**IEEE P802.15**

**Wireless Personal Area Networks**

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| Re: | Task Group 15.4r Technical Guidance for Proposals |
| Abstract | [TG4r - technical guidance for PHY proposals.] |
| Purpose | [Working document for the PAR to the P802.15 Working Group.] |
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**Abbreviations**

The following abbreviations are used in this document.

ATSC Advanced Television Systems Committee

CEPT European Conference of Postal and Telecommunications Administrations

CRTC Canadian Radio-Television and Telecommunications Commission

dB Decibels

DVB-T Digital Video Broadcasting — Terrestrial

ECC Electronic Communications Committee in Europe

EIRP Equivalent Isotropically Radiated Power

ERC European Radiocommunications Committee in Europe

ERP Effective Radiated Power

FCC Us Federal Communications Commission

FD Fixed Device

GDB Geo-Location Database

GSM Global System for Mobile Communications, originally Groupe Spécial Mobile

GHz Gigahertz (1 GHz = 109 Hertz or a frequency of one billion cycles per second)

IDA Info-Communications Development Authority in Singapore

ITU International Telecommunication Union

LOS Line-Of-Sight

M2M Machine To Machine

MAC Media Access Control Layer

MHz Megahertz (1 MHz = 106 Hertz or a frequency of one million cycles per second)

NLOS Non-Line-Of-Sight

NTSC National Television System Committee

PAR Project Authorization Request

PDP Power Delay Profile

PHY Physical Layer

PICS Protocol Implementation Conformance Statement

PPD Personal/Portable Device

TG4m Ieee802 Working Group 15 Task Group m

TGD Technical Guidance Document

TVBD TV Band Device

TVWS TV White Space

UHF Ultra High Frequency

VHF Very High Frequency

WPAN Wireless Personal Area Network

WPAN-WS Wireless Personal Area Network – White Space

WSD White Spaces Device

TG4m Technical Guidance Document (TGD)

1. **Introduction**

**Purpose**

This document provides technical guidance by summarizing parametrically the key PHY characteristics and any necessary MAC changes identified in consideration of WPAN application and regulatory requirements. The technical summary on PHY and MAC parameters are intended to provide guidelines to the proposals for Task Group 802.15.4r. It should be noted that the main objective of this document is to provide technical recommendations for designing and evaluating potential proposals, and should not be understood as mandatory requirements for the system design.

The intent of the task group is to use a flexible and efficient process that provides sufficient descriptions of the technical requirements to enable relevant responses, with efficiency of effort while meeting the critical need for a timely standard. The TG4r task group will use this document to help qualify MAC and PHY protocol related proposals.

The responsibility of the TG4r is to produce a quality and timely standard specification. To achieve this goal, TG4r will consider the technical recommendations in this document to assist the preparation and evaluation of technical proposals.

## Methodology

The methodology provides recommendations to defining a minimal set of features, characteristics, performance and constraints to be considered. This document provides:

* A functional view of the PHY characteristics, in the form of specific parameters which define externally verifiable performance and interoperability characteristics; and
* Application/performance description~~s~~ that characterizes the types of WPAN applications and the derived performance characteristics.

In preparing proposals, this can be used as a framework to produce a concise summary of the characteristics of each given proposal, and will allow the group to see the similarities and differences in submitted proposals.

# Requirements Discussion

## Summary of PAR

**2.1 Title:**

IEEE Standard for Local and Metropolitan Area Networks Part 15.4: Low Rate Wireless Personal Area Networks (LR-WPANs) Amendment: Distance Measurement Techniques

**5.2 Scope:**

Include from PAR

**5.5 Need for the Project:**

There are many instances in large area device command and control applications where infrastructure requirements need to be minimized for effective deployment. These needs are effectively served by the ability to operate 802.15.4 class networks.

The PAR can be found on the IEEE802 web site: (<https://development.standards.ieee.org/P866200033/par>).

## High Level Requirements Overview

From the PAR and general procedural rules, key overall goals and requirements of this project can be summaried as follows:

* [Look at TG 4m]
* The amendment complies with the P802.15.4r PAR and 5 Criteria.
* The amendment will include a PICS proforma.
* The amendment should provide technical mechanisms to enable direct device-to-device communications in both star and peer-to-peer networks.

**Application Requirements Matrix**

|  |  |  |  |
| --- | --- | --- | --- |
| **Application** | **Description**  | **Key Parameters** | **Reference** |
| TBC | TBC  | TBC | TBC |
| Applications using TVWS |  | DMT and TBC | TBC |
| Medical | TBC  | TBC | TBC |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

## Frequency Band Related Regulations

## Summary of Regulations

Incorporate TWS

Enable DMT as widely as possible

## Regulatory Requirements

There are several regulatory bodies including the Federal Communications Commission (FCC) in the U. S, Electronic Communications Committee (ECC) under the European Conference of Postal and Telecommunications Administrations (CEPT) in EU, Ofcom in the U. K., and Industry Canada in Canada. Based on the rules from the FCC (refer to FCC 10-174, Second Memorandum Opinion and Order, September 2010) and ECC (refer to ECC Report 159, January 2011), a set of regulatory requirements for white space communications is identified. Therefore whenever new rules are established or future changes of rules from any regulatory bodies are made, they should be considered for the proposals.

***Requirements identified from FCC rules***

A set of common regulatory requirements for white space communications from the rules of FCC are listed as follows:

Frequency bands:

* Devices shall be operatied in any of the regionally available frequency bands on a license-exempt basis.

Types of devices:

Transmit power:

Transmit power related requirements:

* All devices may incoporate transmit power control to limit their operating power to the minimum necessary for successful communication.

Geolocation requirements:

E.G. TVWS

* Fixed devices
* Mode II personal/portable devices
* Mode I personal/portable devices

Security:

***Requirements from ECC rules not identified in or different from the rules of FCC***

**Coexistence**

The amendment should provide mechanisms to fulfil the requirements mandated in different regulatory domains, particularly in addressing the coexistence with users protected by the regulations.

Coexistence among systems within the same band should be addressed fulfilling the requirements of the coexistence assurance document.

The importance of successful coexistence between 802 wireless systems has been an increasingly important concern within (and between) 802 wireless working groups. Future 802.15.4 devices supporting DMT must successfully operate in proximity to other wireless devices. Coexistence may be viewed from two aspects - tolerance to other systems in the same space and impact on other systems in the same space, including transmitters which might intentionally share the band and unintentionally impact the band. These evaluations and recommendations may be included as a part of the coexistence assurance document.

**Interoperability**

Proposals should discuss levels of interoperability. Support for previously deployed systems is not a consideration.

As guidance to the drafters of the standard, the standard should be written such that there may be behavior that will facilitate interoperability and coexistence with existing devices in the field. The drafters should make a reasonable attempt to include the majority of currently deployed systems.

## Complexity and Cost considerations

The PHY(s) supporting DMT following TG4r should be realizable by low complexity implementations to minimize cost and to enable mass adoption of the standard. The cost considerations are not only for low capital expenditure, but also low operational expenditure. One of this proposed amendment’s objectives includes low cost installation with minimal to no operator intervention.

Cost effective communication and simple modulation techniques are potential mechanisms that help meet the low complexity, low cost requirements.

## Channel Characteristics

To evaluate the proposed systems, channel models are needed which represent target environments given for applications considered for TG4r.

**Path Los Channel Models** (for link budget calculation)

1. *Line-of-Sight (LOS) Propagation Model*

***b.*** *Non-Line-of-Sight (NLOS) Propagation Model*

**Channel Impulse Response Model** (for PHY simulations)

1. For indoor scenarios

1. For Outdoor scenarios

# Definitions

The following provides definition of specific terms in the context of discussion with respect to TG4m applications and PHY proposals**.**

Available Channel:

Fixed device:

Geo-location capability:

# References