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Title	Clarification on TLV Bit Ordering
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Re:	Call for Maintenance Change Requests on IEEE Std 802.16
Abstract	This document suggests changes in IEEE 802.16e-2005 to clarify TLV bit ordering
Purpose	Adopt changes
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Clarification on TLV Bit Ordering

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Motivation

In IEEE 802.16 documents, it is known that byte-ordering is big endian and bit-ordering is little endian. However, for some TLVs with lengths of multiple bytes, it is not clear how to order bits in multiple bytes.

Proposed Remedy

In IEEE 802.16 documents, the 'first byte' is widely used to indicate the most significant byte –for example, p. 37 of IEEE 802.16-2004 and p. 174, p. 661 of IEEE 802.16e-2005.

However, some TLVs are described with 'first byte', implying the least significant byte. Due to the inconsistency, bit #0 among the multiple bytes could be interpreted as either the LSB of the most significant byte or the LSB of the least significant byte.

Here are some examples;

1. UL allocated subchannels bitmap (9 bytes)
   - Description: … The LSB of **the first byte** shall correspond to subchannel 0. ...
   - Two different interpretations:
     i. Interpretation #1: consider 'the first byte' as the least significant byte.
     ii. Interpretation #2: consider 'the first byte' as the most significant byte.

		MS byte																	LS byte							
	bit	MSB							LSB	MSB			…			LSB	MSB								LSB
#1	Subchannel index	x	x	x	x	x	x	X	X	x	x	X	…	10	9	8	7	6	5	4	3	2	1	0
#2	Subchannel index	7	6	5	4	3	2	1	0	15	14	13	…	X	x	x	x	x	x	x	x	x	x	x

   - When all 35 subchannels are used for 1024 FFT size, these interpretations result in;
     i. Interpretation #1: 0x0000000007FFFFFFF
     ii. Interpretation #2: 0xFFFFFFF0700000000

2. Normalized C/N override 2 (8 bytes)
   - Description:
     i. **Bit#0–7**: It shall be interpreted as signed integer in dB. It corresponds to the normalized C/N value in the first line (counting except for header cell of table)
     ii. Bit#8–63: This is a list of numbers, where each number is encoded by one nibble, and interpreted as a signed integer. The nibbles correspond in order to the list define by Table 334, starting from the second line (counting except for the header cell of table), such that the LS nibble of **the first byte** corresponds to the second line in the table. The number

encoded by each nibble represents the difference in normalized C/N relative to the previous line in the table.

- Three different interpretations:
  i. Interpretation #1: consider ‘bit #0’ as the LSB of the least significant byte and ‘the first byte’ as the least significant byte among the remaining 7 bytes.
  ii. Interpretation #2: consider ‘bit #0’ as the LSB of the least significant byte and ‘the first byte’ as the most significant byte among the remaining 7 bytes.
  iii. Interpretation #3: consider ‘bit #0’ as the LSB of the most significant byte and ‘the first byte’ as the most significant byte among the remaining 7 bytes.

		MS byte													…						LS byte							
	bit	MSB						LSB	MSB						…					LSB	MSB						LSB	
#1	Line index	15							14						13			…			2						1		
#2	Line index	3							2						5			…			14						1		
#3	Line index	1													3			…			12			15				14	

Below remedies are proposed so that interpretations #1 in both above cases are correct interpretations.

Add a clarifying text in Section 11. TLV encodings.

Change ‘the first byte’ to ‘the least significant byte’ in some TLVs.

Proposed Text Changes

[Insert the following text on page 661 right before Sec 11.1 Common encodings]

Unless otherwise indicated, bit #0 is the LSB of the least significant byte for all TLVs with length of multiple bytes.

[Modify following entries in Table 353 on page 667 of IEEE 802.16e-2005]

Name	Type (1 Byte)	Length	Value
UL allocated subchannels bitmap	157	9	This is a bitmap describing the physical subchannels allocated to the segment in the UL, when using the uplink PUSC permutation. The LSB of the ~~first~~ least significant byte shall correspond to subchannel 0. For any bit that is not set, the corresponding subchannel shall not be used by the SS on that segment. When this TLV is not present, BS may allocate any subchannels to an SS.
Optional permutation UL allocated subchannels bitmap	158	13	This is a bitmap describing the physical subchannels allocated to the segment in the UL, when using the uplink optional PUSC permutation (see 8.4.6.2.5). The LSB of the ~~first~~ least significant byte shall correspond to subchannel 0. For any bit that is not set, the corresponding subchannel shall not be used by the SS on that segment. When this TLV is not present, BS may allocate any subchannels to an SS.
UL AMC Allocated physical bands bitmap	18	6	A bitmap describing the physical bands allocated to the segment in the UL. When using the optional AMC permutation with regular MAPs (see 8.4.6.3). The LSB of the ~~first~~ least significant byte shall correspond to the physical band 0. For any bit that is not set, the corresponding physical bands shall not be used by the SS on that segment. When this TLV is not present, BS may allocate any physical bands to an SS.
Normalized C/N override	175	8	This is a list of numbers, where each number is encoded by one nibble, and interpreted as a signed integer. The nibbles correspond in order to the list defined by Table 334, starting from the second line, such that the LS nibble of the ~~first~~ least significant byte corresponds to the second line in the table. The number encoded by each nibble represents the difference in normalized C/N relative to the previous line in the table.
Normalized C/N override 2	177	8	Bit#0–7: It shall be interpreted as signed integer in dB. It corresponds to the normalized C/N value in the first line (counting except for header cell of table) Bit#8–63: This is a list of numbers, where each number is encoded by one nibble, and interpreted as a signed integer. The nibbles correspond in order to the list defined by Table 334, starting from the second line (counting except for the header cell of table), such that the LS nibble of the ~~first~~ least significant byte corresponds to the second line in the table. The number encoded by each nibble represents the difference in normalized C/N relative to the previous line in the table.

[Modify following entries in Table 358 on page 674 of IEEE 802.16e-2005]

Name	Type (1 Byte)	Length	Value	PHY scope
DL AMC allocated physical bands bitmap	22	6	A bitmap describing the physical bands allocated to the segment in the DL, when allocating AMC subchannels through the HARQ MAP, or through the Normal MAP, or for Band-AMC CINR reports, or using the optional AMC permutation (see 8.4.6.3). The LSB of the ~~first~~ least significant byte shall correspond to the physical band 0. For any bit that is not set, the corresponding physical band shall not be used by the SS on that segment. When this TLV is not present, BS may allocate any physical bands to an SS	OFDMA
TUSC1 permutation active subchannels bitmap	36	9	This is a bitmap describing the subchannels allocated to the segment in the DL, when using the TUSC1 permutation (see 8.4.6.1.2.4). The LSB of the ~~first~~ least significant byte shall correspond to subchannel 0. For any bit that is not set, the MS on that segment shall not use the corresponding subchannel. The active subchannels are renumbered consecutively starting from 0.	__
TUSC2 permutation active subchannels bitmap	37	13	This is a bitmap describing the subchannels allocated to the segment in the DL, when using the TUSC2 permutation (see 8.4.6.1.2.5). The LSB of the ~~first~~ least significant byte shall correspond to subchannel 0. For any bit that is not set, the MS on that segment shall not use the corresponding subchannel. The active subchannels are renumbered consecutively starting from 0.	__

References

[1] IEEE 802.16 2004: “IEEE Standard for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems”.

[2] IEEE Std 802.16e 2005 and IEEE Std 802.16 2004/Cor1 2005 (Amendment and Corrigendum to IEEE Std 802.16 2004)