**IEEE P802.15**

**Wireless Specialty Networks (WSN)**

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| Project | IEEE P802.15 Working Group for Wireless Specialty Networks (WSN) | |
| Title | **Next Generation SUN PHY Technical Guidance Document** | |
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| Re: | SG NG OFDM PHY Technical Guidance for Proposals | |
| Abstract |  | |
| Purpose | To capture essential PHY requirements, parameterized into a set of PHY characteristics that technical proposals can address. Guide discussion within task group, help proposers and provide a framework for evaluation of proposals by the TG. | |
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DRAFT 802.15.4ad Next Generation SUN PHY Technical Guidance Document

# Introduction

This document provides technical guidance that should be considered when submitting a proposal to be considered for inclusion in the IEEE P802.15.4ad amendment.

# Project Authorization Request (PAR)

The following paragraphs are extracts from the PAR approved by Nescom, included here for convenience.

**5.2.a Scope of the complete standard**:

This standard defines the physical layer (PHY) and medium access control (MAC) sublayer specifications for low-data-rate wireless connectivity with fixed, portable, and moving devices with no battery or very limited battery consumption requirements. In addition, the standard provides modes that allow for precision ranging. PHYs are defined for devices operating in a variety of geographic regions.

**5.4 Purpose:**

The standard provides for ultra low complexity, ultra low cost, ultra low power consumption, and low data rate wireless connectivity among inexpensive devices, especially targeting the communications requirements of what is now commonly referred to as the Internet of Things. In addition, some of the alternate PHYs provide precision ranging capability that is accurate to one meter. Multiple PHYs are defined to support a variety of frequency bands.

**802.15.4ad Scope of the project**:

This amendment expands on the usefulness of the SUN PHYs. It defines new data rate extensions by increasing the occupied bandwidth and/or adding new MCSs and extending the SUN PHY specifications with a focus on long-range communication in congested environments with at least one mode of the SUN-OFDM PHY exceeding -120dBm @ 1% PER 64 bytes (payload) by using lower data rates intended for FCC 15.247 digital modulation system. It defines MAC modification to support the amended PHY and defines frequency bands on updated regional regulations to operate the amended PHYs.

**802.15.4ad Need for the Project:**

The IEEE Std 802.15.4 is widely used in a variety of applications supporting Field Area Networks. Current users and product manufacturers have identified the need for longer range and additional data rates, both lower and higher than those currently defined in order to expand the usefulness of the standard for applications such as Smart Metering, Smart cities and other industrial IoT markets. The PHY enhancements better address the needs of emerging applications and as well as meeting the needs of wider set of applications where additional data rates can expand the usefulness of the SUN PHYs..

# Methodology for Assessment of proposals

The methodology is based on a consensus approach to defining a minimal set of features, characteristics, performance and constraints to be considered when making a proposal.

This document provides a functional view of the PHY characteristics, in the form of specific parameters which define externally verifiable performance and interoperability considerations.

The parameters discussed in this document are essential parameters for the design of physical layer in order to satisfy the PAR requirements. The proposal shall reference the relevant regulations. Devices implementing shall abide by regulations in the region it is operating.

# Proposal Criteria

## Scope of proposals

Proposers are welcome to propose a complete system proposal. However, proposers are also welcome to propose specific technology elements only.

## Proposal criteria.

The following should be included in the proposal:

* **The Scope of proposal:** with reference to the PAR requirements
* **Use cases:** Provide a reference to the Use case document [mentor ref goes here] and summarize the Use cases that the proposal addresses.
* **Complexity:** The complexity should not be significantly higher compared to existing SUN PHYs.
* **Receiver Sensitivity:** if the proposal addresses the required OFDM mode specified in the PAR, then this OFDM mode shall have a sensitivity of at least -120dBm with an occupied channel bandwidth of at least 500 kHz as specified in FCC ?? [rule reference goes here]
* **Data Rate:** One mode with an effective payload data rate higher than of 2.4 Mbps. Proposers are encouraged to propose modes with higher data rates.
* **Channel Bandwidth:** Proposers should support a minimum channel spacing of 200kHz for the OFDM modes to meet the regulation in specific regions. Proposers should support at least one mode with an occupied channel bandwidth of at least 500kHz as specified in FCC ??. Proposers should consider the current channel plans specified for IEEE 802.15.4 SUN PHYs.
* **Performance Evaluation:** Proposers are strongly encouraged to show simulation results for the applicable application scenarios. Channel model and interference model for simulations are described in the appendices
* **Mandatory and Optional Features:** Proposals shall clearly stipulate the mandatory and optional behaviors/features.
* **Forward Error Correction:** The use of a least an optional FEC should be possible in all modes.
* **Modulation:** The proposer should describe modulation.
* **Symmetrical Links:** It should be possible to use the same class of devices for transmit and receive.
* **PHY Frame Structure:** The PHY should be based on the existing SUN PHY specifications. Include packet length here – describe packet length vs PER for simulation and maybe other w.r.t. Use cases
* **Crystal Tolerance:** The PHY should support oscillator tolerances comparable to the existing SUN PHYs.
* **Coexistence Features:** It is highly recommended that the proposer explains how interference to existing IEEE 802.15.4 networks can be avoided.
* **Operational Bands:** At least one of the operational bands relevant to the scope of the project should be supported.
* **Multipath Robustness:** The proposer should describe the immunity to multi-path reception. Simulation results using the Channel Model defined in Annex A are strongly encouraged.
* **Interference Robustness:** The proposer should describe the immunity to interference. Simulation results using the interference model defined in Annex B are strongly encouraged

# Annex A Channel Model

**[describe channel model and expected simulation parameters]**

# Annex B Interference Model

**[describe interference model and expected simulation parameters]**