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| Perfomance of Multidimentional TCM for the IEEE 802.22b |
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Abstract

This document presents some simulation results on the performance of multidimentional trellis coded modulation (MD-TCM) in the PHY proposal from Niigata University (doc. IEEE 802.22-12-0091/r1). The content of this document is a part of comment resolution of the Comment ID 23..

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# Introduction

 This document describes a part of resolution of CID 22 and 23 in the TGb LB1 ballot. The comment database is located in DCN: 22-13/158r0 (or latest revision) and is listed as follows:

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| --- | --- | --- | --- | --- |
| ID | Page | Line | Type | Comment |
| 23 | Table AU1 | 165 | T |  What is the merit of having PHY Mode 22 and 23 since they neither increase data rate nor spectral efficiency ? |

#  System Model

　Simulation model of the multidimensional trellis encoder is shown in Fig. XX1.

 OFDM symbol mapping in the following of the MD-TCM encoder is the same as of conventional coded QAM encoder and mapper as showin in [1].



Figure XX1: Structure of Multidimensional trellis encoder

# Simulation Results

 Fig. XX2 displays the bit-error rate (BER) performance versus the Eb/N0 on the 4D-TCM 48QAM (referred to 48QAM in the figure), 5/6-coded 64QAM (64QAM in the figure), 4D-TCM 192QAM (referred to192QAM in the figure), and 7/8-coded 256QAM (256QAM in the figure) in additive white Gaussian noise (AWGN) channel, respectively. At the 2x10-4 BER, the 4D-TCM 48 QAM has around 5.5dB gain of the signal-to-noise ratio (SNR) comparing to the 5/6-coded 64 QAM. Similar performance gain appears in the case of 4D-TCM 192QAM.

Fig. XX1 Bit error rate performance in AWGN channel

Fig. XX3 shows the BER performance on the 4D-TCM 48QAM (referred to 48QAM in the figure), 5/6-coded 64QAM (64QAM in the figure), 4D-TCM 192QAM (referred to192QAM in the figure), and 7/8-coded 256QAM (256QAM in the figure) in IEEE 802.22 channel model A (CM A). At the 2x10-4 BER, the 4D-TCM 48 QAM has around 7dB SNR gain comparing to the 5/6-coded 64 QAM. Similar performance gain appears in the case of 4D-TCM 192QAM.

Fig. XX2 Bit error rate performance in IEEE 802.22 CM A

Fig. XX4 shows the BER performance on the 4D-TCM 48QAM, 5/6-coded 64QAM, 4D-TCM 192QAM, and 7/8-coded 256QAM in IEEE 802.22 channel model B (CM B). At the 2x10-4 BER, the 4D-TCM 48 QAM has around 8dB SNR gain comparing to the 5/6-coded 64 QAM. In the cases of 4D-TCM 192QAM and 256 QAM, the error floor appears due to severe multipath channel condition. However, the 4D-TCM 192QAM still has some performance advantage.

Fig. XX4 Bit error rate performance in IEEE 802.22 CM B

# Conclusions

 According to the simulation results in Figs. XX2, XX3 and XX4, the PHY mode 22 and 23 should be retained as optional PHY modes.

**References:**

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