**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | **TG4t Technical Guidance Document** | |
| Date Submitted | 21 January 2016 | |
| Source | Clint Powell  Chandler, AZ, USA | Voice: +1 480 586-8457  Fax:  E-mail: [cpowell@ieee.org](mailto:cpowell@ieee.org) |
| Re: | Task Group 15.4t Technical Guidance for Proposals | |
| Abstract | TG4t - Technical Guidance for PHY proposals. | |
| Purpose | To capture essential PHY requirements derived from the CFA responses, 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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Technical Guidance Document

# Introduction

## 802.15.4 Purpose

The standard provides for ultra low complexity, ultra low cost, ultra low power consumption, and low data rate wireless connectivity among inexpensive devices. In addition, one of the alternate PHYs provides precision ranging capability that is accurate to one meter. Multiple PHYs are defined to support a variety of frequency bands.

## 802.15 TG4t Need

The IEEE Std. 802.15.4 enables implementations with low energy consumption by operating in short, high-speed bursts, followed by relatively long sleep periods, resulting in a low-rate network with good battery life. When the original IEEE Std. 802.15.4 was published in 2003, the performance of embedded microcomputers and other sources and sinks of data was such that the 250 kb/s raw data rate of its 2450 MHz O-QPSK PHY was considered to be the highest rate practically attainable as well as more than sufficient to support typical monitoring and control traffic and meta data in what we now call the Internet of Things (IoT).

In today's world, however, there is growing need for higher data rates while, at the same time, supporting backward compatibility and continuing to reduce the energy consumption of IEEE Std. 802.15.4 devices even further. This enhanced performance is needed to help IEEE Std. 802.15.4 maintain its leadership position and compete against other loT oriented communication protocols that are expected to emerge in the near future.

## 802.15 TG4t Scope

This amendment defines a physical layer for IEEE Std. 802.15.4 current revision, capable of supporting 2 Mb/s data rates, utilizing the 2400 - 2483.5 MHz band, having backwards-compatibility to, and the same occupied bandwidth as, the present 2450 MHz O-QPSK physical layer, and capable of simple implementation. Target range should be at least 10 meters. This amendment defines modifications to the Medium Access Control (MAC) layer needed to support this new physical layer

## Methodology

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 and also satisfy IEEE 802.15.4t PAR. The proposal shall reference the relevant regulations. Devices implementing shall abide by regulations in the region it is operating.

## Proposal Criteria

The following shall be included in the proposal:

**Mandatory and Optional Features:**

Proposals shall clearly stipulate the mandatory and optional behaviors/features.

**Compatibility**:

Proposal shall show how it is compatible with the present 2450 MHz O-QPSK physical layer.

**Range**:

The proposal shall show the conditions (channel model, antenna, etc.) under which the solution achieves a radio link distance of at least 10m.

**Data Rate:**

The proposal shall be capable of supporting a 2 Mb/s data rate .

**Symbol/Chip Rate**

The proposer shall specify the symbol/chip rate.

**Modulation/ Coding**

The proposer shall specify the utilized modulation/coding scheme.

**Synchronization and Timing**

The proposer shall state the required synchronization and timing accuracy for all types of devices whether or not they are symmetric and any differences between those of the present 2450 MHz O-QPSK physical layer.

**PHY Frame Structure**

The proposer shall specify the PHY frame structure, including preamble length, total frame length, FCS, etc.

**Transmit Power**

The device shall support transmit powers in alignment with the present 2450 MHz O-QPSK physical layer.

**Transmit PSD**

The proposer should state adjacent channel leakage power ratio (ACL). ACL is defined as the ratio of the power contained in the adjacent channel to the desired channel. Proposals shall have the same occupied bandwidth as, the present 2450 MHz O-QPSK physical layer.

**Interference Rejection Capability**

The ACR (adjacent channel rejection) and ALCR (alternate channel rejection) shall be stated.

**Channel Availability**

The proposer shall specify the minimum number of co-located networks supportable without causing any degradation in performance.

**Sensitivity**

The proposer shall state the sensitivity - defined as the minimum received power to achieve a 1% PER with a 20 octet PSDU.

**Interoperability**

The proposer shall describe the interoperable features of the proposal including any optional behaviors. For instance, it should be made clear whether the data rate can dynamically change.

**Coexistence Features**

The proposal shall state the level of co-existence of the proposed network with other IEEE 802 networks.

**Operational Bands**

At least the operational band stated in the PAR shall be supported.

**MAC Layer Changes and Compatibility**

The proposal shall state all MAC Layer changes required to support the proposed PHY and their compatibility with the MAC used with the present 2450 MHz O-QPSK physical layer. Ideally the proposal shall include NO (or very minimal) changes to the 802.15.4 MAC operation - for compatibility reasons.