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Source(s)	*Bin-chul Ihm, Kyuhyuk Chung, Jin-young Chun, Yongseok Jin* LG Electronics,Inc. 533,Hogye-1dong,Dongan-gu, Anyang-shi,Kyongki-do,Korea Voice: 82-31-450-7903 Fax: 82-31-450-7912 [mailto:jychun03@lge.com]
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Proposal for Double Uplink Scheme in OFDMA

Bin-chul Ihm, Kyuhyuk Chung, Jin-young Chun, Yongseok Jin
LG Electronics

1. Introduction

For adopting OFDMA specified in the current 802.16 standard, an MSS use alone the allocated uplink subchannels (see figure 1). Therefore, if the system needs more channel capacity, the solutions in the current are to add new band or to use AAS but these solutions need to add new hardware system. And another solution using the higher data rate needs more complex encoding and decoding.

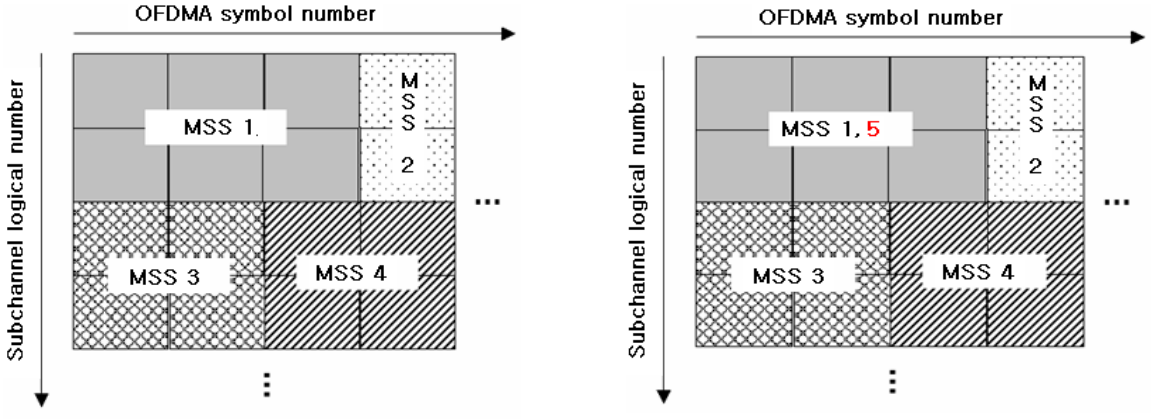

Figure 1 Example of allocation for DUS_IE

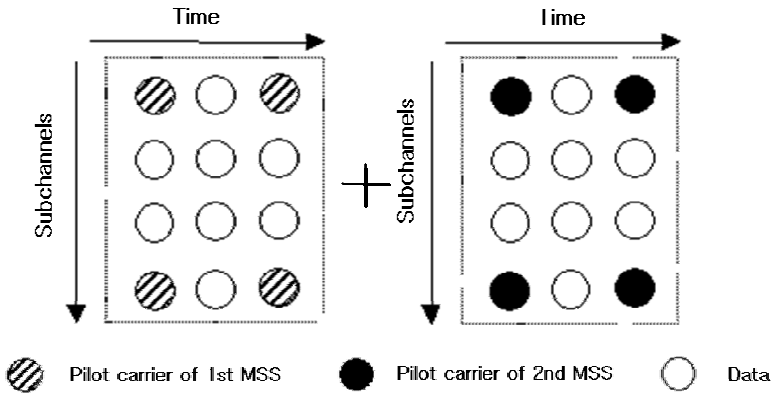

Figure 2 Example of orthogonal pilot pattern for DUS_IE

2. Propose

We propose the double uplink scheme (DUS) that two MSSs share OFDMA uplink subchannels simultaneously. In this scheme, BS can separate their data by signal processing methods when modulations and channels of each MSS are known. Since the channel estimation can be performed using 4 pilots per tile, it is necessary that the pilot patterns per tile of each MSS are orthogonal. BS can assign modulation and pilot patterns of each MSS such that two MSS simultaneously send data through the shared uplink subchannels.

The scheme has the merits as following:

1. Increased uplink channel capacity without additional frequency bands or hardware.
2. Increased uplink channel capacity with lower complexity as compare with using higher data rate
3. Increased downlink channel capacity by allocating resources of uplink subframe into downlink subframe in TDD.

3. Simulation Result

We suppose that OFDMA downlink channel consists of 30 symbols per frame, the channel model is AWGN and data modulation is QPSK. Figure 3 represents the BER performance of uplink subframe when MSS1 and MSS2 use some subchannels to DUS region simultaneously. The Block line expresses BER performance in current OFDMA system. Red line expresses that MSS1 use normal power and MSS2 use +6dB power. And the last Blue line expresses MSS1 use normal power and MSS2 use –6dB power.

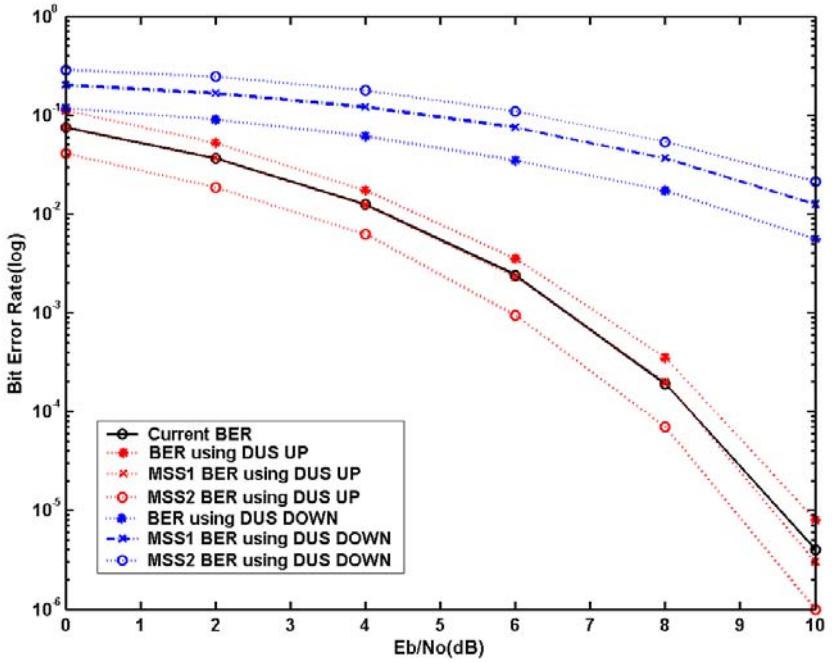

Figure 3. The BER performance of uplink subframe using DUS

4. Proposed text :

[Add a new section 8.4.4.15 DUS_IE (Double Uplink Scheme)]

8.4.4.8 DUS(Double Uplink Scheme)_IE

In the UL MAP, a BS may transit UIUC=15 with the DUS_IE to support Double Uplink Scheme that several MSSs share to the allocated channel at the same time. Each MSS in shared channel use the different orthogonal pilot pattern.

Syntax	Size	Notes
DUS_IE () {		
Extended UIUC	4bits	DUS= 0x08
Length	4bits	Length = 0x03
Duration	10bits	In OFDMA slots
Repetition coding indication	2bits	0b00-No repetition coding 0b01-Repetition coding of 2 used 0b10-Repetition coding of 4 used 0b11-Repetition coding of 6 used
Boosting	3bit	000 : normal(not boosted); 001: +6dB; 010: -6dB; 011:+9dB; 100:+3dB; 101:-3dB; 110: -9dB; 111: -12dB;
Pilot bitmap	4bits	For a tile in PUSC mode, Bit #0: The value of 1st pilot Bit #1: The value of 2nd pilot Bit #2: The value of 3rd pilot Bit #3: The value of 4th pilot
Reserved	5bit	Shall be set to zero
}		

Duration

This indicates the duration, in units of OFDMA slots, of the allocation.

Repetition coding indication

This indicates the repetition code used inside the allocated burst.

Boosting

This indicates whether the subcarriers for this allocation are power boosted.

Pilot bitmap

The bitmap value of these four bits indicates the value of modulated pilots sequentially.