**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) |
| Title | D0 Text Input – Kookmin Univ. PHY modes on table summary |
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| Abstract | [A short summary of Kookmin PHY modes following the D0 template] |
| Purpose | [Re-format PHY mode tables] |
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**PHY Layer Operating mode(s)**

**PHY A modes**

Table 1: Kookmin PHY A modes

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| **PHY Operating Modes** |
| **Modulation** | **RLL Code** | **Optical Clock Rate** | **FEC** | **Data Rate** |
| **Outer code**(Mismatched Frame rates FEC) | **Inner code** |
| S2-PSK | No | 200Hz | Repeat code(10 symbol/sec) | Code rate = (N-1)/N | Uncoded data rate is equal to the symbol rate Rbit = (bit/symbol) x (symbol rate) = (K) x 10 |
| S8-PSK | Yes | 800Hz | Repeat code(10 symbol/sec) | Code rate = (N-1)/Nbad-sampling code rate = 1 | Uncoded data rate is triple the symbol rateRbit = (bit/symbol) x (symbol rate) = (3×N) x 10 |
| DS8-PSK | No | 800×n Hz | Repeat code(10 symbol/sec) | Code rate = (N-1)/Nbad-sampling code rate = 1 | Uncoded data rate is triple the symbol rateRbit = (bit/symbol) x (symbol rate) = (3N) x 10 |

where

symbol = (data + its repetition)

N is the number of LED (a group of LEDs) on a transmitter.

**PHY B modes**

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| **Previous Table. Flicker-free Rolling Shutter PHY 5 Operating Modes** |
| **Modulation** | **RLL Code** | **Tx****optical Clock Rate** | **Rx****frame rate** | **Frame Length** | **FEC** | **OH** | **PHY SAP throughput (bps)** |
| C-OOK | Manchester | Clock rate = 2.2 kHzSymbol rate = **10** | Rx(fps) >Tx (1) | DS=**100**(2) | None | Preamble+Ab | 60 |
| 4B6B | DS=6**0**(4) | None | 150 |
| Manchester | Clock rate = 4.4 kHzSymbol rate = **20** | Rx(fps) ~ Tx(3) | DS=**60**(4) | Outer code(5) | Preamble+2.Ab | 580  |
| 4B6B | DS=**60**(4) | 700 |
| **Modulation** | **Coding** | **Tx** **(freq.# /symbol rate)** | **Rx****frame rate** | **FEC** | **OH** | **PHY SAP throughput (bps)** |
| CM-FSK | None | #\_of\_Freq. = 32Symbol rate = 10 | Rx(fps) ≥ 2.Tx  | None | Ab(per symbol) | 40 |
| 2-PSK | 50 |
| 4-PSK | #\_of\_Freq. = 64Symbol rate = 10 | Outer FEC code(6)  | 70 |

Table 2.1: Kookmin PHY B –OOK modes

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| **PHY Operating Modes** |
| **Mod.** | **RLL Code** | **Optical Clock Rate** | **FEC** | **Data Rate**PHY SAP throughput (bps) |
| **Outer code**(to solve **frame rate variation** and the **time gap** between Images) | **Inner code**(images fusion + frame drop error detection) |
| OOK | Manchester | 2.2 kHz | Repeat DS=100 | Images fusion code (single Ab frame)Code rate = (N-2)/N | 60 |
| 4B6B | 2.2 kHz | Repeat DS=60 | 150 |
| Manchester | 4.4 kHz | Repreat DS=60 | 2/3 missed frames detection code (2 Ab frame)Code rate = (N-4)/N | 580  |
| 4B6B | 4.4 kHz | Repreat DS=60 | 700 |

where N is the number of bits per data sub-packet (DS).

Table 2.2 Kookmin PHY B –FSK modes

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| **PHY Operating Modes** |
| **Mod.** | **RLL Code** | **Optical Clock Rate** | **FEC** | **Data Rate**PHY SAP throughput (bps) |
| **Outer code** | **Inner code**(**Mismatched frame rates code**) |
| FSK | 32-FSK | Variable | Repeat code(10 symbol/sec) | Code rate = 4/5 | 40 |
| 32-FSK/2-PSK | Repeat code(10 symbol/sec) | Code rate = 5/6 | 50 |
| 62-FSK/4-PSK | Repeat code(10 symbol/sec) | Code rate = 7/8 | 70 |

where

N is the number of bits per data sub-packet (DS).

symbol = (data + its repetition)

**PHY C modes**

Table 3.1: Kookmin PHY C modes (color code)

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| **PHY C Operating Modes** |
|  |  | **FEC** |  |
| **Modulation** | **RLL code** | **Outer code** | **Inner code** | **Data Rate** |
| 2D-sequential code | None | Repeat code(symbol/sec) | Code rate = data / (data +clock information)= N/(N+4)Spatial coding | (symbol rate) x (#\_data LEDs)  |
| 4 color 2D-sequential code | (symbol rate) x 2.(#\_data LEDs)  |
| 8 color 2D-sequential code | (symbol rate) x 3.(#\_data LEDs) |
| QR-ISC code | RQR code- (clock transmission)  |

where N is the number of data bits being transmitted through a 2D code block.

Table 3.2: Kookmin Invisible code

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| **PHY Operating Modes** |
| **Modulation****(m:n)** | **RLL Code** | **Optical Clock Rate** | **FEC** | **Data Rate (bits)****m x n x 15 x** RS\_option x CC\_option |
| **Outer code (RS)** | **Inner code (CC)** |
| 2D-invisible sequential code 4:3 | None | 30Hz | RS\_option | CC\_option | **180** x RS\_optionx CC\_option |
| 2D-invisible sequential code 16:10 | None | 30Hz | RS\_option | CC\_option | **2400** x RS\_optionx CC\_option |
| 2D-invisible sequential code 8:5 | None | 30Hz | RS\_option | CC\_option | **600** x RS\_optionx CC\_option |
| 2D-invisible sequential code 16:9 | None | 30Hz | RS\_option | CC\_option | **2160** x RS\_optionx CC\_option |
| 2D-invisible sequential code 8:3 | None | 30Hz | RS\_option | CC\_option | **360** x RS\_optionx CC\_option |

where

N: Number of vertical cells

M: Number of horizontal cells

RS\_option: Select one RS scheme from Table 3.2b

CC\_option: Select one CC scheme from Table 3.2c

Table 3.2b: Outer code (RS)

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| RS\_option | RS description | RS\_rate |
| 1 | None | 1 |
| 2 | RS(64,32) | 1/2 |
| 3 | RS(160,128) | 128/160 |
| 4 | RS(15,7) | 7/15 |
| 5 | RS(15,11) | 11/15 |
| 6 | RS(15,2) | 2/15 |
| 7 | RS(15,4) | 4/15 |

Table 3.2c: Inner code (CC)

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| CC\_option | CC description | CC\_rate |
| 1 | None | 1 |
| 2 | CC(1/4) | 1/4 |
| 3 | CC(1/3) | 1/3 |
| 4 | CC(2/3) | 2/3 |