**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) |
| Title | **Proposal of FSK LECIM PHY extension** |
| Date Submitted | [“07 September, 2018”] |
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| Re: |  |
| Abstract | [Propose to add a new lower data-rate and a narrow band FSK PHY for new spectrum in Korea.] |
| Purpose | [Extend the IEEE 802.15.4k standard.] |
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1. **PPDU format for GFSK PHY**

The GFSK PPDU format shall support the same format in FECIM FSK PHY



Figure 1: Format of the LECIM FSK PPDU

1. **Modulation and coding for GFSK PHY**

The modulation for the LECIM FSK PHY shall be FSK or position-based FSK (P-FSK).

In the 262~264MHz band, the modulation index shall be as follows:

* 2.0 for 2.4 kb/s
* 1.0 for 4.8 kb/s

12.5 kHz channel spacing may be used as permitted by local regulations

In the 169 MHz band, the modulation index shall be as follows:

* 0.5 for 25 kb/s
* 1.0 for 12.5 kb/s

For all other LECIM FSK PHY band identifiers, the modulation index shall be as follows:

* 0.5 for 37.5 kb/s
* 1.0 for 25 kb/s
* 2.0 for 12.5 kb/s
* 2.0 for 6.25Kb/s

Either 100 kHz or 200 kHz channel spacing may be used as permitted by local regulations.

1. **Spreading**

The use of spreading is controlled by the PIB attribute *phyLecimFskSpreading*, as defined in 11.3. The spreading factor (SF) can be 1, 2, 4, 8, or 16. The variable SF is indicated by the PIB attribute *phyLecimFskSpreadingFactor*, as defined in 11.3.

For spreading, a single input bit (b0) is mapped into the spreading bits (c0, c1, …, cSF-1)

Apply sequence spreading scheme to improve SFD detection performance and maintain SHR at a level similar to the reliability of PHR and PSDU



Figure 2: Spreading procedure

 We suggest three spreading factor (SF) 2, 4 and 8 to reduce transmission overhead due to extended synchronization header with SFD sequence spreading as shown. The input SFD sequence bits to SFD spreading bits mapping as shown in Table 1.

Table 1: Input to spreading bit mapping

|  |  |  |
| --- | --- | --- |
|  | Input bit$(b\_{0})$ = 0 | Input bit$(b\_{0})$ = 1 |
| SF = 2 | $(c\_{0}, c\_{1})$ = 01 | $(c\_{0}, c\_{1})$ = 10 |
| SF = 4 | $\left(c\_{0}, …, c\_{3}\right)$ = 0101 | $(c\_{0}, …, c\_{3})$ = 1010 |
| SF = 8 | $(c\_{0}, …, c\_{7})$ = 11010100 | $(c\_{0}, …, c\_{7})$ = 00101011 |