

Efficient Demodulators for the Full Diversity Full Rate Golden Code**IEEE 802.16 Presentation Submission Template (Rev. 9)**

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Venue:

Re: TGM SDD: In response to the TGM Call for contributions and Comments on 802.16m-08/003r5 for session 58 (support for comment)

Base Contribution:

IEEE C802.16m-08/1274

Purpose:

To discuss and adopt the proposed text in the next revision of the 802.16m SDD.

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Introduction

- Open loop schemes are rated based on
 - Diversity versus Multiplexing gain
- The perfect code would be a full-rate and full-diversity (FRFD) code.
- The following (Golden code) is a perfect code $\theta = 0.5 \tan^{-1}(2)$, $\phi = -i$.

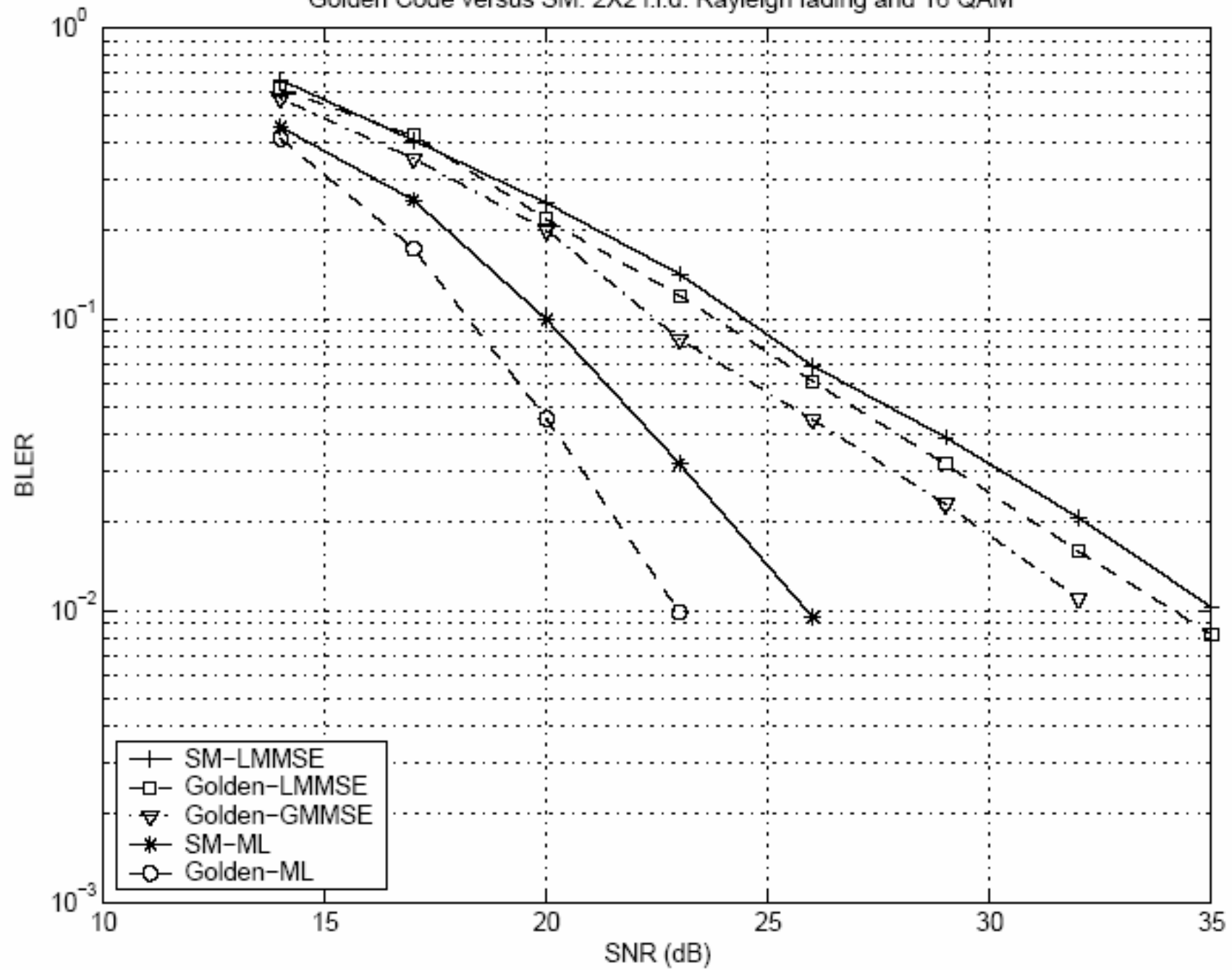
$$\mathbf{X} = \begin{bmatrix} \cos(\theta)X_n + \sin(\theta)X_{n+1} & \phi^{1/2}(\cos(\theta)X_{n+2} + \sin(\theta)X_{n+3}) \\ \phi^{1/2}(\cos(\theta)X_{n+3} - \sin(\theta)X_{n+2}) & \cos(\theta)X_{n+1} - \sin(\theta)X_n \end{bmatrix}$$

- It yields the highest possible diversity order of $2 \times N_R$ (where N_R is the number of receive antennas).
- It also closely follows the outage probability curve
 - in any fading distribution, and
 - at any data rate and hence is referred to as a universal code.

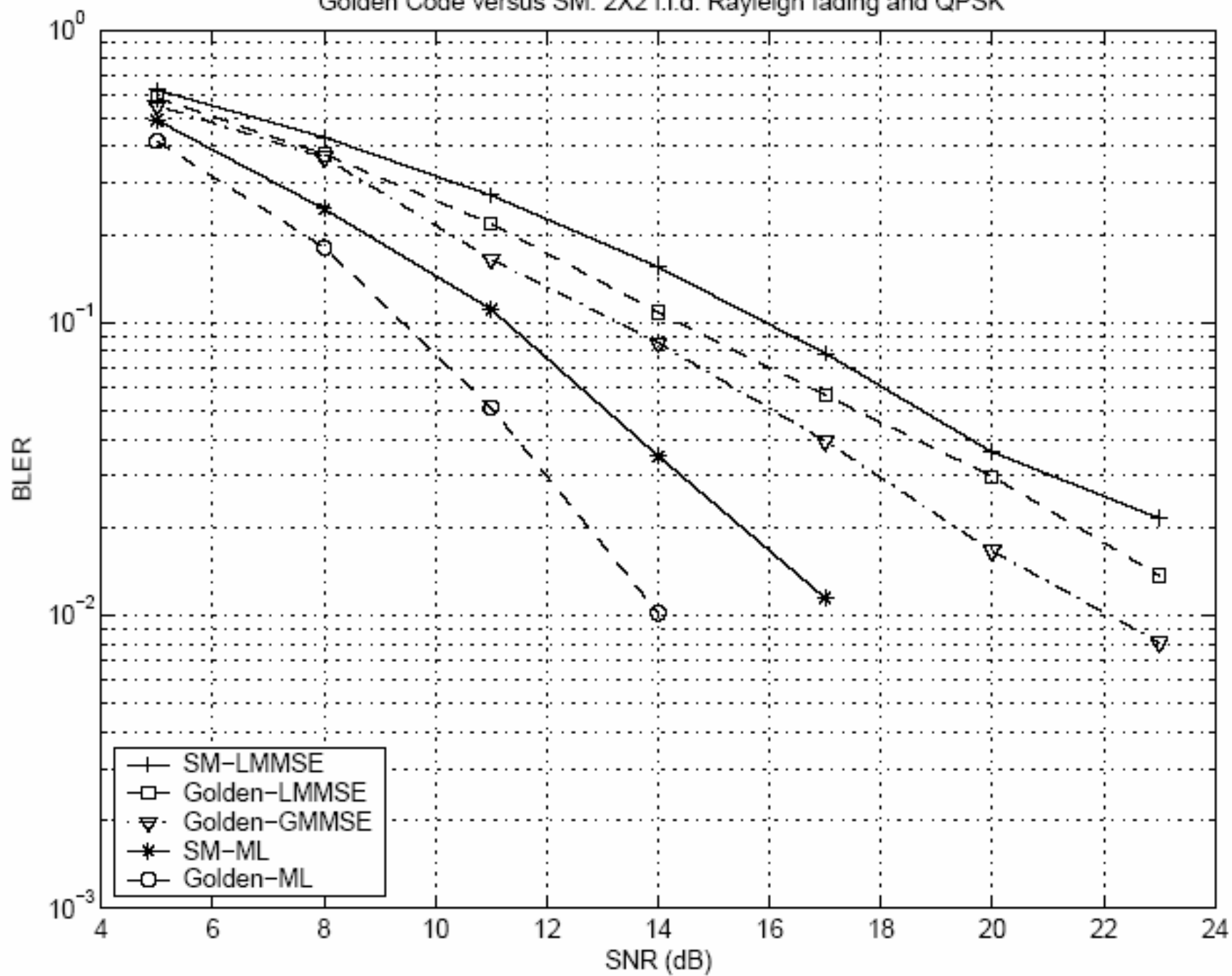
Complexity

- We can be more aggressive than 16e in terms of complexity
- For 2TX Spatial multiplexing (SM) with MMSE and M-QAM:
 - Complexity $O(M^{0.5})$
- Golden code with Group-MMSE and M-QAM:
 - Complexity $O(M^{0.5})$
 - Group MMSE is better than usual linear MMSE
- Spatial multiplexing (SM) with MLD and M-QAM:
 - Complexity $O(M^2)$
- Golden code with MLD and M-QAM:
 - Complexity $O(M^{2.5})$ for efficient MLD
 - and $O(M^4)$ for naïve MLD.
- Efficient demodulator might not be well-known. Our contribution shows that a range of receiver options is available that exploit the structure of the Golden code.

Golden Code versus SM: 2X2 i.i.d. Rayleigh fading and 16 QAM



Golden Code versus SM: 2X2 i.i.d. Rayleigh fading and QPSK



Proposed Text(1)

- [Modify the text in section 11.8.2.1]
 - For OL SU-MIMO, the following schemes are FFS: 2 Tx rate-2 Golden code, 4Tx rate-1 SFBC + Antenna hopping, 4Tx rate-2 Double SFBC + Antenna hopping, 4Tx rate-2 SM + Antenna hopping, 4Tx rate-3 SM + Antenna hopping, 4Tx rate-3 hybrid SM + SFBC + Antenna hopping.\

Proposed Text(2)

- [Modify the text in section 11.12.2.1.1]
 - For OL SU-MIMO, the following schemes are FFS: rate-1 STBC/SFBC and rate-2 Double STBC/SFBC, **2 TX Golden code for rate-2**, 2-DPOD for rate-1 and rate-2, rate-3 hybrid SM+STBC/SFBC, differential STBC/SFBC, Antenna hopping, and SM+Antenna hopping.