

**Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)**

**Submission Title:** [Super-orthogonal convolutional (SOC) coding for Tg4a]

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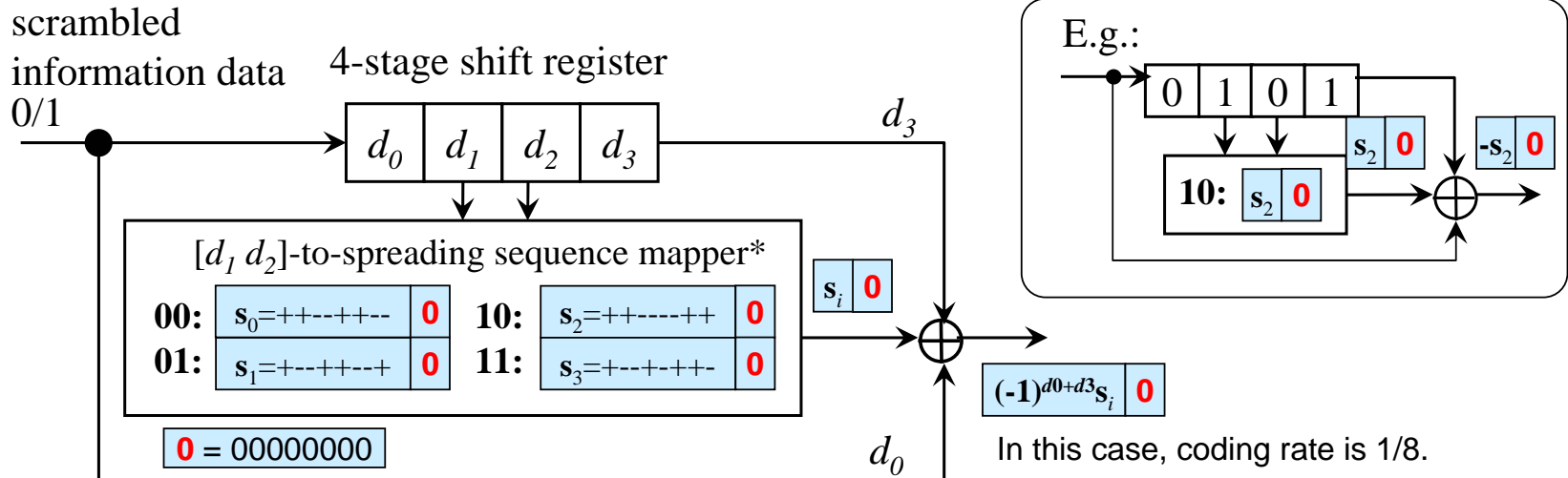
**Abstract** [Simulation results of super-orthogonal convolutional (SOC) codes]

**Purpose:** [Assist the group in the selection of a modulation scheme]

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# K=4 SOC encoder for coherent receiver

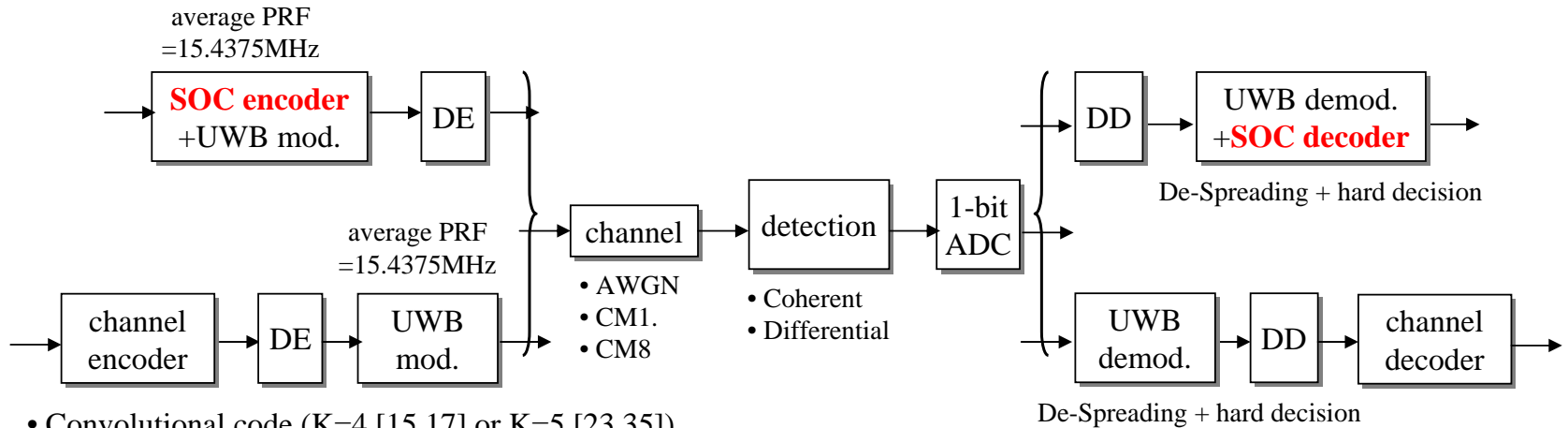


\*: this is one example. We can also use the PPM mapping (Option ||| shown in doc.428-02).

|     |                |                |     |                |                |
|-----|----------------|----------------|-----|----------------|----------------|
| 00: | $s_0=++--++--$ | 00000000       | 10: | $s_1=+-+--+--$ | 00000000       |
| 01: | 00000000       | $s_0=++--++--$ | 11: | 00000000       | $s_1=+-+--+--$ |

By changing the set of spreading codes, SOC is applicable to Non Coherent receiver

# System model

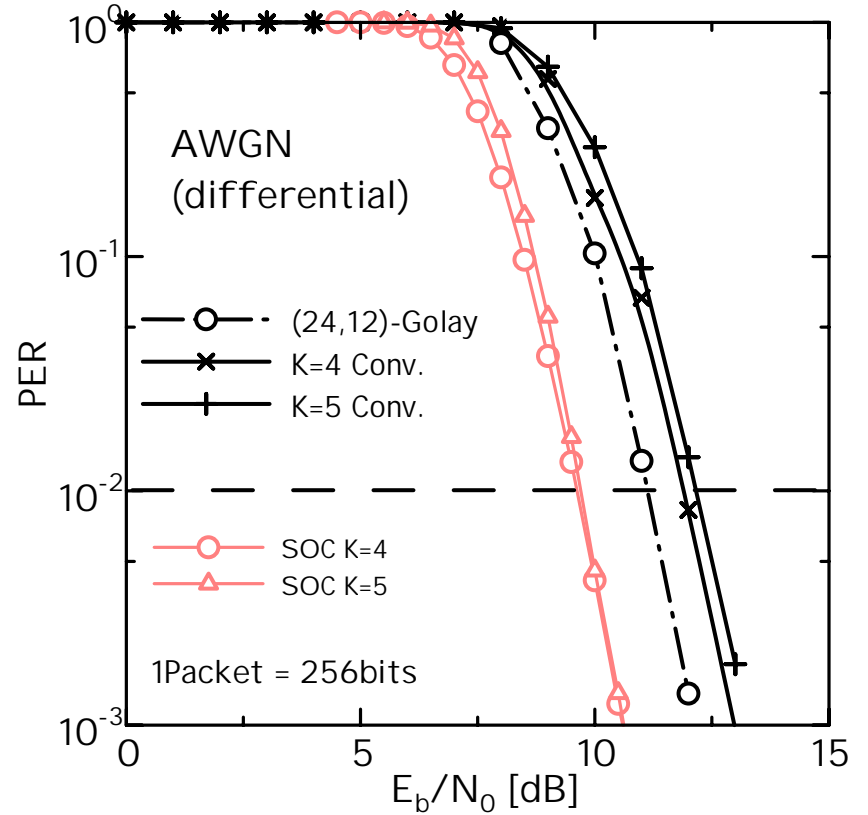
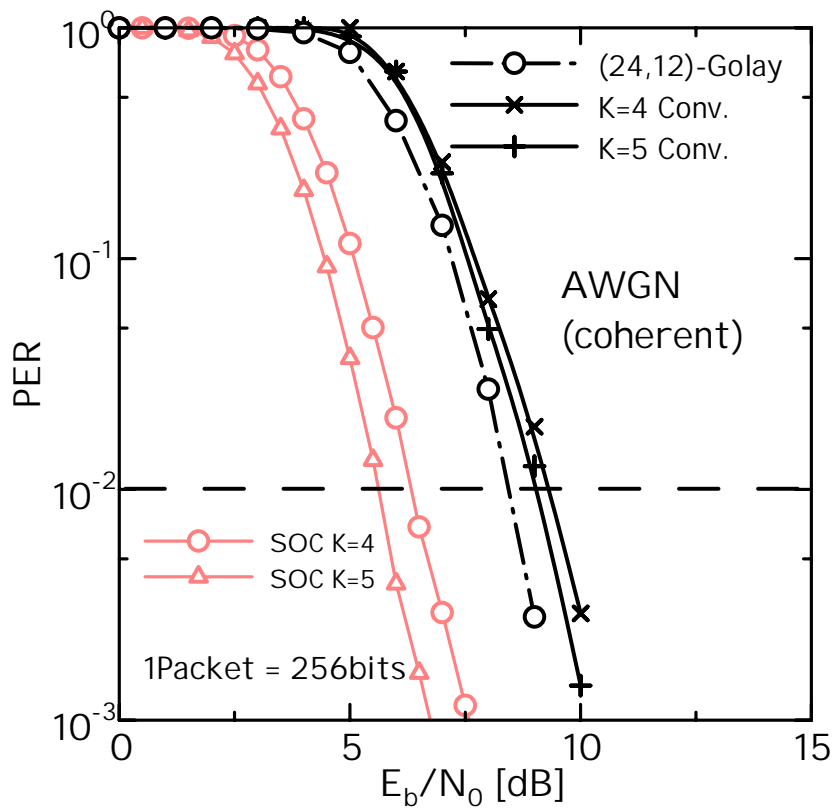


- Convolutional code (K=4 [15,17] or K=5 [23,35])
- (24,12)-Extended Golay

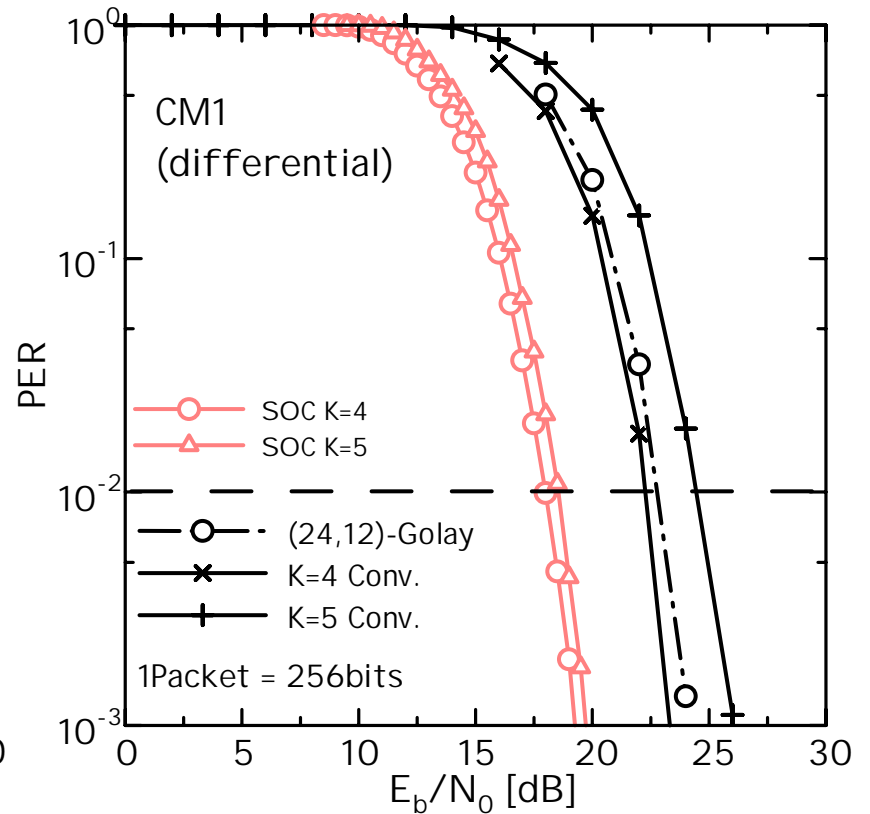
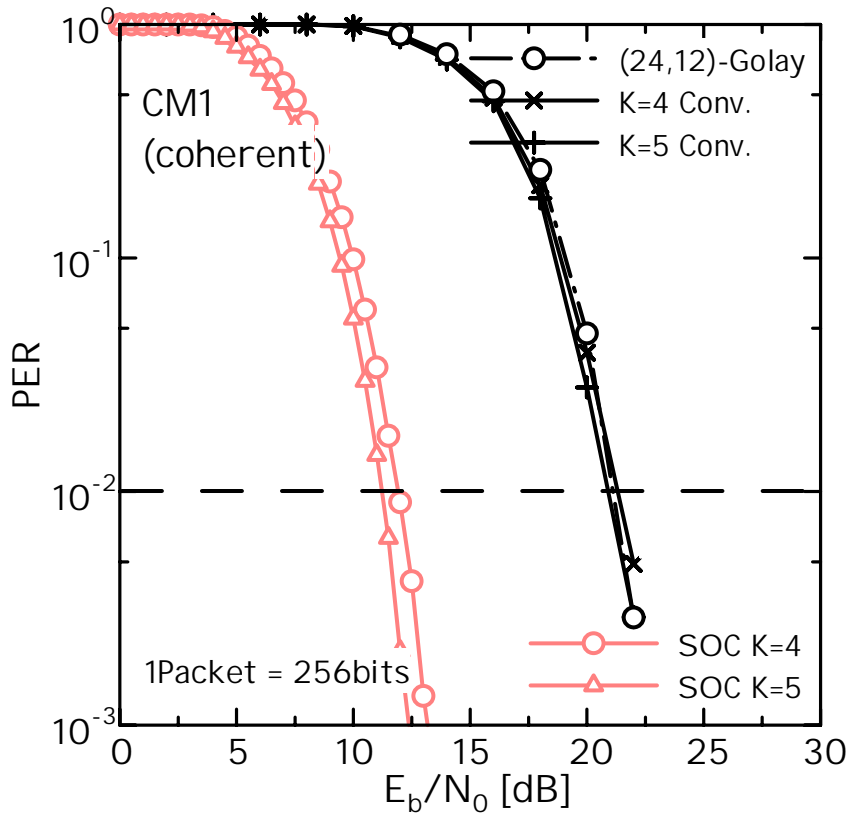
DE: Differential encoding    DD: Differential decoding

|                      | K=4 SOC | K=5 SOC | K=4 Conv. | K=5 Conv. | (24,12)-Golay |
|----------------------|---------|---------|-----------|-----------|---------------|
| Coding rate          | 1/4     | 1/8     | 1/2       | 1/2       | 1/2           |
| Spreading rate       | 1/4     | 1/2     | 1/8       | 1/8       | 1/8           |
| Gate count (decoder) | ~8K     | ~32K    | ~4K       | ~8K       | ~1K           |

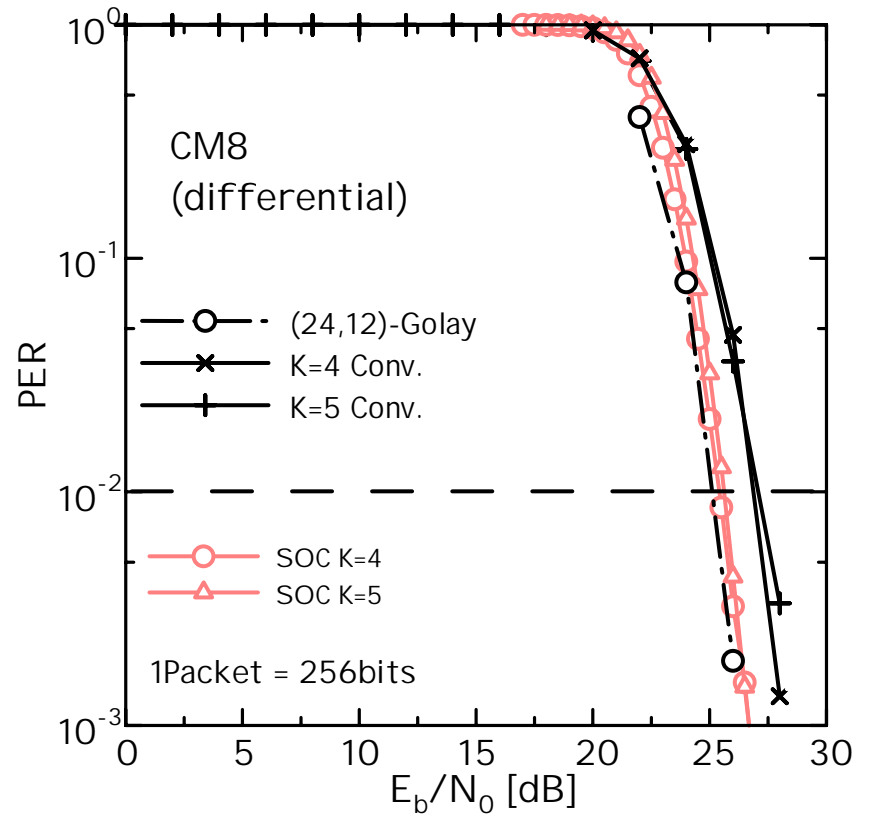
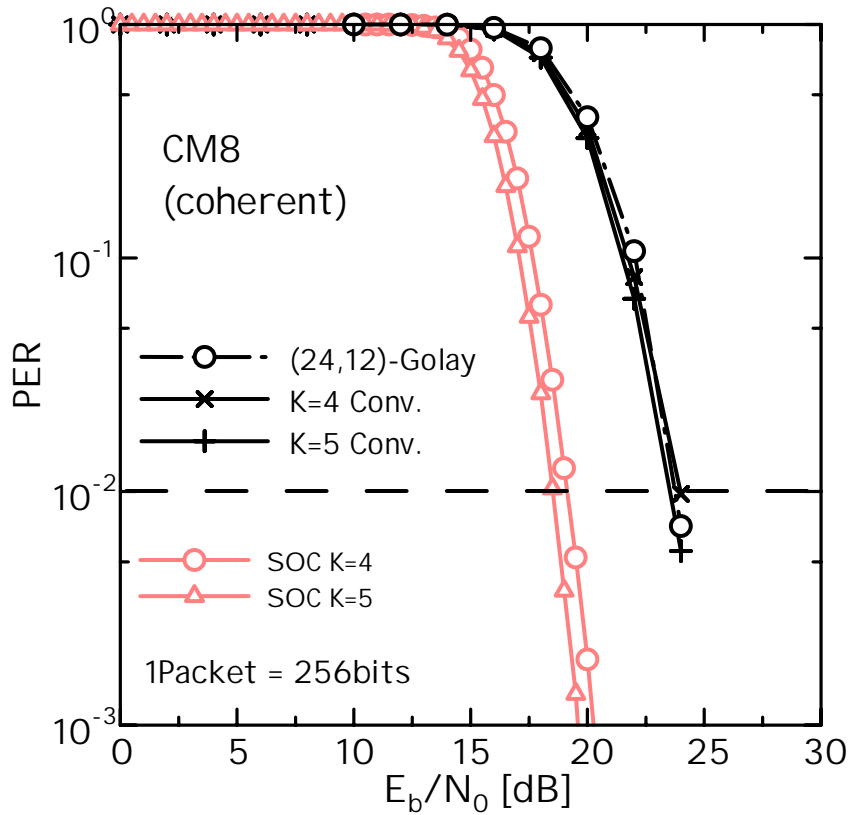
# Simulation results (AWGN)



# Simulation results (CM1)



# Simulation results (CM8)



# Conclusions

|                   | PER performance |                 |                 | Decoder complexity<br>(gate count) |
|-------------------|-----------------|-----------------|-----------------|------------------------------------|
|                   | AWGN            | CM1             | CM8             |                                    |
| <b>K=4 SOC</b>    | <b>+/&gt;++</b> | <b>+/&gt;++</b> | <b>+/&gt;+</b>  | <b>~8K</b>                         |
| K=5 SOC           | <b>++/&gt;+</b> | <b>++/&gt;+</b> | <b>++/&gt;+</b> | ~32K                               |
| K=4 Convolutional | -/>-            | -/>-            | -/>+            | ~4K                                |
| K=5 Convolutional | -/>-            | -/>-            | -/>+            | ~8K                                |
| (24,12)-Golay     | -/>-            | -/>-            | -/>++           | ~1K                                |

**Since K=4 SOC provides good performance with low complexity, we recommend it as an error correcting code for Tg4a.**