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Re:	This contribution is for call for contribution about IEEE P802.16e/D5-2004
Abstract	This contribution proposes the DIUC update procedure using MOB-TRF-IND message in sleep mode
Purpose	
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Efficient DIUC update in sleep-mode

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SAMSUNG ELECTRONICS

1. Problem statements

A MSS may enter sleep mode through the signaling with MOB-SLP-REQ and MOB-SLP-RSP message. While the MSS is in sleep mode, it shall try to receive the broadcasting messages like a MOB-TRF-IND during its listening window and may remain in low-power state to reduce power consumption during its sleep window. The MSS which is in sleep mode examines the *DCD count*, *UCD count* and *frame number* just after entering listening window to verify synchronization with its serving BS. If the MSS detects changes of them, it continues to remain in wake-up state and tries to acquire the updated DCD and UCD message.

During the sleep window, the MSS's serving BS may update the contents of DCD message and/or UCD message. During the first incoming listening window after changes of DCD or/and UCD message, if the MSS receives MOB-TRF-IND message with positive traffic indication, the MSS terminates sleep mode and returns to normal mode to receive the pending DL traffic which is addressed to it. At this moment, the MSS may not utilize the previously stored DCD burst profile encodings to correctly receive its pending DL traffic until the MSS receives the newly updated DCD, UCD message. But if there is no changes of downlink burst profile encodings before and after update, the MSS may use the downlink burst profile information in old DCD message to receive its pending DL traffic. Unfortunately, the MSS can not know whether downlink burst profile encodings were changed or not. Therefore, the MSS has no choice but to use the most robust decoding scheme to receive its pending DL traffic. It needs more processing power and more time at the MSS.

If the MSS may detect changes of downlink burst profile encodings in the received MOB-TRF-IND message, it is easier for the MSS to decide whether to utilize the old DCD message or to use changed FEC code type signaled in MOB-TRF-IND message by BS for acquiring its DL traffic. This method will reduce the unnecessary DL traffic retransmission at BS and power consumption at the MSS. The format of the present MOB-TRF-IND message and DCD burst profile encodings is as follows.

Table 106c—Traffic-Indication (MOB_TRF-IND) message format

Syntax	Size	Notes
MOB_TRF-IND_Message_Format() {		
Management message type = 52	8 bits	
FMT	1 bit	0 = SLPID based format 1 = CID based format
if (FMT == 0) {		
reserved	7 bits	
SLPID Group Indication bit-map	32 bits	Nth bit of SLPID-Group indication bit-map [MSB corresponds to N = 0] is allocated to SLPID Group that includes MSSs with SLPID values from N*32 to N*32+31 Meaning of this bit 0 : There is no traffic for all the 32 MSSs which belong to the SLPID-Group 1 : There is traffic for at least one MSS in SLPID-Group.
Traffic Indication Bitmap	Variable	Traffic Indication bit map comprises the multiples of 32-bit long Traffic Indication unit. A Traffic Indication unit for 32 SLPIDs is added to MOB_TRF-IND message whenever its SLPID Group is set to '1' 32 bits of Traffic Indication Unit (starting from MSB) are allocated to MSSs in the ascending order of their SLPID values 0 : Negative indication 1 : Positive indication

Syntax	Size	Notes
} else {		
Num-pos	7 bits	Number of CIDs on the positive indication list
for (i=0; i<Num-pos; i++) {		
Short Basic CID	12 bits	12 least significant bits of the Basic CID
}		
while (!(byte_boundary)) {		
Padding bits	<= 7 bits	padding for byte alignment
}		
}		
}		

Table 361—DCD burst profile encodings—WirelessMAN-OFDMA

Name	Type (1 byte)	Length	Value (variable length)
FEC Code type	150	1	0 = QPSK (CC) 1/2 1 = QPSK (CC) 3/4 2 = 16-QAM (CC) 1/2 3 = 16-QAM (CC) 3/4 4 = 64-QAM (CC) 2/3 5 = 64-QAM (CC) 3/4 6 = QPSK (BTC) 1/2 7 = QPSK (BTC) 3/4 or 2/3 8 = 16-QAM (BTC) 3/5 9 = 16-QAM (BTC) 4/5 10 = 64-QAM (BTC) 2/3 or 5/8 11 = 64-QAM (BTC) 5/6 or 4/5 12 = QPSK (CTC) 1/2 13 = QPSK (CTC) 2/3 14 = QPSK (CTC) 3/4 15 = 16-QAM (CTC) 1/2 16 = 16-QAM (CTC) 3/4 17 = 64-QAM (CTC) 2/3 18 = 64-QAM (CTC) 3/4 19 = 64-QAM (CTC) 5/6 20 = QPSK (ZT CC) 1/2 21 = QPSK (ZT CC) 3/4 22= 16-QAM (ZT CC) 1/2 23= 16-QAM (ZT CC) 3/4 24= 64-QAM (ZT CC) 2/3 25= 64-QAM (ZT CC) 3/4 26..255 = *Reserved*
DIUC Mandatory exit threshold	151	1	0–63.75 dB CINR at or below where this DIUC can no longer be used and where this change to a more robust DIUC is required, in 0.25 dB units. See Figure 81.
DIUC Minimum entry threshold	152	1	0–63.75 dB The minimum CINR required to start using this DIUC when changing from a more robust DIUC is required, in 0.25 dB units. See Figure 81.

2. Proposed remedies

We proposed two remedies to indicate the change of DL burst profile encodings of DCD.

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2.1. Remedy #1

To indicate that the downlink burst profile encodings in DCD was changed, we propose to insert DIUC-FEC code type pair (DIUC values and changed FEC code types corresponding to DIUC values) as TLV format into the MOB-TRF-IND message. The utilization of this new field can be explained as following figure1 and figure2.

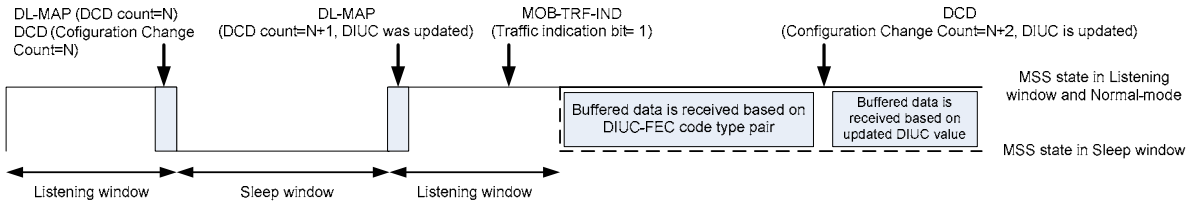

Fig. 1. Buffered data receiving procedure on changing DCD count in DL-MAP

(DIUC was updated and DCD count is N+1)

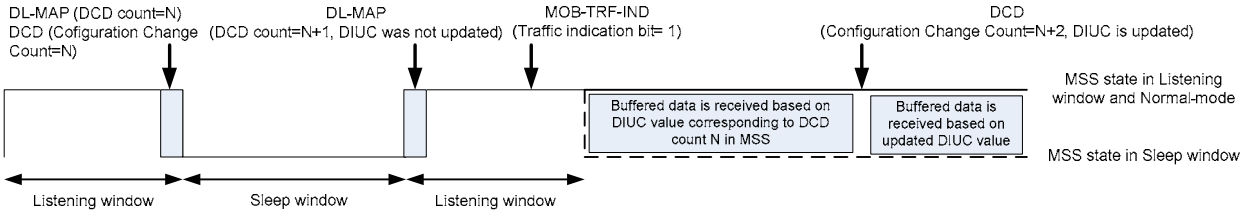

Fig. 2. Buffered data receiving procedure on changing DCD count in DL-MAP

(DIUC was not updated and DCD count is N+1)

We described the individual situation in Figure 1 and Figure 2.

In figure1, the MSS detects the changes of DCD count value at the beginning of listening window and tries to receive its DL traffic by using DIUC-FEC code type pair as TLV format signaled in MOB-TRF-IND message.

In figure2, the MSS detects the changes of DCD count value at the beginning of listening window and uses the previous stored DCD message (Configuration Change Count=N) to receive its DL traffic.

2.2. Remedy #2

To indicate whether the downlink burst profile encodings in DCD was changed or not, we propose to insert *DIUC update indicator*, DIUC-FEC code type pair (DIUC values and changed FEC code types corresponding to DIUC values) into the MOB-TRF-IND message. The utilization of this new field can be explained as following figure3 and figure4.

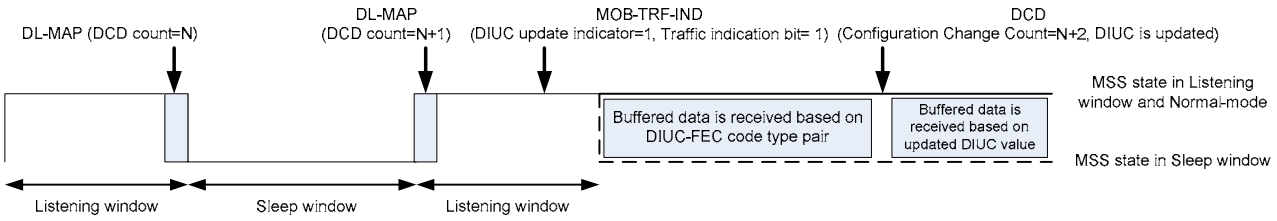

Fig. 3. Buffered data receiving procedure on changing DCD count in DL-MAP

(DIUC update indicator = 1)

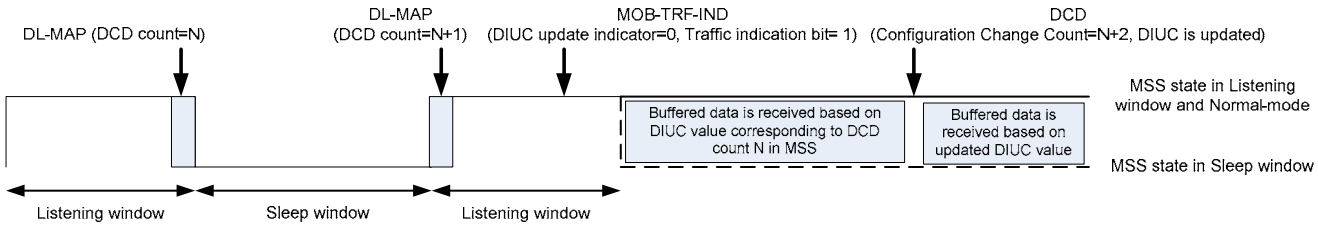

Fig. 4. Buffered data receiving procedure on changing DCD count in DL-MAP

(DIUC update indicator = 0)

We described the individual situation in Figure 1 and Figure 2.

In figure1, the MSS detects the changes of DCD count value at the beginning of listening window and finds that the DIUC update indicator is equal to 1 and the MSS tries to receive its DL traffic by using DIUC-FEC code type pair.

In figure2, the MSS detects the changes of DCD count value at the beginning of listening window and finds that the DIUC update indicator is equal to 0 and it uses the previous stored DCD message (Configuration Change Count=N) to receive its DL traffic.

3. Proposed Text Change

3.1. Remedy #1

[Modify MOB-TRF-IND message in Page 60, Table 106c]

Syntax	Size	Notes
MOB_TRF-IND_Message_Format() {		
Management message type = 52	8 bits	
FMT	1 bit	0 = SLPID based format 1 = CID based format
if (FMT == 0) {		
reserved	7 bits	
SLPID Group Indication bit-map	32 bits	Nth bit of SLPID-Group indication bit-map [MSB corresponds to N = 0] is allocated to SLPID Group that includes MSSs with SLPID values from N*32 to N*32+31 Meaning of this bit 0 : There is no traffic for all the 32 MSSs which belong to the SLPID Group 1 : There is traffic for at least one MSS in SLPID-Group.
Traffic Indication Bitmap	Variable	Traffic Indication bit map comprises the multiples of 32-bit long Traffic Indication unit. A Traffic Indication unit for 32 SLPIDs is added to MOB_TRFIND message whenever its SLPID Group is set to '1' 32 bits of Traffic Indication Unit (starting from MSB) are allocated to MSSs in the ascending order of their SLPID values 0 : Negative indication 1 : Positive indication
} else {		
Num-pos	6 bits	Number of CIDs on the positive indication list
for (i=0; i<Num-pos; i++) {		
Short Basic CID	12 bits	12 least significant bits of the Basic CID
}		
while (!(byte_boundary)) {		
Padding bits	<=7 bits	padding for byte alignment
}		
}		
TLV encoded information	variable	TLV specific
}		

The following TLV parameters may be included in MOB-TRF-IND message :

DIUC_update (11.17.2)

The DIUC_update is a compound TLV value that provides changed FEC code type in DCD burst profile encodings corresponding to DIUC comparing to previous DCD message. The DIUC_update TLV may contain multiple FEC code types to DIUC values (DIUC-FEC code type pair) for the MSSs positively indicated in MOB_TRF-IND message.

[Insert the followings after the end of section 11.16]

11.17.2 DIUC_update

The DIUC_update TLV specifies changed FEC code types corresponding to DIUC values. This TLV may include multiple DIUC-FEC code type pair values for the MSSs positively indicated in MOB-TRF-IND message.

Type	Length	Value	Scope
	Variable	See following table	MOB-TRF-IND

Field	Length	Note
DIUC- FEC code type pair	9 bits	First 4 bits indicates DIUC value corresponding to changed FEC code type and the second 5 bits indicates changed FEC code type.

3.2. Remedy #2

[Modify MOB-TRF-IND message in Page 60, Table 106c]

Syntax	Size	Notes
MOB_TRF-IND_Message_Format() {		
Management message type = 52	8 bits	
FMT	1 bit	0 = SLPID based format 1 = CID based format
DIUC update indicator	1 bit	This field indicates whether changed DCD count is attributed to FEC code type update corresponding to DIUC value during last sleep window or not. If set to 0, buffered data from BS is received based on FEC code type in previous received DCD message. Otherwise, changed FEC Code types corresponding to DIUC values are included.
If (DIUC update indicator == 1) {		

if (FMT == 0) {		
reserved	7 bits	
SLPID Group Indication bit-map	32 bits	Nth bit of SLPID-Group indication bit-map [MSB corresponds to N = 0] is allocated to SLPID Group that includes MSSs with SLPID values from N*32 to N*32+31 Meaning of this bit 0 : There is no traffic for all the 32 MSSs which belong to the SLPID Group 1 : There is traffic for at least one MSS in SLPID-Group.
Traffic Indication Bitmap	Variable	Traffic Indication bit map comprises the multiples of 32-bit long Traffic Indication unit. A Traffic Indication unit for 32 SLPIDs is added to MOB_TRFIND message whenever its SLPID Group is set to '1' 32 bits of Traffic Indication Unit (starting from MSB) are allocated to MSSs in the ascending order of their SLPID values 0 : Negative indication 1 : Positive indication
} else {		
Num-pos	~~7~~6 bits	Number of CIDs on the positive indication list
for (i=0; i<Num-pos; i++) {		
Short Basic CID	12 bits	12 least significant bits of the Basic CID
}		
}		
N_DIUC_updates	4 bits	Number of changed FEC code types corresponding to DIUC comparing to previous DCD message
for (i=0;i<N_DIUC_updates;i++) {		
DIUC-FEC code type pair	9 bits	Bit #0 - #4 : changed FEC code type Bit #5 - #8 : DIUC value corresponding to changed FEC code type For example, 001000010 means that FEC code type corresponding to DIUC 2 is changed to FEC code type 2 (i.e., 16-QAM (CC) 1/2).
}		
}		
else {		
if (FMT == 0) {		
reserved	7 bits	
SLPID Group Indication bit-map	32 bits	Nth bit of SLPID-Group indication bit-map [MSB corresponds to N = 0] is allocated to SLPID Group that includes MSSs with SLPID values from N*32 to N*32+31 Meaning of this bit

		0 : There is no traffic for all the 32 MSSs which belong to the SLPID Group 1 : There is traffic for at least one MSS in SLPID-Group.
Traffic Indication Bitmap	Variable	Traffic Indication bit map comprises the multiples of 32-bit long Traffic Indication unit. A Traffic Indication unit for 32 SLPIDs is added to MOB_TRFIND message whenever its SLPID Group is set to '1' 32 bits of Traffic Indication Unit (starting from MSB) are allocated to MSSs in the ascending order of their SLPID values 0 : Negative indication 1 : Positive indication
} else {		
Num-pos	6 bits	Number of CIDs on the positive indication list
for (i=0; i<Num-pos; i++) {		
Short Basic CID	12 bits	12 least significant bits of the Basic CID
}		
}		
}		
while (!(byte_boundary)) {		
Padding bits	<=7 bits	padding for byte alignment
}		
}		

Parameters shall be as follows:

FMT

This field indicates one of the SLPID bit-map based format and the Short Basic CID based format.

DIUC update indicator

This field indicates whether changed DCD count is attributed to FEC code type update corresponding to DIUC value during last sleep window or not. If set to 0, buffered data from BS is received based on FEC code type in previous received DCD message. Otherwise, changed FEC Code types corresponding to DIUC values are included.

SLPID-Group indication bit-map

SLPIDs from 0 to 1023 are divided into 32 SLPID-Groups. Therefore, the respective SLPIDGroup has the range as follows:

SLPID-Group#0 (MSB) corresponds to SLPID = 0 ... 31.

SLPID-Group #1 corresponds to SLPID = 32 ... 63.

...

SLPID-Group#31 corresponds to SLPID = 992 ... 1023.

'SLPID-Group Indication bit-map' is a 32 bit-long field whose each bit is assigned to the respective SLPID-Group. In other words, the most significant bit (=MSB) in it is assigned to SLPID-Group#0, and subsequent bit relates to SLPID-Group #1, etc. [VY: in 802.16 bit transmission order is from MSB, so it's more natural to start from MSB]

The n^{th} bit (b_n), n=0~31, of SLPID-Group Indication bit-map shall be interpreted in the following manner:

b_n = 0 means that there is no traffic for all the 32 MSSs belonging to SLPID-Group #n. In this case, the MSSs in sleep mode belonging to SLPID-Group #n may return to sleep mode.

b_n = 1 means that there exists traffic for one or more MSSs belonging to SLPID-Group #n. In this case, the MSSs in sleep mode belonging to SLPID-Group #n shall read its own Traffic Indication bit-map in MOB_TRF-IND message.

Traffic Indication bit-map

Traffic Indication bit map comprises the multiples of 32-bit long Traffic Indication Unit for every SLPID-Group with SLPID-Group indication bit = 1. Bits in 32-bit Traffic Indication unit (starting from MSB) are allocated to MSSs to in ascending order of SLPIDs. Each bit signals traffic information for the corresponding MSS as follows:

0: Negative Indication

1: Positive Indication

Num-pos

The number of Positive indication.

Short Basic CID

The Basic CID for MSS to be transited into an awake mode.

N_DIUC_updates

Number of changed FEC code types corresponding to DIUC comparing to previous DCD message

DIUC-FEC code type pair

Bit #0 - #4 : changed FEC code type

Bit #5 - #8 : DIUC value corresponding to changed FEC code type

For example, 001000010 means that FEC code type corresponding to DIUC 2 is changed to FEC code type 2 (i.e., 16-QAM (CC) 1/2).

When MOB_TRF-IND message has FMT=0, it may include the following TLV:

SLPID_Update (11.16.1)

The SLPID_Update is a compound TLV value that provides a shorthand method for changing the SLPID used by the MSS in sleep mode operation. The SLPID_Update TLV specifies a new SLPID that replaces an old SLPID. The SLPID_Update TLV may contain multiple Old_New_SLPID values for the MSSs negatively indicated in MOB_TRF-IND message.