Project	IEEE 802.16 Broadband Wireless Access Working Group **<http://ieee802.org/16>**
Title	Enhancement Feature for Robust Multimedia Broadcasting
Date Submitted	[2004-07-15]
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Re:	This contribution is for reply of IEEEP802.16e/D3 recirculation.
Abstract	This contribution proposes the physical enhancement feature for robust multimedia broadcasting service. This is the harmonized contribution related to multimedia broadcasting service among comment #336, #342 and #417 (referring to C802.16e-04_193, C802.16e-04_195r1 and C802.16e-04_169)
Purpose	Discussion and Adoption in IEEE 802.16e
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Enhancement Feature for Robust Multimedia Broadcasting

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Introduction

This contribution proposes enhancement feature to achieve better transmitting and receiving efficient for multimedia broadcasting service.

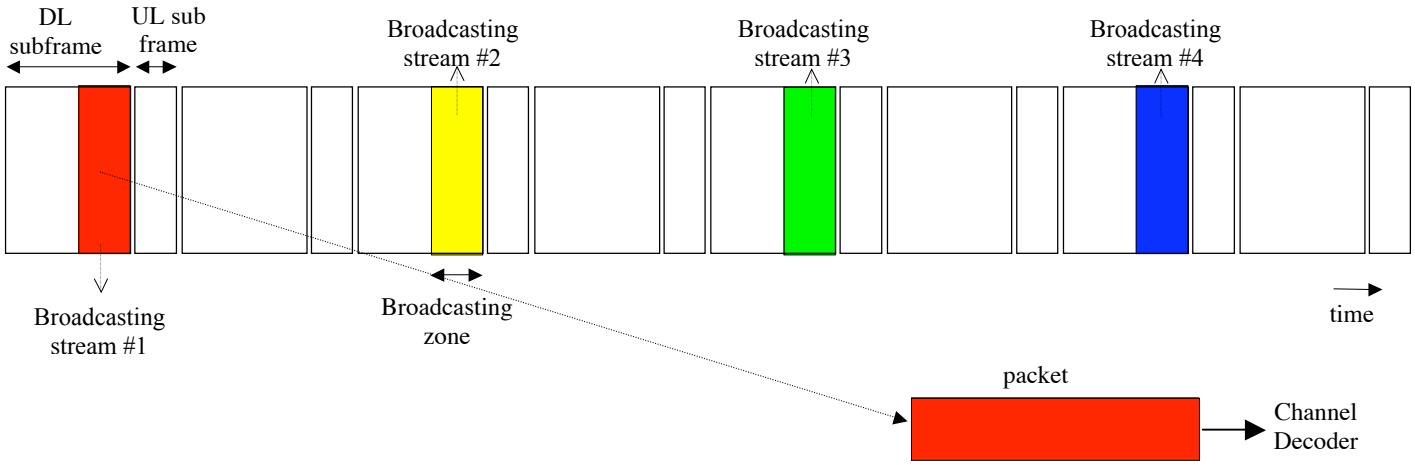
When we transmit traffic for multimedia broadcasting service (MBS) based on current IEEE802.16 draft, after FEC, interleaving and modulation, we should transmit multimedia broadcasting traffic in continuous time. Therefore this traffic occupies only short time in air, we cannot achieve time diversity. Furthermore since it should be broadcasted to multiple MSS, we cannot use several methods such as downlink power control to overcome fading.

In this contribution, we propose the way to achieve time diversity, with which we can make downlink transmission time for multimedia broadcasting traffic to be greater than coherent time of wireless channel.

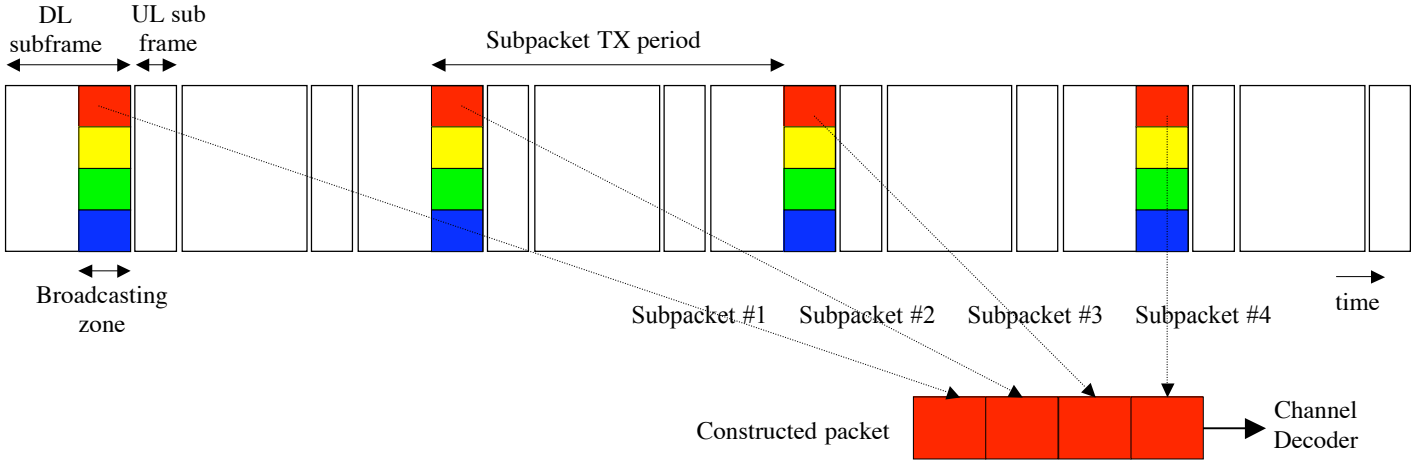
This contribution is one of the harmonized contributions for multimedia broadcasting system among comments 336, 342 and 417 with contribution 193, 195r1 and 169.

Proposed Mechanism

In this contribution, ~~as shown in figure 1,~~ we propose the ~~way~~ BS transmission scheme of ~~t~~ multimedia broadcasting traffic to exploit time diversity. In the proposed scheme, the encoded packet is divided into multiple subpackets and each subpacket is transmitted in different frame so as to go through different fading channel. MS collects and concatenates these subpackets, and then the constructed packet is decoded at the channel decoder. Figure 1 depicts the proposed multi-subpacket transmission scheme. The example shown in this figure is for the case that the packet is divided into 4 subpackets and the transmission period of subpacket is 2 frames.~~Time multiplexing is the scheme that divides the coded symbols from encoder into multiple symbols and transmits each during discontinuous time interval.~~



(a) Conventional Transmission



(b) Multi-subpacket transmission

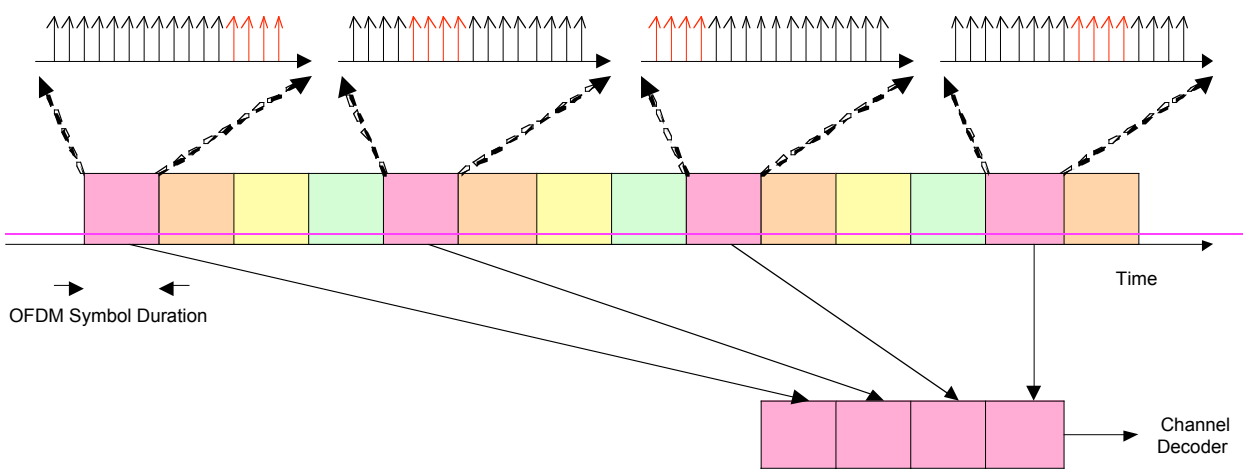


Figure 1. ~~Time multiplexing for OFDMA~~The multi-subpacket transmission scheme

We present the performance of the proposed scheme in figure 2. Simulation environment is the following:

- 1 Path Rayleigh fading: mobile speed = 10km/h, center frequency = 2.35GHz
- Channel bandwidth: 10MHz
- FFT size: 1024
- Cyclic prefix length: 128 samples
- Ideal channel estimation
- Encoder packet size: 384 bit
- Convolutional code: R=1/2
- QPSK
- Number of subpackets per packet: 4, Each subpacket is conveyed by 2 subchannels
- Frame length: 5ms
- Subpack transmission period (P): 5ms (1 frame), 10ms (2 frame), 20ms (4 frame)

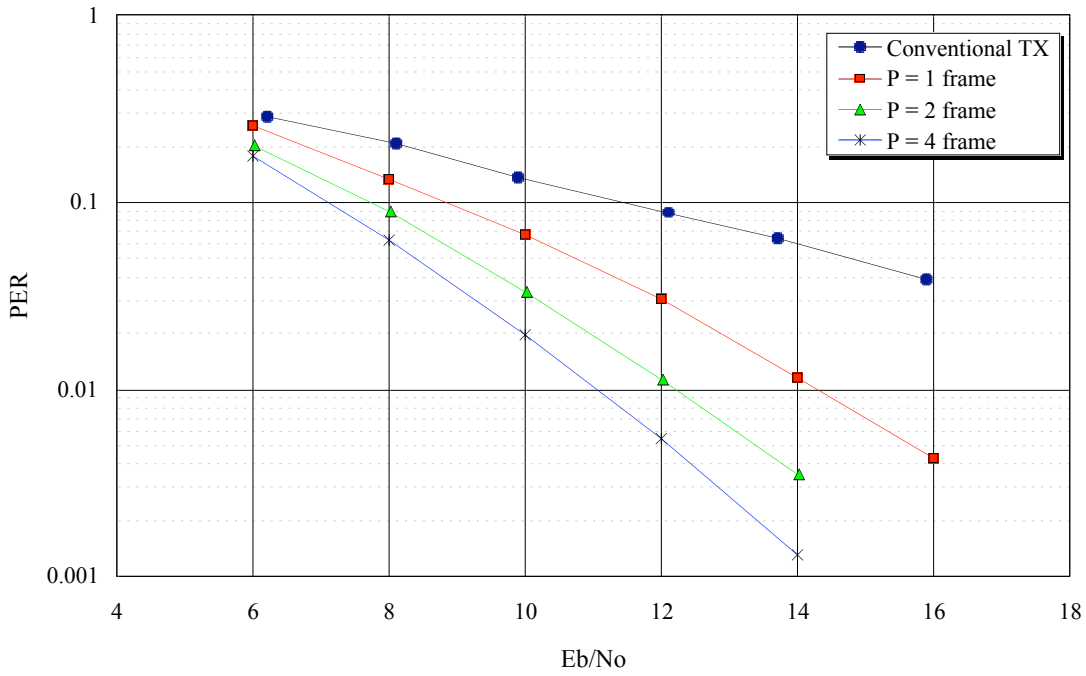


Figure 2. Performance of the multi-subpacket transmission scheme.

In figure 2, we can see that PER (packet error rate) is significantly decreased by employing the proposed scheme, and the decreases in PER becomes larger as the subpack transmission period (P) increases. It is noted that such performance gain has been achieved through exploiting time diversity.

To support ~~time multiplexing as shown in figure 1~~the proposed multi-subpacket transmission scheme, we should make another DL-MAP_IE.

It should also be noted that when MBS are provided to H-ARQ enabled MSS, we can easily implement the proposed scheme.

Proposed Text Changes

[Remedy 1 : Insert Followings in line 46, page 76]

8.4.5.3.~~12~~ 13 TimeDivsertiy MBS_DL-MAP_IE
In the DL-MAP, a BS may transmit DIUC=15 with the Broadcast_DL-MAP_IE() to indicate that traffic for multimedia broadcast service is transmitted. A multimedia broadcast packet should be divided to 4 subpackets and notified at different Broadcast_DL-MAP_IE() with different time position. First allocation of Broadcast_DL-MAP_IE() should start with SPID=0 in a frame. The subsequent allocations shall use

next SPID, increased by 1. The multimedia broadcasting service zone in downlink subframe should be defined with a common IDcell.

Table ??. TimeDiversity_MBS_DL-MAP_IE

Syntax	Size	Notes
Broadcast_DL-MAP_IE{	_	_
Extended DIUC	4 bits	Broadcast Service = ??
Length	4 bits	Length of the IE in Bytes
N_CID		Number of CID for Broadcasting Service
For(i=0;i<N_CID;i++){		
CID	16bits	CID of each Broadcasting Service
~~MBS_ZONE_Identifier~~	~~8 bits~~	~~MBS Zone ID~~
SPID	2 bits	Subpacket ID
OFDMA Symbol Offset	8 bits	
Subchannel Offset	6 bits	
No. OFDMA Symbols	6 bits	
NO. Subchannels	6 bits	
DIUC	4 bits	
}		
}		

Extended DIUC
DIUC used for the burst.
Connection Identifier (CID)
Represents the assignment of the IE to a broadcast or multicast address.
SPID
Defines SubPacket ID, which is used to identify the four subpackets generated from an encoder packet.
OFDMA Symbol offset
The offset of the OFDMA symbol in which the burst starts, measured in OFDMA symbols from beginning of the downlink frame in which the DL-MAP is transmitted.
Subchannel offset
The lowest index OFDMA subchannel used for carrying the burst, starting from subchannel 0.
No. OFDMA Symbols
The number of OFDMA symbols that are used (fully or partially) to carry the downlink PHY Burst.
No. of subchannels
The number of subchannels with subsequent indexes, used to carry the burst.

[Remedy 2 : Adopt Followings modifications to the end of section 6.3.2.3.43.6.6]

Table 99a - DL-MAP subtypes

DL-MAP Subtype	Description
0	TimeDiversity_MBS_DL-MAP_IE
1 ~ 31	Reserved

6.3.2.3.43.6.6.1 H-ARQ_MBS_DL-MAP_IE

The TimeDiversity MBS_DL-MAP_IE format is presented in Table ??. This message defines the access information for the multimedia broadcasting service burst of H-ARQ enabled MSS. The multimedia broadcasting service burst indicated by TimeDiversity MBS_DL-MAP_IE is encoded at the same way of H-ARQ. But it does not need the acknowledgement from MSS. The multimedia broadcasting service zone in downlink subframe should be defined with a common IDcell.

Table ??. H-ARQ_MBS_DL-MAP_IE

Syntax	Size	Notes
TimeDiversity_MBS_DL-MAP_IE{	_	_
For(i=0;i<N_CID;i++){		N_CID can be calculated by Length field in Compact_DL-MAP IE format for extension
CID	16 bits	CID of each Broadcasting Service
Subchannel Offset	12 bits	
N_{EP} code	4 bits	
N_{SCH} code	4 bits	
AI_SN	1 bits	ARQ ID seq. No
SPID	2 bits	Subpacket ID
ACID	4 bits	ARQ Channel ID
reserved	5 bits	
}		
}		

Subchannel Offset

Subchannel Offset is the starting position of each subpacket notified by TimeDiversity MBS_DL-MAP_IE.

N_{EP} code, N_{SCH} code

The combination of N_{EP} code and N_{SCH} code indicates the number of allocated subchannels and scheme of coding and modulation for the DL burst

AI_SN

Defines ARQ Identifier Sequence Number. This is toggled between ‘0’ and ‘1’ on successfully transmitting each encoder packet with the same ARQ channel.

SPID

Defines SubPacket ID, which is used to identify the four subpackets generated from an encoder packet.

ACID

Defines ARQ Channel ID for timerdiversity MBS packet. Each timediversity MBS connection can have multiple ARQ channels, each of which may have an encoder packet transaction pending.