bits	The length in bytes of the relay MAC PDU including the relay MAC header.
CID	16 bits	May be tunnel CID or basic CID of the RS
HCS	8 bits	Header check sequence
}		
else if (HT == 1) {		If no payload is attached
Use legacy 802.16e or 802.16j Format	39 bits	
HCS	8 bits	
}		
}		

4. Reference

[1] "Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems - Multihop Relay Specification", IEEE P802.16j/D1, August 2007

[2] "IEEE Standard for Local and Metropolitan Area Networks − Part 16: Air Interface for Fixed Broadband Wireless Access Systems, Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands," IEEE Computer Society and the IEEE Microwave Theory and Techniques Society, February 2006.