**IEEE P802.15**

**Wireless Personal Area Networks**

|  |  |  |
| --- | --- | --- |
| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | **Draft 0.0 of TG4w Coexistence Document** | |
| Date Submitted | 29 October, 2018 | |
| Source | Joerg Robert FAU Erlangen-Nuernberg Am Wolfsmantel 33, 91058 Erlangen | Voice: +49 9131 8525373 Fax: +49 9131 8525102 E-mail: joerg.robert@fau.de |
| Abstract | Analysis on coexistence of 802.15.4w with other 802 systems within the same spectrum bands. | |
| Purpose | To address the coexistence capability of 802.15.4w. | |
| Notice | This document has been prepared to assist the IEEE P802.15. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein. | |
| Release | The contributor acknowledges and accepts that this contribution becomes the property of IEEE and may be made publicly available by P802.15. | |

Contributors of the CA document are sorted by alphabetical order of last name:

* Joerg Robert (TG4w chair)

[1. Introduction 4](#_Toc528589476)

[1.1 Bibliography 4](#_Toc528589477)

[2. Overview 5](#_Toc528589478)

[2.1 Regulatory Information 5](#_Toc528589479)

[2.2 Changes to 802.15.4k 5](#_Toc528589480)

[2.3 Overview of Coexistence Mechanisms in 802.15.4w 5](#_Toc528589481)

[3. Dissimilar Systems Sharing the Same Frequency Bands with 802.15.4w 6](#_Toc528589482)

[4. Coexistence Scenarios and Analysis 7](#_Toc528589483)

[4.1 PHY Modes in the 802.15.4w System 7](#_Toc528589484)

[4.1.1 Parameters of the 802.15.4w PHY Modes 7](#_Toc528589485)

[4.1.2 BER / FER Calculations for the 802.15.4w PHY Modes 7](#_Toc528589486)

[4.2 Interference Modeling 7](#_Toc528589487)

[4.3 802.15.4 Coexistence Performance 7](#_Toc528589488)

[4.4 802.11 Coexistence Performance 7](#_Toc528589489)

[5. Interference Mitigation and Avoidance Techniques 8](#_Toc528589490)

[6. Conclusions 9](#_Toc528589491)

# Introduction

## Bibliography

TODO: List all existing specs and the corresponding coexistence documents

# Overview

## Regulatory Information

TODO: Highlight all 802.15.4w frequency bands

## Changes to 802.15.4k

TODO: Highlight the technical changes to the existing 802.15.4k LECIM FSK PHY. We basically just do minor changes for the non-frequency hopping mode, which will most likely have the very same effect as any existing 802.15.4k system. For the frequency hopping modes we improve the Forward Error Correction (FEC) and add frequency hopping. However, also here we do not add any new modulation scheme. Hence, 802.15.4w will have similar effect on other 802 systems like the existing 802.15.4k LECIM FSK PHY.

## Overview of Coexistence Mechanisms in 802.15.4w

TODO: Highlight that 802.15.4w has been designed to cope with interference from other systems. Therefore, the frequency hopping mode is able to tolerate significant levels of interference from other systems (will be presented in 4.1.2). Additionally, 802.15.4w uses the classical Listen before Talk schemes to avoid interference to other systems.

# Dissimilar Systems Sharing the Same Frequency Bands with 802.15.4w

TODO: List all systems using the same frequency band for the sub-GHz channels. These systems are 802.15.4 and 802.11ah. Most work (except 802.11ah) can be done by referencing existing IEEE 802.15.4 coexistence documents.

# Coexistence Scenarios and Analysis

## PHY Modes in the 802.15.4w System

### Parameters of the 802.15.4w PHY Modes

TODO: Give a parameter overview of the used parameters.

### BER / FER Calculations for the 802.15.4w PHY Modes

TODO: Show simulation results for 802.15.4w in the AWGN and the defined interference channel. These simulations already exist from the call for proposals and can be copy paste.

## Interference Modeling

TODO: Assume the very same interference model as defined in section 4.2 of the 802.15.4k coexistence document. However, for the coexistence with 802.11ah use the 802.11ah indoor channel model instead, because most interference in this case is expected for indoor usage scenarios. (Indoor model to be confirmed)

## 802.15.4 Coexistence Performance

TODO: Show the coexistence performance by referencing the coexistence assurance documents of 802.15.4g, k, and q. As we have not defined any new modulation scheme, we may just reference the existing results. (To be confirmed)

## 802.11 Coexistence Performance

TODO: The existing 802.15.4 coexistence documents do not cover 802.11ah, which did not exist when the previous new PHY modes were defined. Hence, we have to show the impact of 802.15.4w on 802.11ah and vice versa. We will do this by assuming worst case conditions, e.g. maximum overlap between both systems. Following the discussions within the 802.19 GHz coexistence study group we would use the same MCS modes as defined there, i.e. MCS1, MCS3, and MCS7. We would limit our simulations to the PHY only. Within the TG4w we already discussed to use the MATLAB WiFi Toolbox for the simulations, which makes the simulation results reproducible to others.

# Interference Mitigation and Avoidance Techniques

TODO: Mention techniques used by 802.15.4, e.g. LBT.

# Conclusions