

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

**Submission Title:** [SUN FSK PHY proposal for FANE]

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**Abstract:** [PHY proposal for supporting up to 2.4Mb/s data rates and long range in 15.4]

**Purpose:** [To be considered in the PHY amendment as part of 802.15.4x]

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# Background

- **Scope of the project:**

“This amendment defines enhancements to the IEEE Std 802.15.4 SUN Orthogonal Frequency-Division Multiplexing (OFDM) PHYs enabling the support for data rates up to 2.4Mb/s. This amendment also defines additional channel plans, as needed, to support emerging applications.”

## Purpose and Objective

- Longer range modes support
  - SUN FSK lower data rate modes only currently defined for licensed bands
  - Channel plan is not defined for unlicensed bands, including for North America
- Specify operational SUN FSK lower data rate PHY parameters for existing 15.4 regions

# Proposal – FSK Modulation and channel parameters

- SUN FSK PHY

Modulation	Parameter	Operating Mode #1	Operating Mode #2	Operating Mode #3	Operating Mode #4	Operating Mode #5
SUN FSK Mandatory Mode	Data Rate (kb/s)	50	100	150	10	20
	Modulation Index	1.0	0.5	0.5	1.0	1.0
	Channel spacing (kHz)	200	200	200	50	50/ 100

- All additional PHY parameters shall be as per existing SUN FSK PHY
- Channel center frequency for channel 0 to be align with existing region center frequency

# Discussion

- Proposed mode can be applicable to all unlicensed regional frequency bands supported by SUN FSK PHY
  - 17 regional frequency bands
  - Some of the regions already have 5 operating modes for FSK PHY
  - Even the channel numbering also need to be added for all newly defined modes

# Proposal on new FSK modes

- Define the new optional FSK operating modes under sub-clause 20.3 as a description and not including in the table
- 15.4md revision group already looking into consolidating all the PHY modes across multiple PHYs
  - The new optional modes can be added to the list with a new approach planned to be taken by the 15.4md group

# Proposed draft Text

- Sub-clause: 20-3
  - Include a new table after 20-7

Parameter	Operating Mode #a	Operating Mode #b
Data Rate (kb/s)	10	20
Modulation Index	1.0	1.0
Channel spacing (kHz)	50	50/ 100

## Proposed draft Text

- 470 MHz, 780 MHz, 863 MHz, 866 MHz, 915 MHz, 917 MHz, 867 MHz, 870 MHz, 915 MHz-a, 915 MHz-b, 915 MHz-c, 915 MHz-d, 915 MHz-e, 919 MHz, 920 MHz, 920 MHz-a, and 920 MHz-b may additionally support operating mode #a and #b.



# Additional Changes

- Channel Numbering SUN PHYs
  - Add optional mode for all supported frequency bands
- Transmit spectral mask

# Additional Changes

- SUN Device Capabilities IE

Table 7-25—FSK-A PHY mode encoding

PHY Mode ID	Narrowband FSK PHY mode
0	4.8 kb/s; 2-FSK; mod index = 1.0; channel spacing = 12.5 kHz
1	9.6 kb/s; 4-FSK; mod index = 0.33; channel spacing = 12.5 kHz
2	10 kb/s; 2-FSK; mod index = 0.5; channel spacing = 12.5 kHz
3	20 kb/s; 2-FSK; mod index = 0.5; channel spacing = 12.5 kHz
4	40 kb/s; 2-FSK; mod index = 0.5; channel spacing = 12.5 kHz
5	4.8 kb/s; 2-FSK; mod index = 0.5; channel spacing = 12.5 kHz
6	2.4 kb/s; 2-FSK; mod index = 2.0; channel spacing = 12.5 kHz
7	9.6 kb/s; 4-FSK; mod index = 0.33; channel spacing = 12.5 kHz
8–10	Reserved