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Re:	
Abstract	The performance of the proposed Forward Error Correction (FEC) Scheme for 802.16.3 OFDM PHY is investigated. The proposed scheme employs a concatenated Reed- Solomon and a convolutional code, with relatively short blocks. It is shown that due to the short block lengths employed, the proposed scheme is inefficient, and that there are more efficient and simpler schemes. In particular, it is shown that the rate equivalent convolution code performs as well as the proposed concatenated scheme.
Purpose	Aid in the selection of the FEC scheme.
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FEC Performance of the proposed 802.16.3 OFDM PHY

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1. Introduction

In the proposed 2-11GHz air interface draft [1], a Forward Error Correction (FEC) scheme is defined. This scheme utilizes concatenated Reed Solomon block codes and a tail-biting convolution code. The block lengths of the resulting code are matched to the OFDM symbol size. As a result, the block lengths are dependent on the modulation alphabet, in the range of 24…108 bytes.

In a recent submission ([2]) to the OFDM ad-hoc group, C. Cahn and A.W Wang demonstrated that for the ideal BPSK/QPSK channel, the proposed schemes are be inefficient due to the short block lengths.

In this submission, more simulation results are shown for the bit interleaved coded modulation (BICM) channel. The performance of the proposed concatenated schemes, are compared with an equivalent rate, convolutional code (CC). The results indicate, that the CC is <u>equal or better</u> to its equivalent concatenated code.

2. Coding schemes

In this submission two coding schemes are considered:

1. The proposed concatenated RS code and a convoultional code (CC). The CC used is the standard rate=1/2 K=7 with generator polynomials 171_8 and 133_8. The CC is punctured to a desired rate. The parameters of block length puncturing and RS code are given in Table 1.

Modulation	Over all code rate	Block lengths (Bytes)	RS parameters (N,K,T)	CC Code rate
QPSK	_	24	(32,24,4)	2/3
QPSK	_	36	(40,36,2)	5/6
QAM16	_	48	(64,48,8)	2/3
QAM16	_	72	(80,72,4)	5/6
QAM64	_	96	(108,96,6)	_
QAM64	_	108	(120,108,6)	5/6

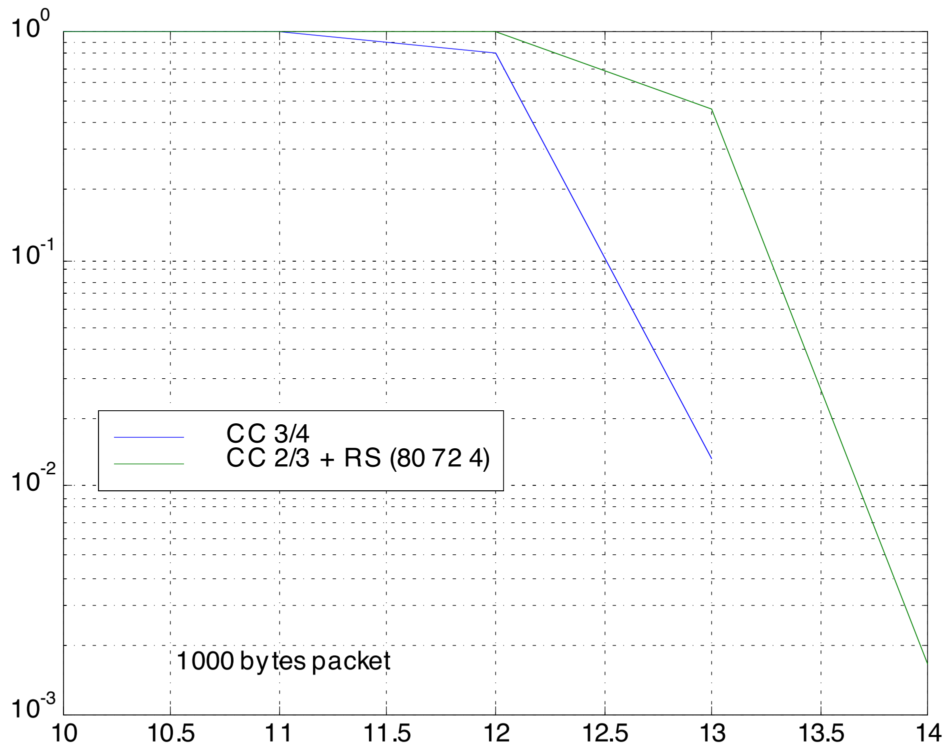
Table 1 Concatenated Coding schemes

2. Zero tail convolutional code with rate=1/2 K=7. The code is continuous over the entire message and is terminated at the end of the massage by inserting 6 zero bits.

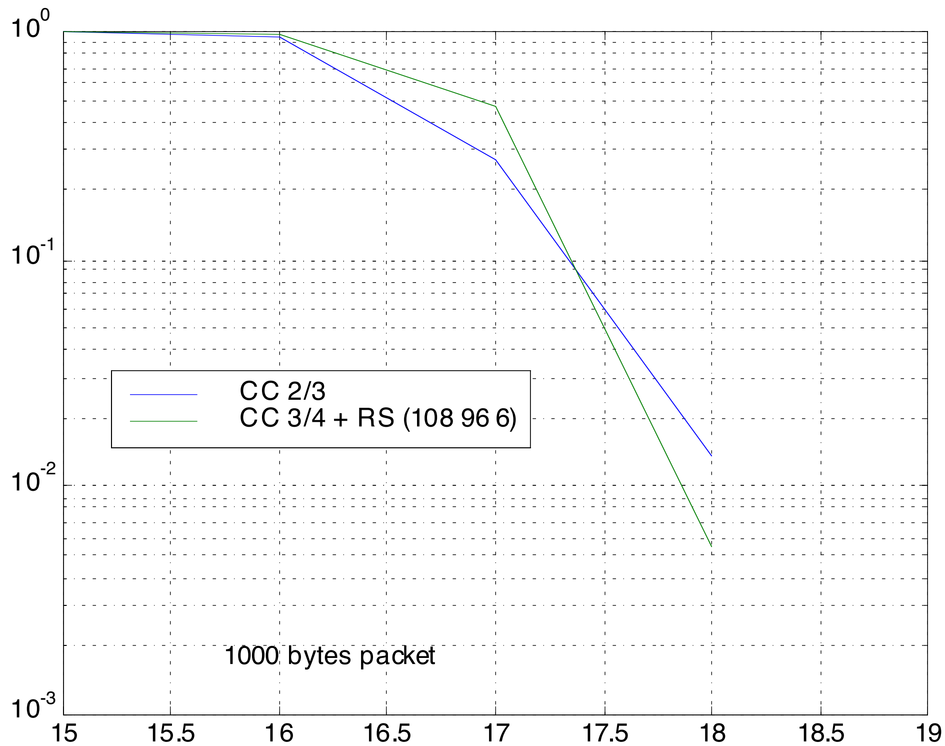
3. Simulation results

The simulation results for AWGN channels at QAM16 rates _ and QAM64 rates 2/3 and _ are shown in the following figures.

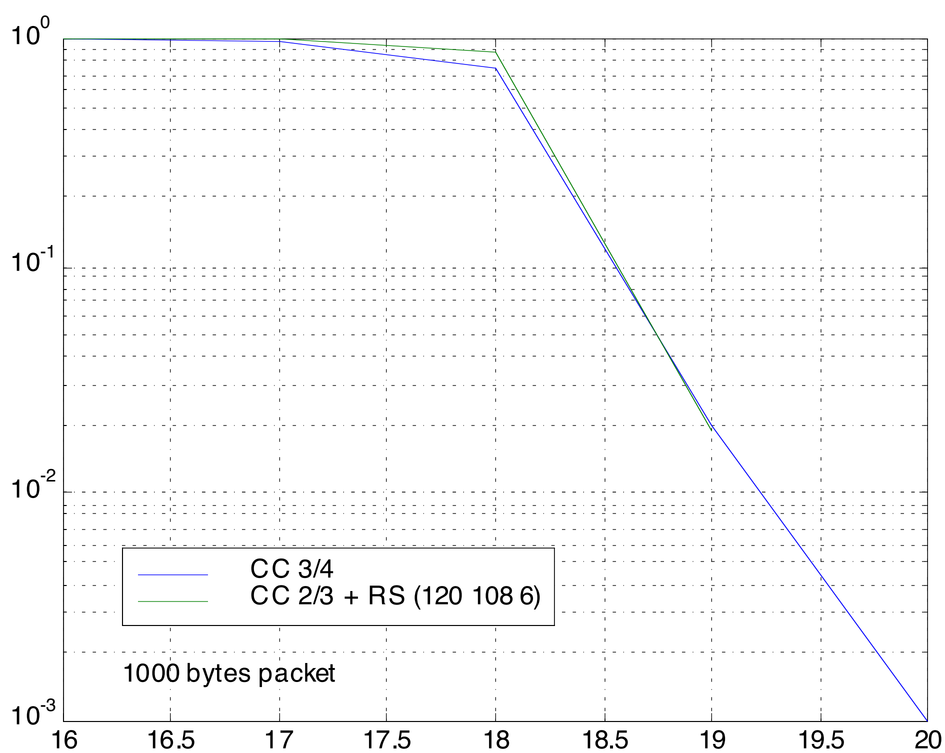
In all cases the packet length simulated was about 1000 bytes. Ideal channel estimation was assumed.



10^0
10^{-1}
10^{-2}
10^{-3}
10
10.5
11
11.5
12
12.5
13
13.5
14
CC 3/4
CC 2/3 + RS (80 72 4)
1000 bytes packet



10^0
10^-1
10^-2
10^-3
15
15.5
16
16.5
17
17.5
18
18.5
19
CC 2/3
CC 3/4 + RS (108 96 6)
1000 bytes packet



10^0
10^-1
10^-2
10^-3
16
16.5
17
17.5
18
18.5
19
19.5
20
CC 3/4
CC 2/3 + RS (120 108 6)
1000 bytes packet

4. Conclusions

For the cases shown, the CC either outperformed or was equal to the concatenated code. This is due to the short block length employed. As a consequence we can either:

1. Use the CC code without concatenation
2. Increase the block length of the RS code to the full (255,239) to gain SNR improvement.

It should be noted that further study is needed for the multipath case.

5. References

[1] IEEE 802.16ab-01/01 : Air Interface for Fixed Broadband Wireless Acess Systems Part A: System between 2 and 11GHz

[2] Charlie Cahn, Arthur W. Wang, '*A STUDY OF THE BENEFIT OF CONCATENTATED CODING IN IEEE 802.16*', a submission to the OFDM ad-hoc group.