FPEH Overhead reduction & Quick Decryption (16.2.2)

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Purpose:
   Discuss and approve the proposed text changes into IEEE802.16m/D4 document

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Introduction (1/2)

- The FPEH format in 16m (P802.16m/D3) is shown below
  - The minimum FPEH overhead in MAC PDU with AGMH can be reduced to 2 bytes by optimizing some signaling bits which are not needed in every packet

FPEH Type (4)		FC (2)	SN (2)
SN (8)			

AFI (1)	AFP (1)	RI (1)	LSI* (1)	SSN* (4)	
SSN (7)					End (1)

Length (8)	
Length (3)	End (1)

Fixed Info

Packing Info (variable)

* LSI & SSN are present if RI = 1

Length (8)		
Length (3)	End (1)	Reserved (var)
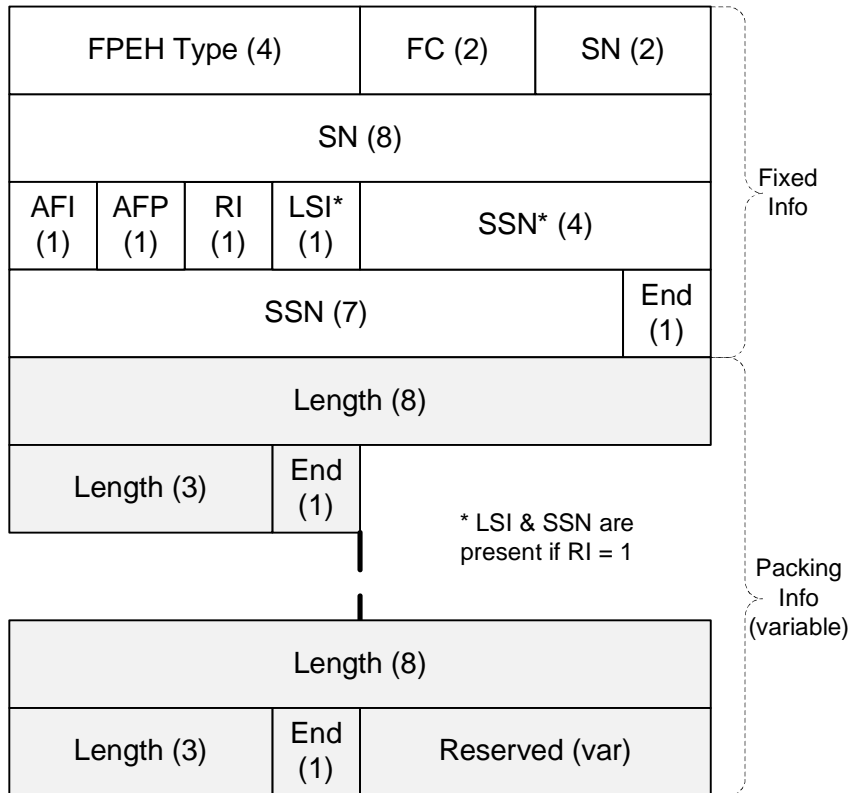
FPEH in MAC PDU with AGMH

FPEH Type (4)		FC (2)	End (1)
Length (8)			
Length (3)	End (1)		

Fixed Info

Length (8)		
Length (3)	End (1)	Reserved (var)

Packing Info (variable)
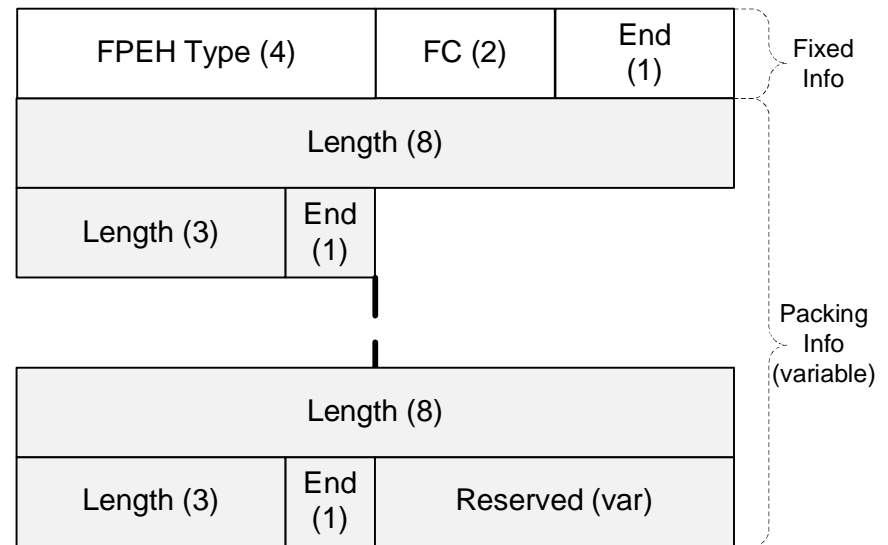
FPEH in MAC PDU with CMH

Introduction (2/2)

- MCEH format and MAC PDU with MCEH in D3 is shown below
  - EC bit in MCEH indicates encryption for control connection payload
    - In control connection MAC PDU, receiver has to decode MAC header and then the extended headers before it can decrypt the payload.
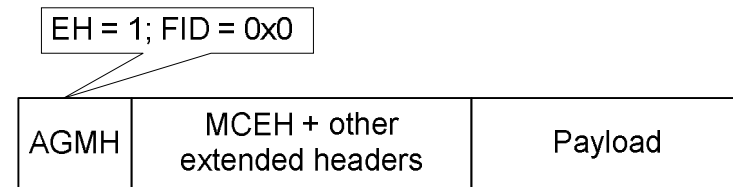   - There are several EHs, which are variable in nature. This delays the processing of MAC PDU payload and hence impacts performance.

- Receiver should be able to quickly decrypt control connection payload like the transport connection payload

EC (1)	CH ID (1)	SNI (1)	Reserved (5)

MCEH with SNI = 0

EC (1)	CH ID (1)	SNI (1)	FC (2)	PI (1)	SN (2)
SN (6)				Reserved (2)	

MCEH with SNI = 1

EH = 1; FID = 0x0

AGMH	MCEH + other extended headers	Payload

MAC PDU with MCEH

Modified EH Format

CB (1)	EH Length (7)
EH Type (4)	
Body Contents (variable)	

EH Type (4)

Body Contents (variable)
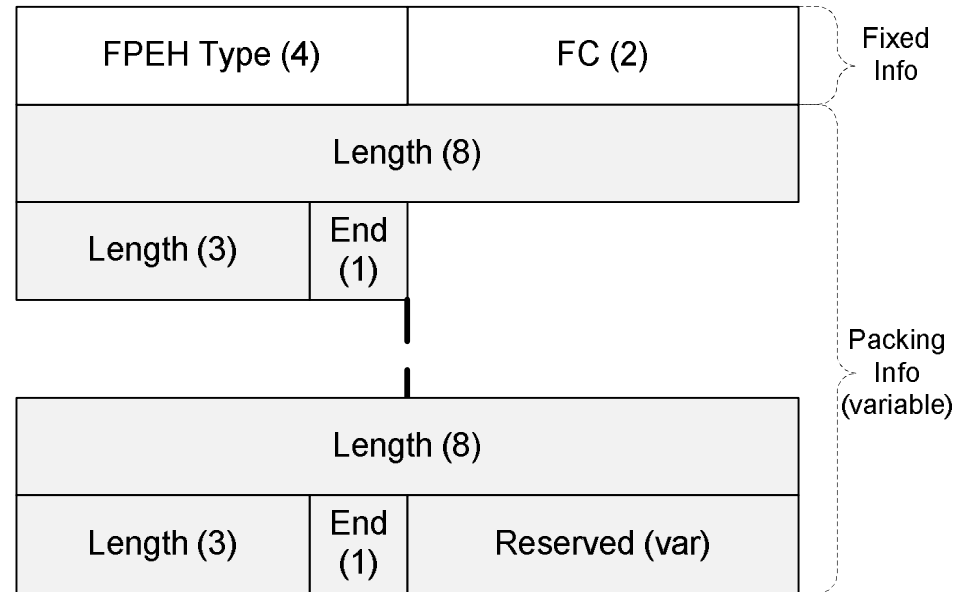
EH Length
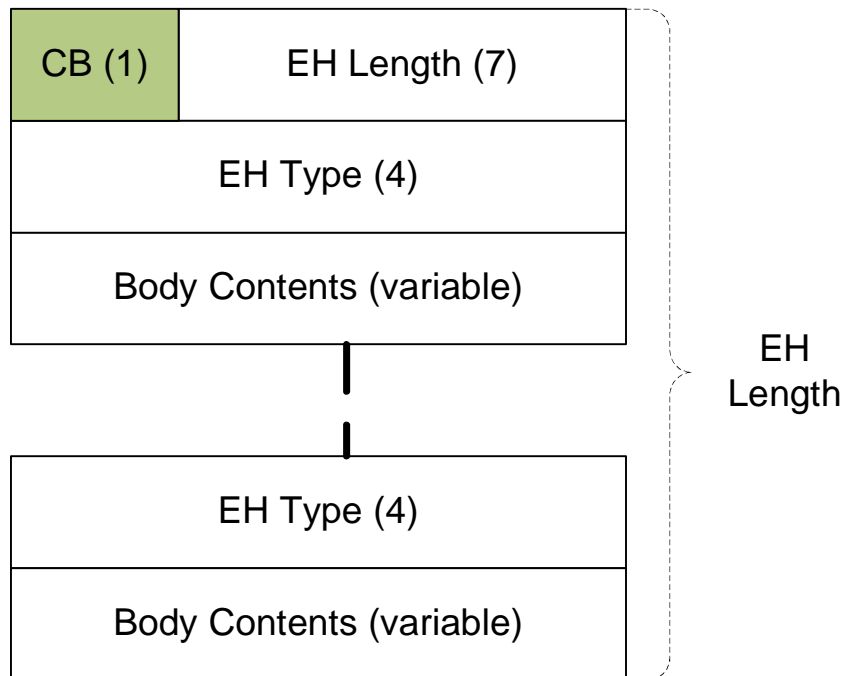
A control bit (CB) is introduced in EH format. EHLen is reduced from 8 to 7 bits

1. CB bit acts as a Packing info indicator in a transport connection MAC PDU with FPEH

2. CB bit acts as a Encryption Control Indicator in a Control Connection MAC PDU

Modified FPEH Format

FPEH Type (4)	FC (2)	SN (2)
SN (8)		
Length (8)		
Length (3)	End (1)	

Fixed Info

Packing Info (variable)

Length (8)		
Length (3)	End (1)	Reserved (var)

FPEH Type (4)	FC (2)
Length (8)	
Length (3)	End (1)

Fixed Info

Packing Info (variable)

Length (8)		
Length (3)	End (1)	Reserved (var)
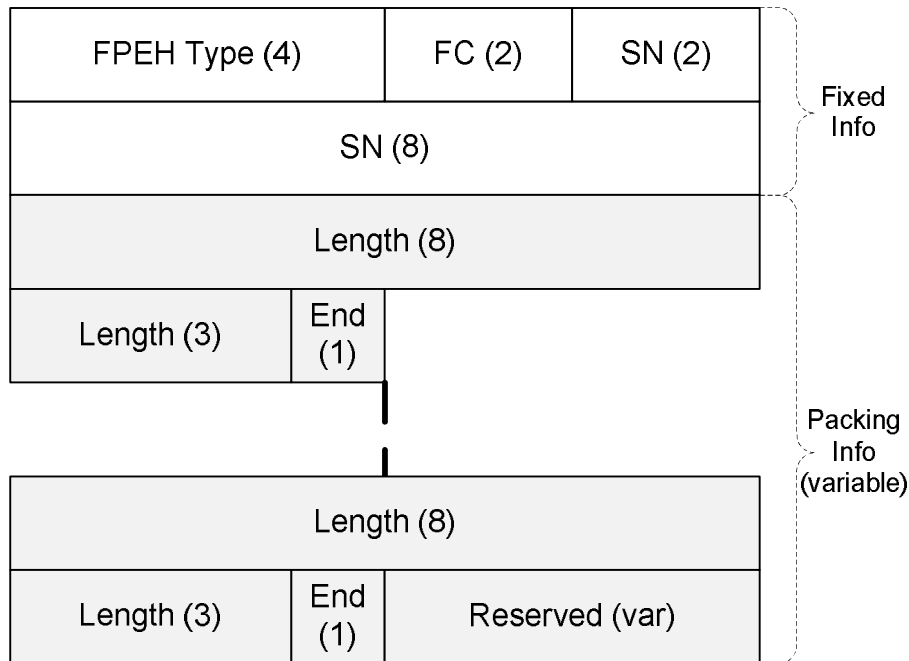
Control information (RI, AFI, AFP, SSN, LSI) are removed from FPEH. Overhead is reduced from 3 to 2 bytes.

Packing Info is present in FPEH if CB equals '1'

New Extended Header - RFPEH

RFPEH Type (4)	FC (2)	SN(2)
SN(8)		
LSI (1)	SSN (7)	
SSN (4)		
Length (8)		
Length (3)	End (1)	

Fixed Info

Length (8)		
Length (3)	End (1)	Reserved (var)

Packing Info (variable)
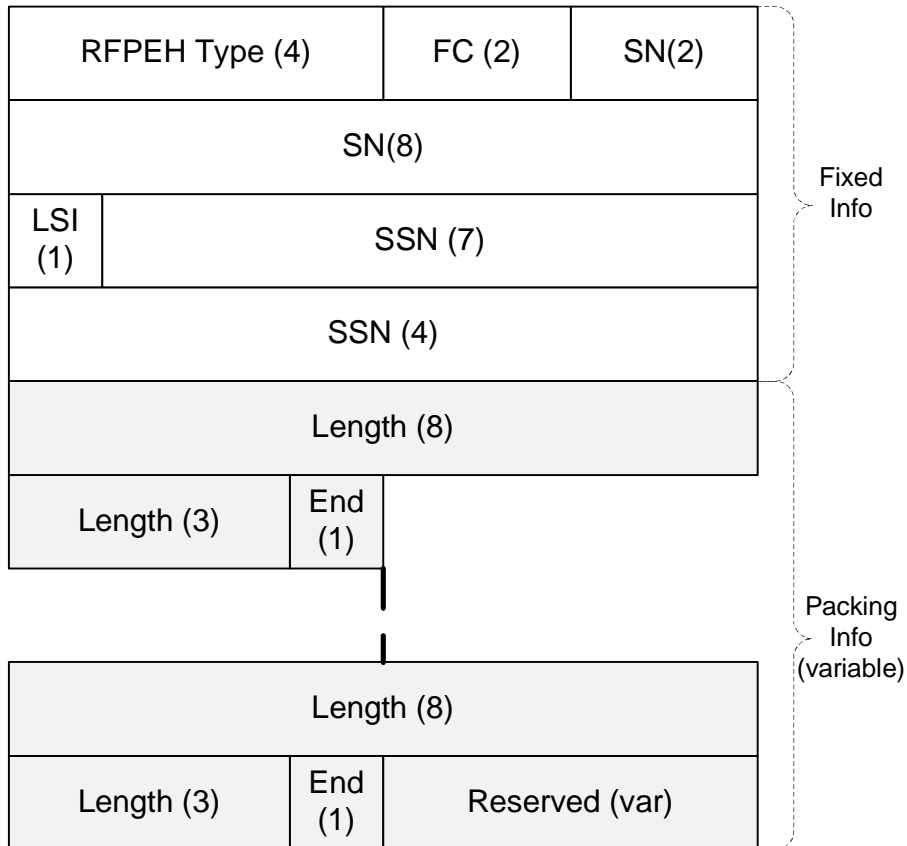
Packing Info is present in RFPEH if CB equals '1'

Modified MCEH Format

MCEH Type (4)	CH ID (1)	SNI (1)	Rsvd (2)

MCEH with SNI = 0

Same format as other EHs. Special handling is not required.

MCEH Type (4)		CH ID (1)	SNI (1)	FC (2)
PI (1)	SN (7)			

MCEH with SNI = 1

EC bit is removed and MCEH Type is added

Overhead is same as in D3

Modified MEH Format

MEH Type (4)		N_FIBs (4)	
FID (4)	Length (11)	(R)FPEH/MCEH Indicator (1)	PI (1)

'ith' FIB in MEH

FID (4)	Length (11)	(R)FPEH/MCEH Indicator (1)	PI (1)

Indicates the presence/absence of (R)FPEH/MCEH corresponding to 'i+1' th Flow

This field is present only for transport FID. Indicates the presence of packing info in (R)FPEH corresponding to 'i+1' th transport flow. This bit is only present if (R)FPEH indicator is '1' for transport flow.
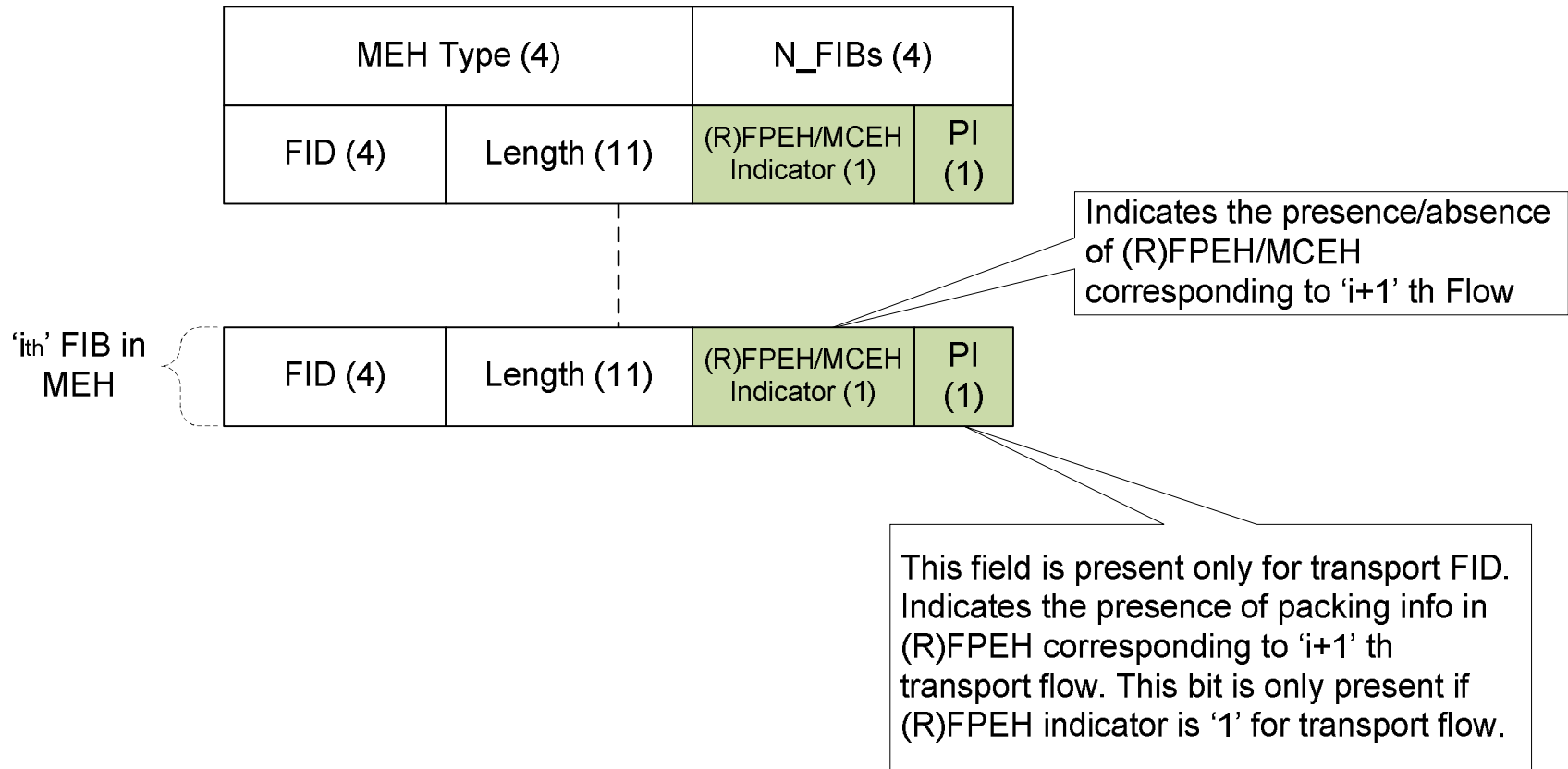
Transport Connection MAC PDU - Illustration (1/2)
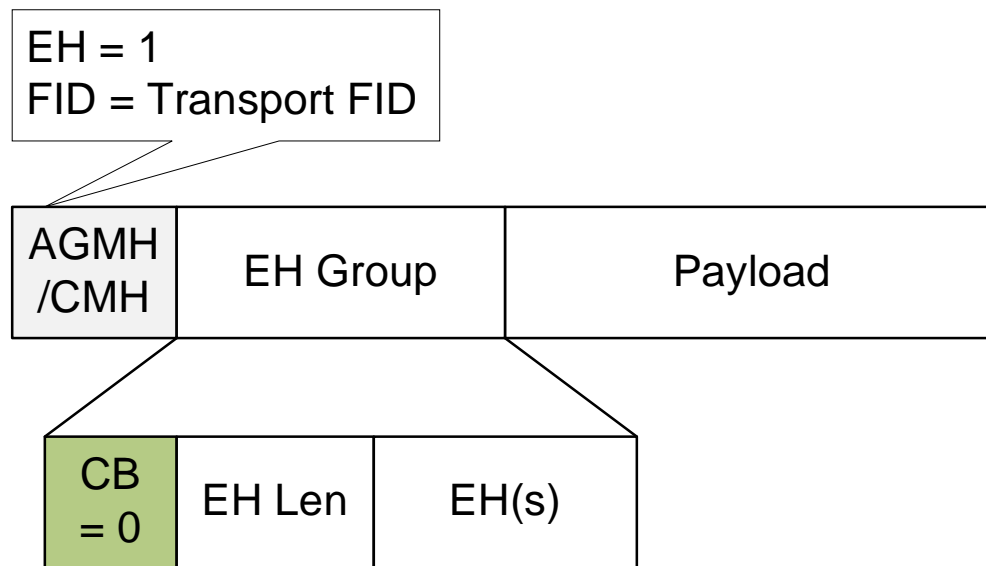
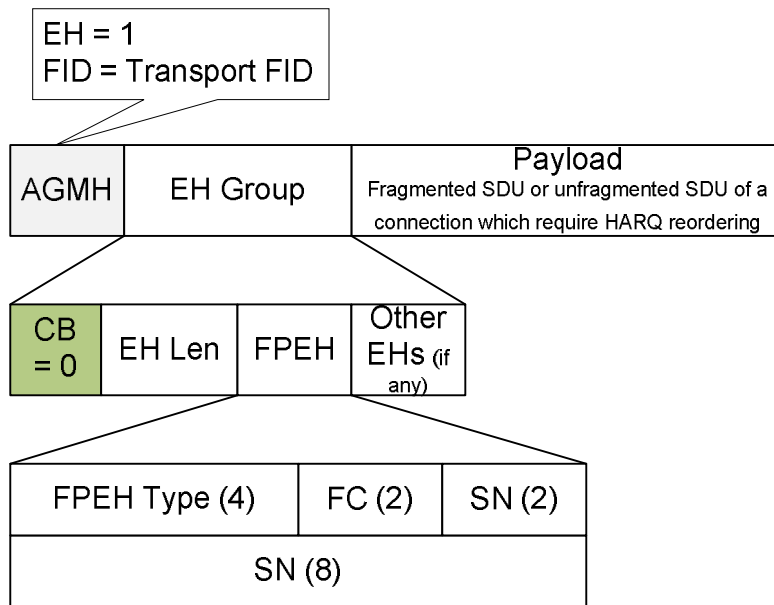Transport Connection MAC PDU: Without FPEH/RFPEH

Transport Connection MAC PDU - Illustration (2/2)

EH = 1
FID = Transport FID

AGMH	EH Group	Payload Fragmented SDU or unfragmented SDU of a connection which require HARQ reordering

CB = 0	EH Len	FPEH	Other EHs (if any)

FPEH Type (4)	FC (2)	SN (2)
SN (8)		

Transport Connection MAC PDU:
FPEH without packing info

EH = 1
FID = Transport FID

AGMH	EH Group	Payload (Multiple Fragmented or unfragmented SDUs)

CB = 1	EH Len	FPEH	Other EHs (if any)

FPEH Type (4)	FC (2)	SN (2)
SN (8)		
Length (8)		
Length (3)	End (1)	

Packing
Info
(variable)

| Length (8)		
Length (3)	End (1)	Reserved (var)
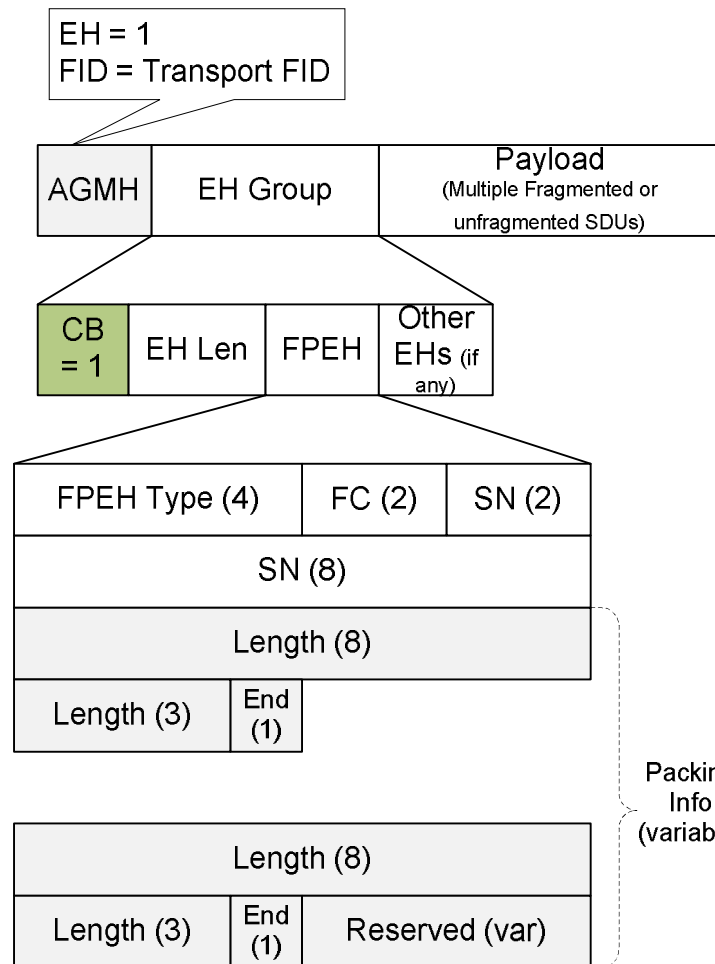
Transport Connection MAC PDU:
FPEH with packing info

Control Connection MAC PDU - Illustration (1/2)
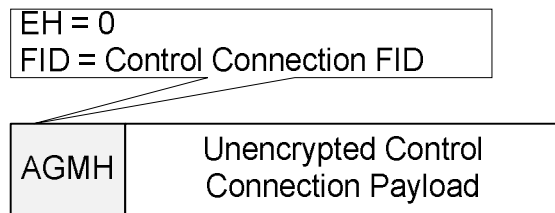
EH = 0
FID = Control Connection FID

AGMH	Unencrypted Control Connection Payload

MAC PDU with UNENCRYPTED control connection payload and in the absence of any EHs

EH = 1
FID = Control Connection FID

AGMH	CB = 1	EHLen = 1	Encrypted Control Connection Payload
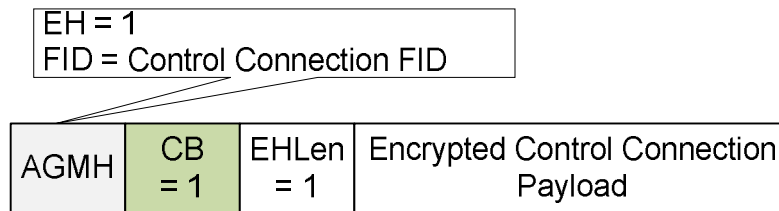
MAC PDU with ENCRYPTED control connection payload and in the absence of any EHs

Control Connection MAC PDU - Illustration (2/2)

EH = 1
FID = Control Connection FID

| AGMH | CB = 0 | EHLen = x | Other EHs (if any) | Unencrypted Control Connection Payload |

←————x bytes————→

MAC PDU with UNENCRYPTED control connection payload in the presence of other EHs

EH = 1
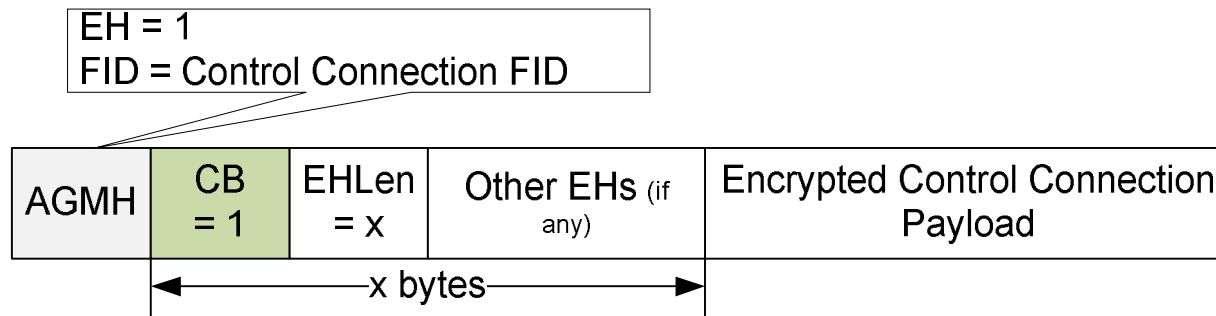FID = Control Connection FID

| AGMH | CB = 1 | EHLen = x | Other EHs (if any) | Encrypted Control Connection Payload |

←————x bytes————→
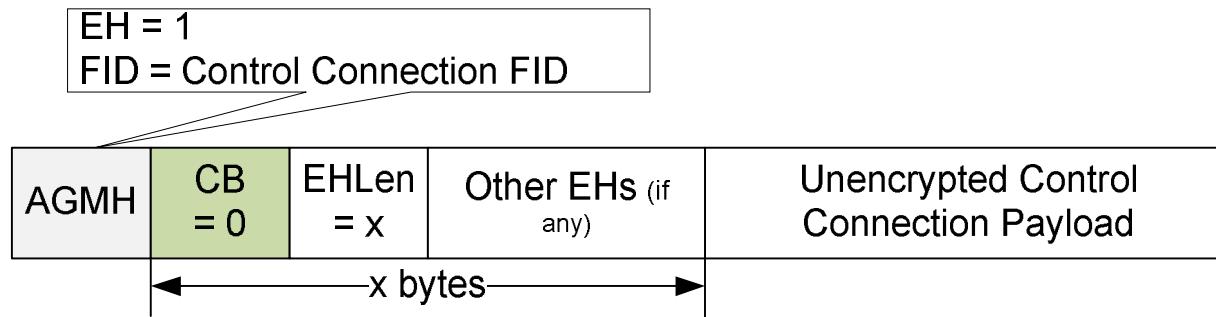
MAC PDU with ENCRYPTED control connection payload in the presence of other EHs

MAC PDU with multiplexing - Illustration

Transport FID in AGMH: Set to '0' if FPEHx does not contain packing info and set to '1' if FPEHx contains packing info.
Control FID in AGMH: CB bit acts as encryption control indicator for the entire payload of MAC PDU.

A-GMH	CB	EHLen	MEH	FPEHx	FPEHz	Payloadx	Payloady	Payloadz

Note: Among the multiple FPEHs in MAC PDU, the presence of FPEH for 1st flow is determined implicitly from the FPEH/FEH indicators of other flows

MEH Type		N_FIBs = 2	
FID = y	Length	FPEH/FEH indicator = 0	
FID = z	Length	FPEH/FEH indicator = 1	PI

Set to '0' if FPEHz does not contain packing info otherwise set to '1'

For Flow z

ARQ Feedback Extended Header - AFEH

- New extended header to carry ARQ Feedback is defined
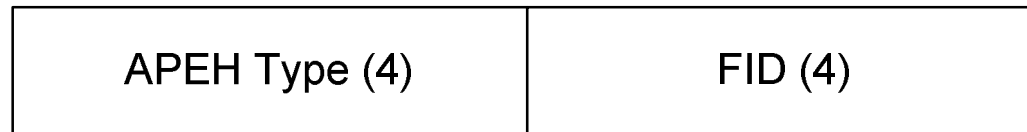
AFEH Type (4)	ARQ Feedback IE (Variable)

ARQ Feedback Extended Header

ARQ Feedback Polling Extended Header - APEH

- New extended header for polling is defined

APEH Type (4)	FID (4)

**ARQ Feedback Polling
Extended Header**

Proposed Text

- See contribution C80216m-09_2745