| Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	Link Adaptation with the Feedback of Rician Channel k-factor
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Re:	Call for Contributions of IEEE 802.16m_08/024 on the topic of "Link Adaptation Schemes"
Abstract	The Rician k-factor is an indicator for channel status and should be used as one of parameters for link adaptation. This contribution proposes a Link Adaptation with Rician Channel k-factor feedback for 802.16m systems.
Purpose	Discussion and approval by the task group.
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Patent Policy	The contributor is familiar with the IEEE-SA Patent Policy and Procedures: <http://standards.ieee.org/guides/bylaws/sect6-7.html#6> and <http://standards.ieee.org/guides/opman/sect6.html#6.3>. Further information is located at <http://standards.ieee.org/board/pat/pat-material.html> and <http://standards.ieee.org/board/pat>.

Introduction

- In a typical wireless communication environment, a transmitter and receiver are surrounded by objects which reflect and scatter the transmitted energy, causing several waves to arrive at the receiver via different routes.

- If there is a direct path between transmitter and receiver, then it is called LOS propagation.

- If the direct wave from the transmitter to receiver is blocked by buildings, walls, and etc, the propagation is termed as NLOS propagation.

- NLOS component is composed of random multipath signals, resulting in Rayleigh distributed amplitude.

- The theoretical distribution which applies in this case is Rician distribution.

- Rician k-factor is proportional to the strength of LOS component and coherent bandwidth.

- Therefore, the Rician k-factor is an indicator for channel status and could be used as one of parameters for link adaptation.

Proposed Link Adaptation with the Feedback of Rician k-factor

■ Adaptation of MIMO Transmission Mode

- For SISO mode, BER is worse in channel with greater k-factor.
- For MIMO mode, BER is worse in channel with smaller k-factor.
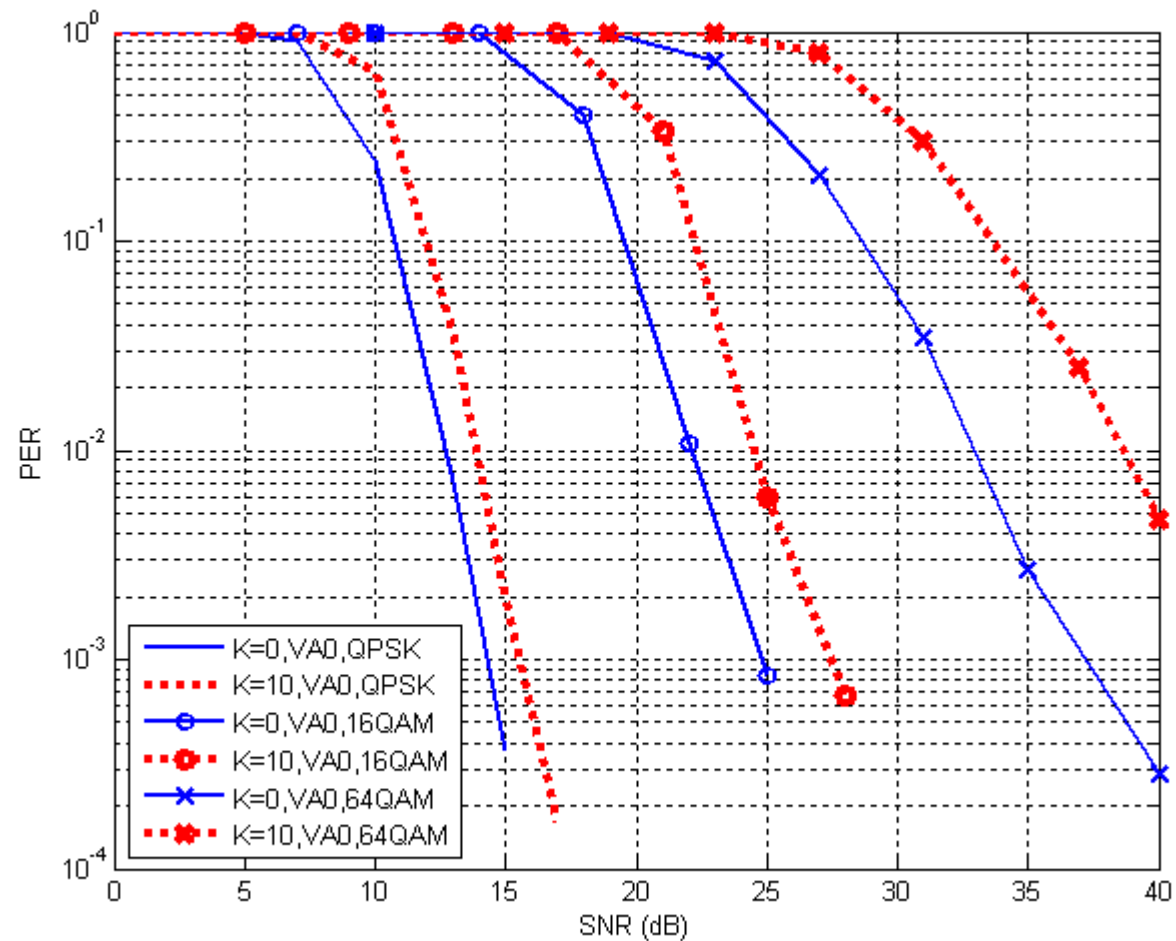- Therefore, k-factor can be used for mode selection.

System	Proposed channel condition
SISO	high k-factor, high SNR
STBC	middle k-factor, high SNR
VBLAST	low k-factor, high SNR
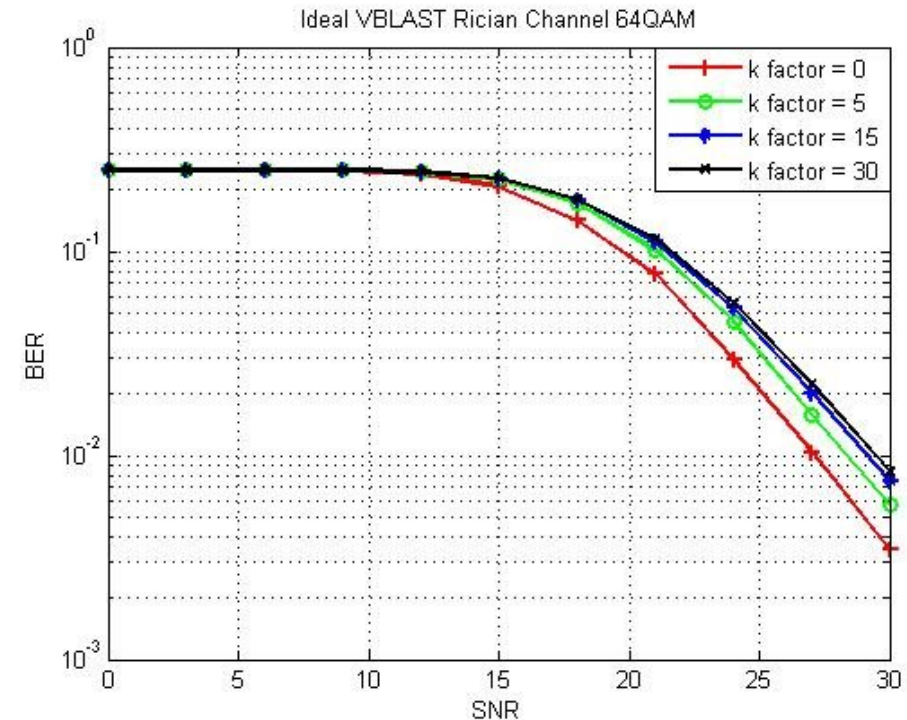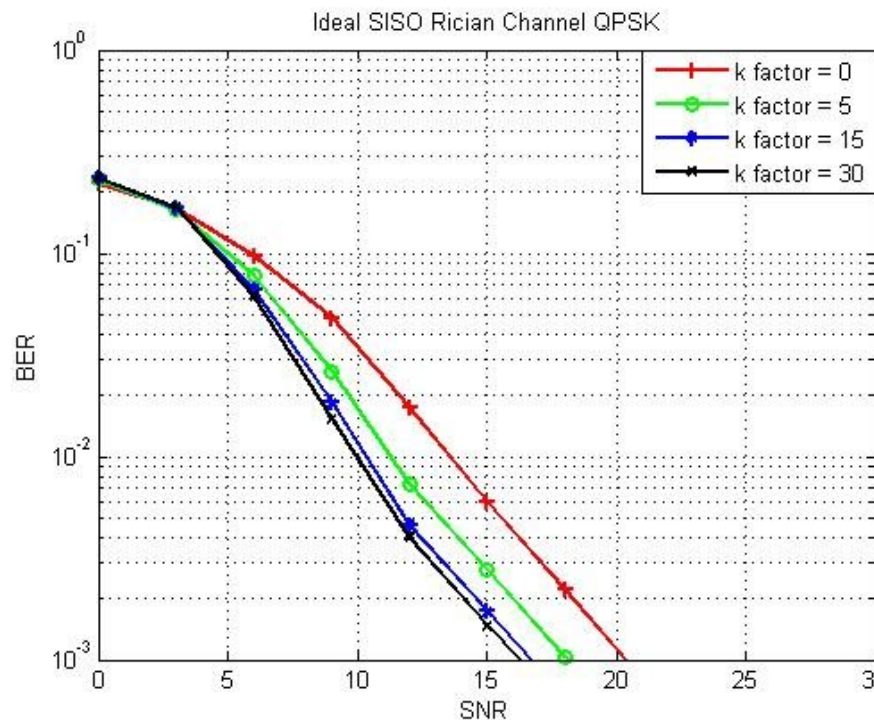
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Proposed Link Adaptation with the Feedback of Rician k-factor (cont.)

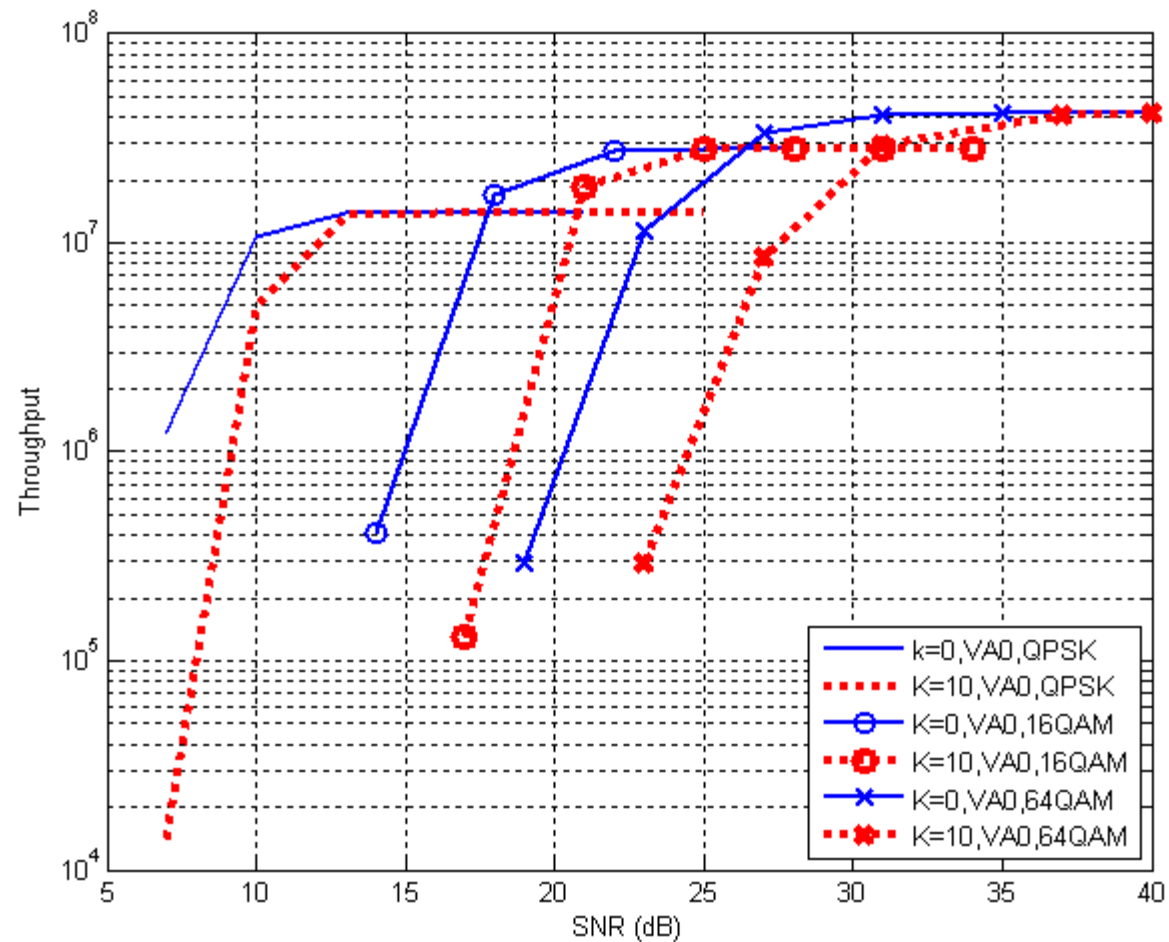- Adaptation of Modulation Mode
  - 2x2 SM

Proposed Link Adaptation with the Feedback of Rician k-factor (cont.)

- Adaptation of Modulation Mode
  - 2x2 SM

Proposed Link Adaptation with the Feedback of Rician k-factor (cont.)

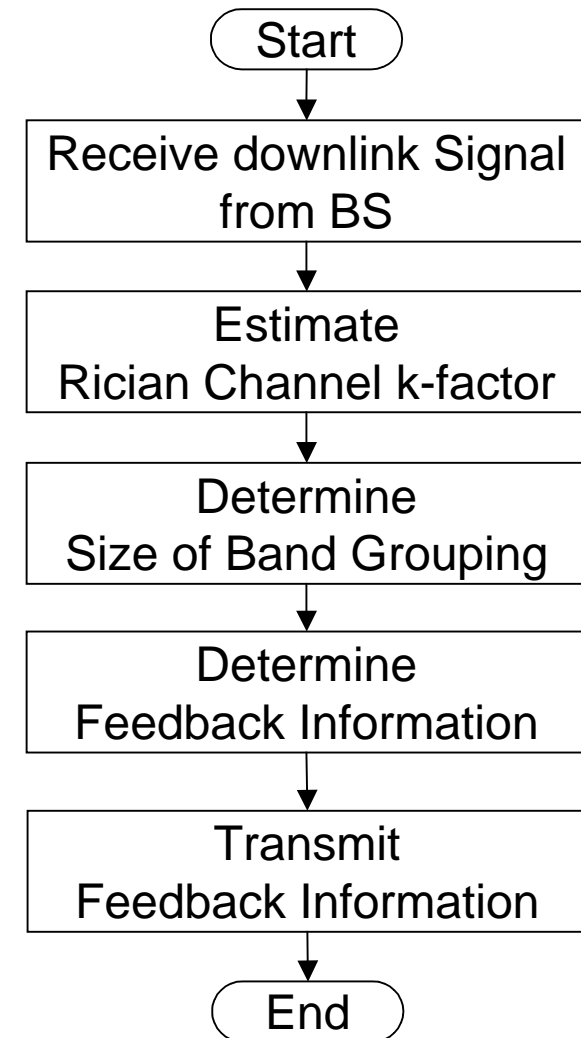- Channel frequency responses of multi-path channels with different k-factors

  - k-factor can be used as an indicator for channel flatness.
  - Greater k-factor implies the LOS component dominates the signal transmission, such that the channel is relative flat.
  - k-factor can be used to determine the size of band grouping for different modulation and coding schemes.
  - k-factor can be used to reduce the feedback overhead if the channel is relative flat.
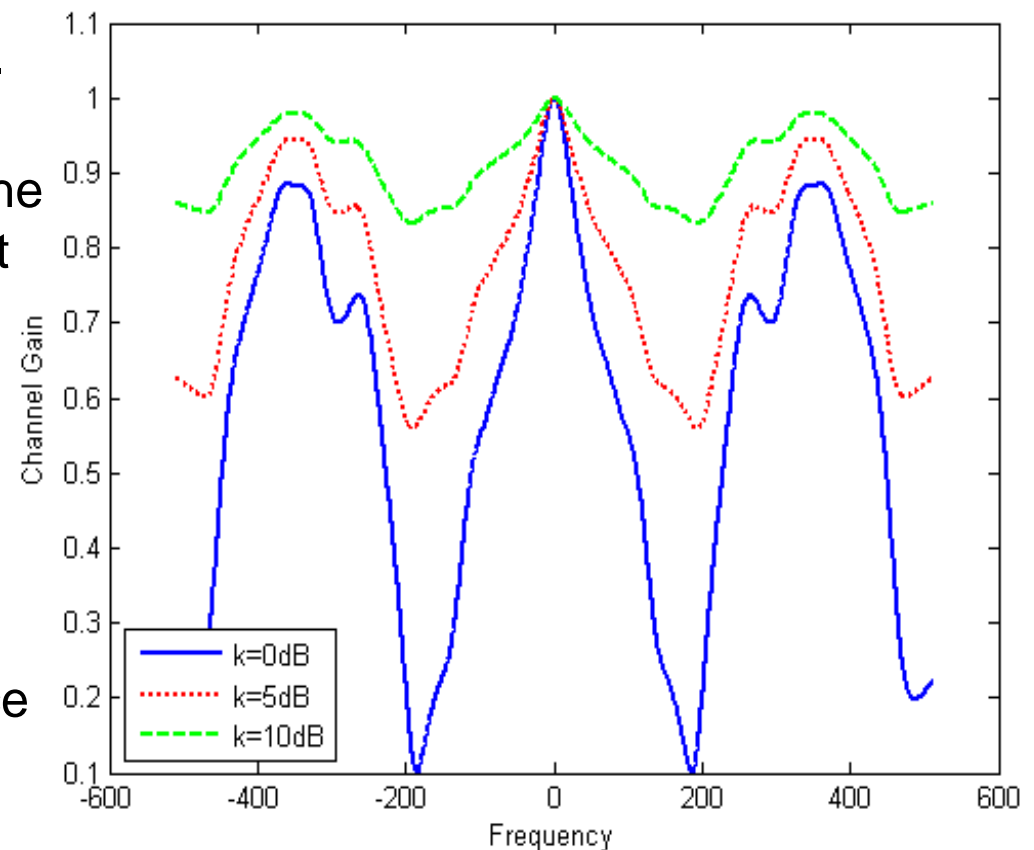
Proposed Link Adaptation with the Feedback of Rician k-factor (cont.)

- ## Procedure at Mobile Station

  - First, the MS estimates the Rician channel k-factor based on the received DL signal.

  - Secondly, the MS determines the size of frequency band grouping and determines the channel information needed to feedback to the BS.

  - The feedback information includes Rician k-factor, SNR, SINR, etc.

  - Thirdly, the MS transmits the feedback information.

Start

↓

Receive downlink Signal from BS

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Estimate Rician Channel k-factor

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Determine Size of Band Grouping

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Determine Feedback Information

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Transmit Feedback Information

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End

Proposed Link Adaptation with the Feedback of Rician k-factor (cont.)

- ## Procedure at Base Station
  - First, the BS receives the feedback information from the MS.
  - Secondly, the BS determines the transmission mode, such as modulation and coding schemes, MIMO schemes, etc, for each band.
  - Finally, the BS schedules the data and transmits them to the MS.

Start

↓

Receive
Feedback Information

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Determine
Transmission Mode

↓

Schedule
Data Transmission

↓

Transmit Data

↓

End
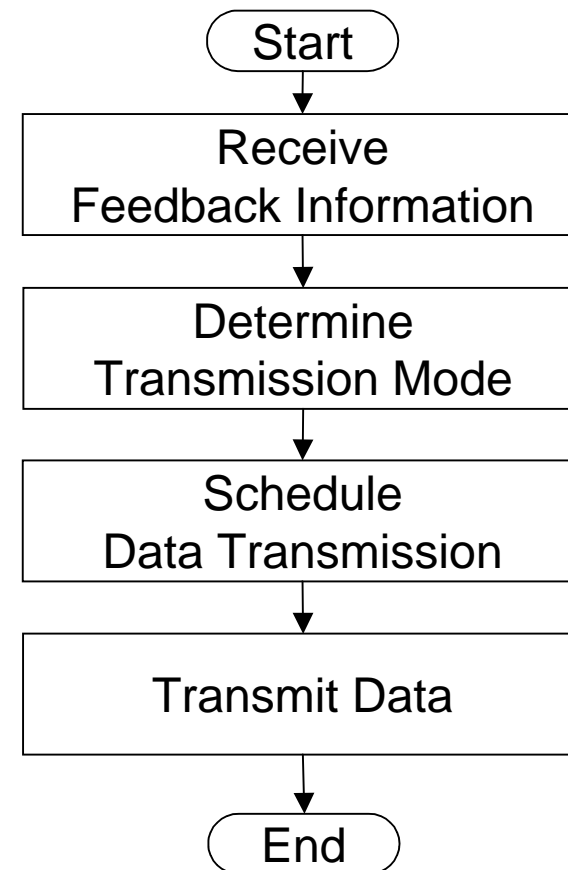
Proposed Text

11 Physical layer

11.x Link Adaptation Schemes

- Rician channel k-factor can be considered in link adaptation for 802.16m systems. It can be used for the determination of transmission mode, size of band grouping, and size of channel feedback overhead.

11.x Channel Quality Feedback Information

- Rician channel k-factor can be included in CQI feedback. The reduction of CQI feedback overhead can be supported by the estimation of Rician channel k-factor.