

Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [Low latency MSDU aggregation]

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Re: [In response to TG3c comments (IEEE P802.15-08-0020-09-003c)]

Abstract: [Comment resolutions]

Purpose: [To be considered in TG3C baseline document.]

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# Comment # 43, 44, 47

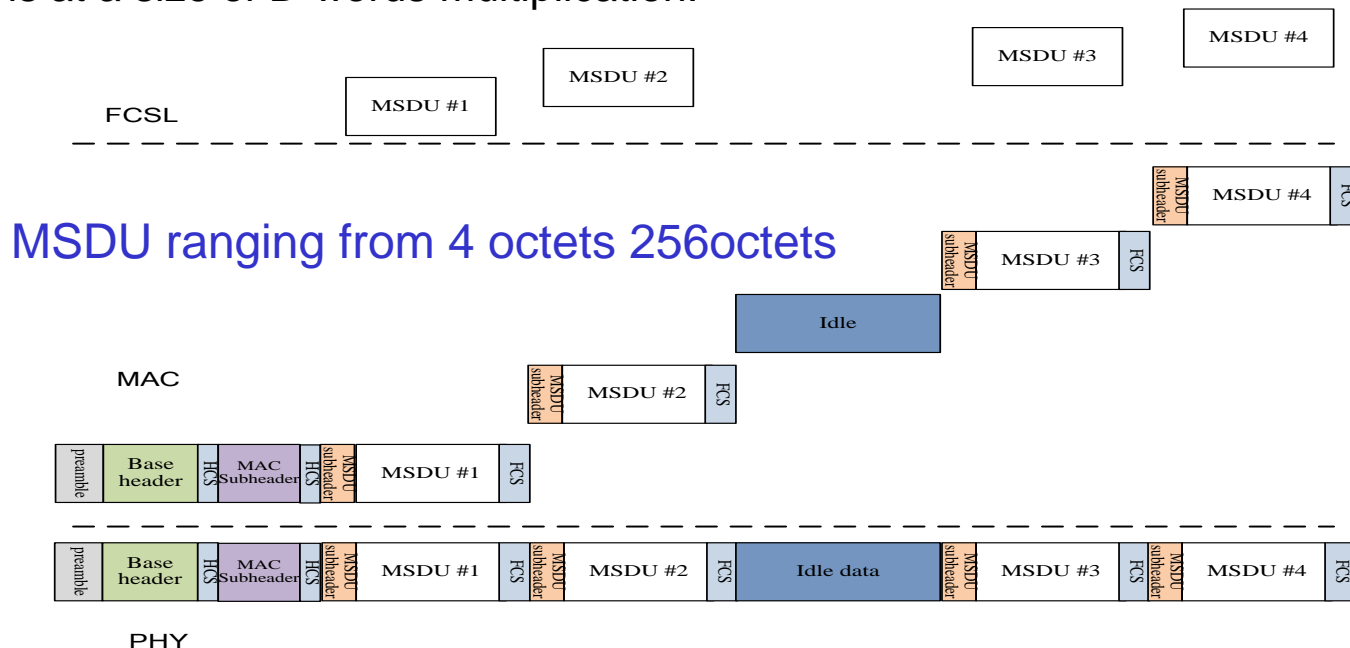
- Comment #43
  - Enable MSDU aggregation
- Comment#44
  - Enable Block Ack to be aggregated with data
- Comment #47
  - Enable CTA to be bi-directional (meaning interchanging transmissions between 2 DEV at the same CTA)
- Response
  - The necessary information is provided in the following presentation

# Summary

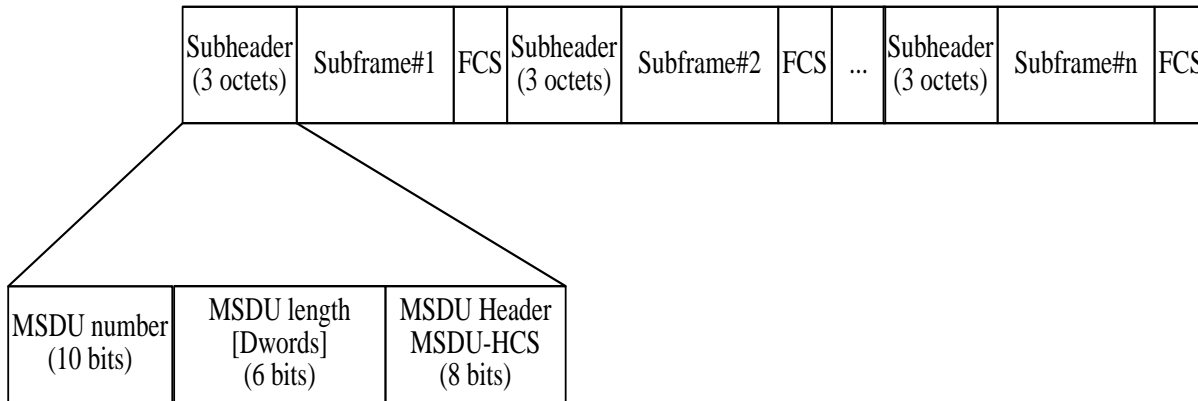
- To support application which requires low latency bi-directional communication such as USB, PCI express, USB, eSATA or wireless docking, a low latency A-MSDU aggregation method is proposed.
  - System requirement 15-05-0353-08-003c-draft-tg3c-system-requirements
    - A-MSDU aggregation
    - Use of Bi-Directional CTA (using the CTA relinquish bit)
    - Frame format
      - One bit in the PHY header to indicate the Bi-Directional low latency mode
      - Adding BA field in the MAC subheader
- The aggregation procedure can be easily accommodated in the current SC proposal with only 1 extra bit indication in PHY header

# Low latency MSDU aggregation

- It is assumed that MSDU (4octets ~256octets) containing data which comes from upper layer, usually in a burst distribution.
- MAC, upon receiving a MSDU, attaches each MSDU a subheader and FCS, directly sent them out without waiting for the following MSDUs to be aggregated
- When the coming MSDU didn't arrive on time, idle data can be transmitted to fill the gap between real MSDUs (zeros as example)
  - Idle is at a size of D-words multiplication.



# A-MSDU Header Definition



- MSDU sequence Number – 10 bits
- MSDU Length – Length in DWords Units [6 bits]
- MSDU-HCS- MSDU header checksum [8 bits]
  - Idles can be inserted as zero transmission is between MSDUs
  - Header will be identified by searching a pattern which corresponds to the MSDU-HCS
  - In the case of MSDU header HCS error, a new header can be identified

# Low latency AMSDU aggregation frame format

- 2 different frame formats one for standard mode the other for low latency mode
  - Subheaders are encapsulated in between subframes (low latency mode)
  - Subframe length ranges from 4 octets to 256 octets (low latency mode)
  - Maximum number of aggregated MSDUs is **256**
  - Idles are transmitted in between MSDUs
  - MSDU header is identified using the MSDU header

Standard aggregation mode

MCS information (5 bits)	FCS information (1 bit)	Retransmission (1 bits)	Retry bit (1 bit)	Resolution indication (1 bit)	Subframe length (11 bits)	Subframe information (2 bits)	Skewed Constellation mode (1bit)	MSDU offset (3 bit)	Last fragmentation (1 bit)	Reserved (5 bit)
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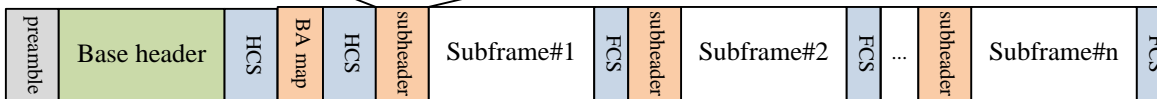
1 octet to 1Moctets

Up to 8 subframe

1 bit in Base header to indicate using Bi Directional low latency mode

MSDU number (10 bits)	MSDU length [Dwords] (6 bits)	MSDU Header MSDU-HCS (8 bits)
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Low latency mode

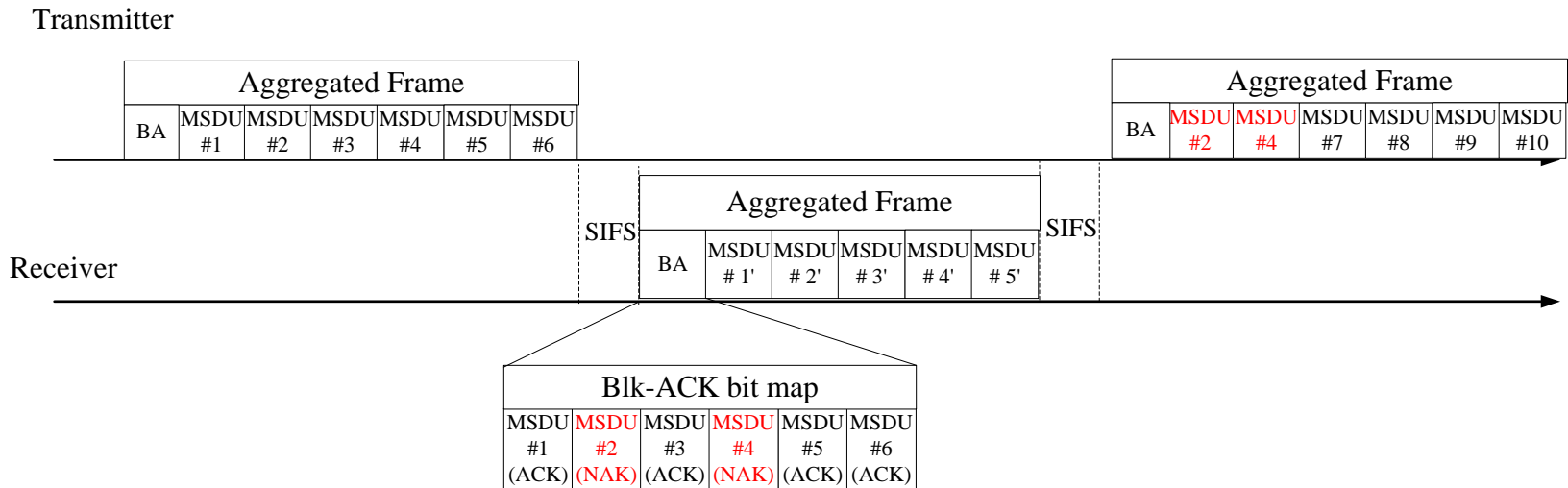


4 octet to 256 octets

Up to 256 MSDUs

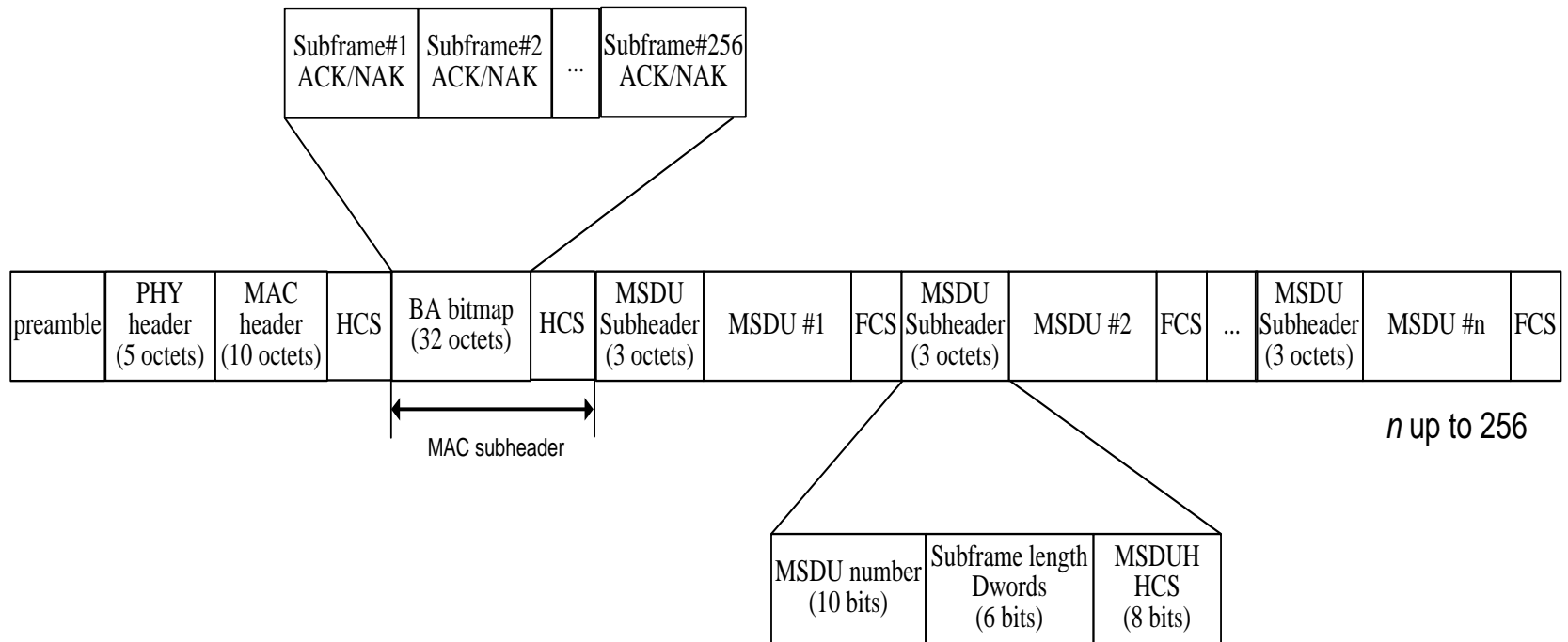
# Comment# 44 -Bi-directional data transmission

- When the Bi-directional low latency mode is set
  - Will be block ack
- Block ACK
  - Will be part of the MAC subheader
  - Each bit represent individual MSDU number



# Frame format for Bi Directional Low Latency mode

- PHY Header addition
  - Low latency mode bit – when set:
    - the MAC subheader will be transmitted using the same MCS as the data
  - When set to 0
    - Standard aggregation mode
- Use CTA relinquish bit (MAC Header) to handover the control to the Destination device, and visa versa





2008/3/20

## CRC suggested (MSDU HCS)

- The MSDU header CRC that will be used is:
  - Polynomial equal to  $X^8+X^2+X+1$
  - Example of implementation:

