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Source(s)	QunFang Lou, Hebing Wu, Michael (Jibin) Wang, Tao Li, John Lee, Lili Huawei/FutureWei (Huawei North America Division) 3255-4 Scott Blvd.Suite 101, Santa Clara, CA 95054 Huawei Technologies Co., Ltd. No.98, Lane 91, Eshan Road, Pudong Shanghai, P.R. China, 200127 Voice: +86-21-68644808 408-712-9326 Fax: +86-21-50898375 Mail to : louqunfang@huawei.com John_Lee@huawei.com
Re:	IEEE P80216Cor1/D3
Abstract	Problem and solution with data mapping approach for OFDMA PHY in DL PUSC zone
Purpose	For adoption
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Problem with Data Mapping for OFDMA PHY in DL PUSC Zone

QunFang Lou, Hebing Wu, Michael (Jibin) Wang
Tao Li, John Lee (Jiang Li), Li Li,
Huawei Technologies Co., Ltd.

1 Problem Statement

In 8.4.3.1 of P80216_Cor1_D3, one slot is one subchannel by two OFDMA symbols for downlink PUSC using the distributed subcarrier permutation (defined in 8.4.6.1.2.1). According to the slot concatenation rule in 8.4.9.2, the modulated data is mapped from FEC block to j concatenated slots. The value of j varies from modulation types. Fig. 1 is a data mapping example (j=2).

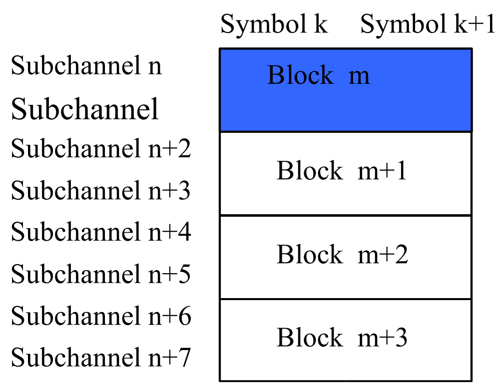

Fig. 1 data mapping example of j equal to 2

The downlink subchannel subcarrier allocation in PUSC is depicted in 8.4.6.1.2.1.1 of IEEE 802.16D9. According to this allocation scheme, the subcarriers in each subchannel are discrete and frequency diversity gain can be obtained to some extent. However, the corresponding physical subcarriers of each subchannel in the two successive OFDMA symbols of a slot will be adjacent or even the same. Table 1 lists the physical subcarrier index of the allocated subcarriers in OFDMA downlink PUSC taking 1024 FFT for example. As is easy to see, the corresponding subcarriers are adjacent or even the same.

Table 1 allocated subcarriers in same slot

Symbol k	......	689	881	886	542	552	757	759	517	522	556	......
Symbol k+1	......	690	880	887	541	553	757	760	516	523	555	......

Because the OFDMA Symbol duration is far shorter than minimum Doppler period in real world, time diversity gain in one FEC block (containing two OFDMA symbols) is very small. According to the above mentioned subchannel subcarrier allocation scheme, the subcarrier of the second symbol in one slot must encounter deep fading when the corresponding subcarrier of the first symbol encounters deep fading.

Here, a new data mapping scheme is proposed to achieve better performance. Simulation results show that 1~3.5dB gain can be obtained at BER=1e-6.

2 Proposed solutions

See for details.

3 Specific text changes

[Change the text in section 8.4.3.1, from line 42 to 62 in page 89 of P80216_Cor1_D3 as the following:]

Change the second paragraph as indicated:

The definition of an OFDMA slot depends on the OFDMA symbol structure, which varies for uplink and downlink, for FUSC and PUSC, and for the distributed subcarrier permutations and the adjacent subcarrier permutation.

— For downlink FUSC (defined in 8.4.6.1.2.2) and downlink optional FUSC (defined in 8.4.6.1.2.3) using the distributed subcarrier permutation (defined in 8.4.6.1.2.2 and 8.4.6.1.2.3), one slot is one subchannel by one OFDMA symbol.

— For downlink PUSC using the distributed subcarrier permutation (defined in 8.4.6.1.2.1), one slot ~~is one subchannel by three OFDMA symbols.~~ consists of two different subchannels in two successive OFDMA symbols. Assume L subchannels are allocated to the user with indexes k, k+1,…,k+L-1, and the subchannel index for the first OFDM symbol in the slot is m, then the subchannel index for the second symbol in the slot is k+mod(m-k+L/2,L).

— For uplink PUSC using either of the distributed subcarrier permutations (defined in 8.4.6.2.1 and 8.4.6.2.5), one slot is one subchannel by three OFDMA symbols.

— For uplink and downlink using the adjacent subcarrier permutation (defined in 8.4.6.3), one slot is one subchannel by onetwo, three or six OFDMA symbols.

4 Simulation results

4.1 simulation condition

System parameter	Parameter value	
FFT size	1024	
Channel model	TU channel (Ref 3)	
Tb	89.6us	
Tg	11.2us	
Multipath Parameters Class Doppler Spectrum	Power (dB)	Delay (ns)
	-4.0	0
	-3.0	100
	0	300
	-2.6	500
	-3.0	800
	-5.0	1100
	-7.0	1300
	-5.0	1700
	-6.5	2300
	-8.6	3100
	-11	3200
	-10	5000
The frequency of carriers	2.5GHz	
Velocity	42km/h	

4.2 simulation results

Simulation results under the simulation condition listed above is shown in Fig2.

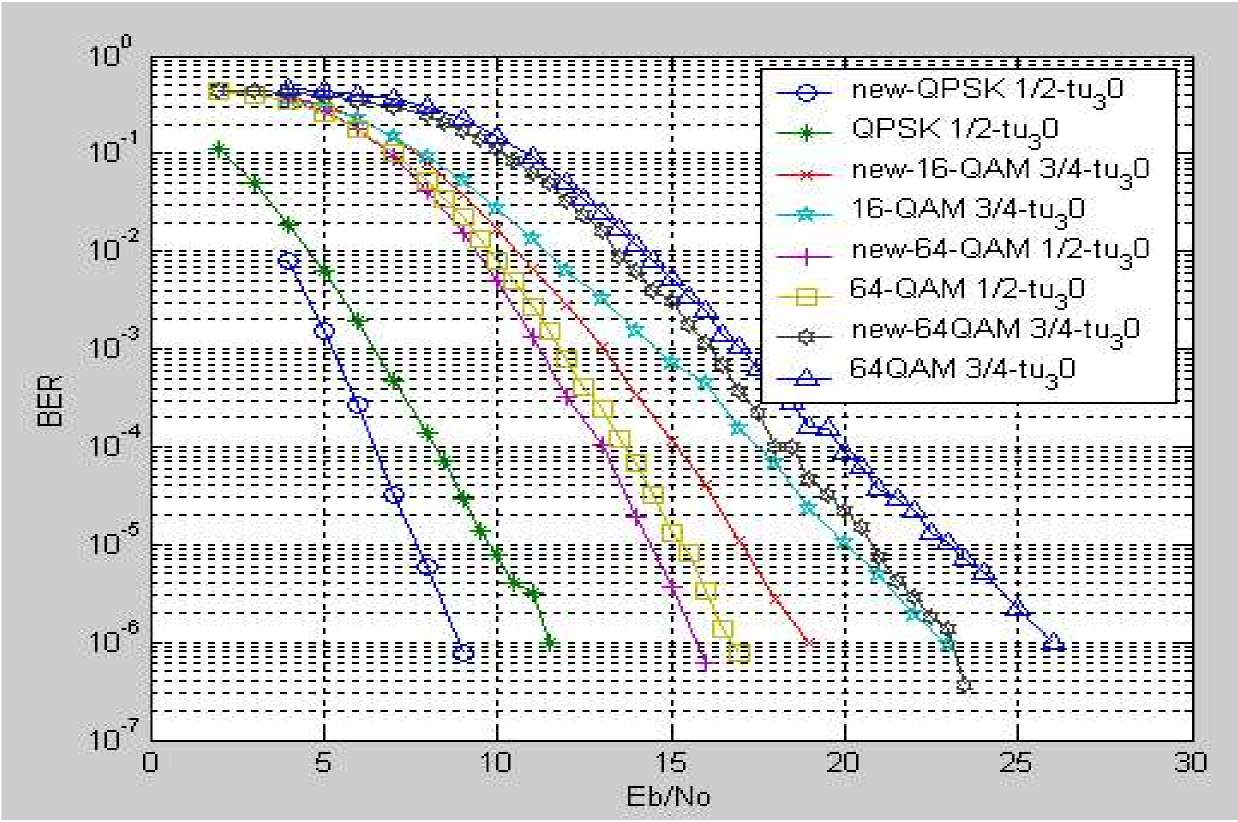

Fig. 2 Simulation results of proposed solution and the existing sulution

Table 2 lists the of Eb/No(dB) requirements of the proposed solution and the existing solution at BER=1e-6.

	QPSK 1/2	16QAM 3/4	64QAM 1/2	64QAM 3/4
Existing solution	11.500	22.940	16.785	26.000
Proposed solution	8.865	19.000	15.726	23.112
Difference	2.635	3.940	1.059	2.888

5 Reference material

[1] P80216_Cor1_D3, June 2005
[2] IEEE Standard 802.16-2004
[3] 3GPP TS 05.05 V8.15.0, “3GPP: Technical Specification Group GSM/EDGE Radio Access Network; Radio transmission and reception (Release 1999).