**IEEE P802.15**

**Wireless Personal Area Networks**

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| Re: | Technical Guidance for 802.15.8 Proposals | |
| Abstract | The contribution presents some clarifications and elements that are missing from the TGD. | |
| Purpose | To expedite completion of the TGD. | |
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Comments to PAC TGD 12-0568-01-008

The contribution presents some clarifications and elements that are missing from the TGD

*In the following, italicized text is a comment and not a part of the proposed text.*

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# Overview

The 802.15.8 specification shall be developed according to the P802.15.8 Peer Aware Communication (PAC) project authorization request (PAR), as approved on 30th March 2012 [1], and Five Criteria document [2].

# Definitions

## General definitions

## Specific definitions to this standard

Device ID: e.g. MAC address

. This is a unique identifier for a compliant PD.

Device group ID:

. This is a unique identifier for a group of compliant PDs.

Application type ID:

. This identifies a class of specific applications enabled in a PD.

. e.g. SNS, gaming, etc.

Application-specific ID:

. This identifies a specific application enabled in a PD.

. e.g. Facebook, Twitter, Space Invaders, etc.

Application-specific user ID:

. This is the user account ID linked to a specific application.

. e.g. account@facebook

Application-specific group ID:

. This identifies a group of selected Application-specific users.

Peer: this is equal to Application-specific user ID.

# Abbreviations and acronyms

PD (PAC Device)

# General descriptions

This clause provides the basic framework of PDs. The framework serves as a guideline in developing the functions of PDs and their interactions specified later in detail.

## Concepts and architecture

IEEE 802.15.8 shall support a fully distributed, decentralized, and self organized system composed of PDs.

Some of these devices may be able to connect on an opportunistic basis to infrastructure, which is out of scope for IEEE 802.15.8.

IEEE 802.15.8 shall support one-to-one and one-to-many communications.

IEEE 802.15.8 shall support scalable data rate to accommodate many applications such as listed in the Application Matrix (doc. #350r4 or the latest revision).

Possibly aided by higher layers, a PD shall support data transfers between itself and identified PDs or groups.

IEEE 802.15.8 shall support both one-way and two-way communications.

**>>>>>>>>>>> Begin Change <<<<<<<<<<<<<<<<<<<<<<<<<<**

*As discussed in the CC the contents of this section can only be determined after technical proposals are presented and agreed. Therefore it is inappropriate for TGD, I would suggest removal.*

## ~~States of the PD~~ This section left blank to maintain numbering

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## Topology

Several topologies are considered to support various service interactions within PDs.

One-to-one and one-to-many topologies shall be supported.

IEEE 802.15.8 shall support a PD participation in at least two independent one-to-many communications with different peers at the same time.

IEEE 802.15.8 shall support a PD having simultaneous communication sessions for same or different applications.

Mesh topology may be supported.



## Reference model

All PDs are internally partitioned into a physical (PHY) layer and a medium access control (MAC) sublayer of the data link layer, in accordance with the ISO/OSI-IEEE Std 802-2001 reference model. Direct communications between PDs are to transpire at the PHY layer and MAC sublayer as specified in this standard; Message security services are to occur at the MAC sublayer, and security operations are to take place inside and/or outside the MAC sublayer.

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*The current description focuses on user plane PDU’s. For completeness it is appropriate to mention that control information is also passed between the layers.*

Within a PD, the MAC provides its service to the higher layer through the MAC service access point (SAP) located immediately above the MAC sublayer, while the PHY provides its service to the MAC through the PHY SAP located between them. On transmission, the higher layer passes MAC service data units (MSDUs) to the MAC sublayer via the MAC SAP, and the MAC sublayer passes MAC frames (also known as MAC protocol data units or MPDUs) to the PHY layer via the PHY SAP. On reception, the PHY layer passes MAC frames to the MAC sublayer via the PHY SAP, and the MAC sublayer passes MSDUs to the higher layer via the MAC SAP.

MAC and PHY SAPs also pass control information between the layers.

# >>>>>>>>>>> End Change <<<<<<<<<<<<<<<<<<<<<<<<<<



There may be a logical PD management entity (PDME) that exchanges network management information with the PHY and MAC as well as with other layers.

# General requirements

## Operating frequencies

All PDs shall operate in selected globally available unlicensed/licensed bands, below 11 GHz.

There are 4 candidate bands;

* Unlicensed Sub 1 GHz band
* Unlicensed 2.4 GHz, 5 GHz ISM band
* Unlicensed 6 ~ 10 GHz UWB band
* Licensed bands

**>>>>>>>>>>> Begin Change <<<<<<<<<<<<<<<<<<<<<<<<<<**

*Duplexing schemes are either TDD or FDD. By saying that duplexing may be either we are making no new requirements. Therefore I would suggest removal of section.*

## ~~Duplex~~ This section left blank to maintain numbering

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# Functional requirements

The functional requirements described in this document shall be met by IEEE 802.15.8 compliant PDs.

## Multiple access

Multiple access schemes shall be supported.

## Synchronization

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***This section is needed to define minimum requirements for synchronization. Further requirements may depend on modulation etc. and are out of scope for TGD.***

Synchronization shall / may be used to reduce discovery listening time and battery consumption.

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## Discovery

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For the purpose of TGD discovery is defined as uni-directional. Mutual discovery is therefore two concurrent uni-directional discoveries.

Possibly with higher layer support, An IEEE 802.15.8 device shall support peer discovery, service discovery, and group discovery.

Peer discovery implies device discovery.

The following properties are desirable for discovery process.

* Expedited discovery
* Energy-efficient discovery (e.g. low duty cycle)
* Support high PD density and high discovery traffic
* Efficient spectrum utilization
* Prioritized discovery

For the purpose of discovery of PAC peers, the discovery signal conveys information that may reflect one or more of the following IDs such as Device ID, Device Group ID, Application type ID, Application-specific ID, Application-specific user ID, Application-specific group ID.

Note that it is up to higher layers or the implementer how to use and implement these IDs or to use part of them.

*The reason for the change in the next paragraph is the inability to define which applications are the same. For example, are revisions of the same application “same”? How about two different applications which use the same data base?*

IEEE 802.15.8 may support that a peer ID is discovered to only other peers who is in the mappable application-specific ID/group ID or the designated application-specific ID/group ID (or application specific user ID or user group ID).

*Note that support by PAC only means we have a MAC mechanism for that, not necessarily that all PDs will support it. This isn’t a compliance spec.*

IEEE 802.15.8 shall support mechanisms to ensure privacy that a PD is not tracked.

802.15.8-PAC shall support protection of identity from impersonation.

IEEE 802.15.8 may provide support proximity-based presence functionality that a PD shall recognizes another peer entering in the proximity as well as the peer going out of the proximity.

*redundant.*.

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## Peering

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IEEE 802.15.8 shall support peering. Peering is equivalent to link establishment; link establishment is the process at the end of which two or multiple PDs are ready to exchange data.

802.15.8-PAC shall support expedited re-peering.

>>>>>>>>>>> End Change <<<<<<<<<<<<<<<<<<<<<<<<<<

## Scheduling

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IEEE 802.15.8 shall provide a fully distributed coordination mechanism. *Coordination is a more generic expression that doesn’t imply a specific solution*

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## QoS

IEEE 802.15.8 shall support prioritized services, various QoS classes, enabling an optimal matching of service, application and protocol requirements to resources and radio characteristics.

## Interference management

IEEE 802.15.8 shall provide the functionality to mitigate interference from other PDs.

## Multicast

IEEE 802.15.8 shall support a reliable multicast transmission including both one-hop and multi-hop cases.

## Broadcast

IEEE 802.15.8 shall support a broadcast transmission including both one-hop and multi-hop cases.

## Multi-hop support

IEEE 802.15.8 shall provide at least 2-hop relaying function.

Only relay-enabled PD shall relay discovery messages and/or traffic data from PDs in the proximity.

## Relative positioning

## Power management

IEEE 802.15.8 shall support a power management functionality to reduce power consumption in PDs for all services as listed in the Application Matrix (DCN15-12-0350).

## Security

The impact of security procedures on the performance of other system procedures, such as discovery and peering procedures should be minimized.

>>>>>>>>>>> Begin Change <<<<<<<<<<<<<<<<<<<<<<<<<<

*In many cases applications for smart phones are created by a third party and sold by a mobile phone vendor. Neither vendor nor mobile operator vets the application for security. On the other hand, 802.15 cannot specify applications, which puts the burden of 802.15 (with the aid of higher layers as necessary) to provide whatever security is required and cannot depend on the good behavior of applications. Therefore I would suggest the following requirement:*

IEEE 802.15.8 shall make no assumption regarding security protection offered by applications.

>>>>>>>>>>> End Change <<<<<<<<<<<<<<<<<<<<<<<<<<

## Scalability

IEEE 802.15.8 shall support scalability according to the number of PDs and data rates.

### Network scalability

* IEEE 802.15.8 shall support discovery and communications for at least a hundred of PDs.

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### Data rate scalability

* PAC shall support scalable data rate to accommodate many applications such as listed in the Application Matrix (DCN15-12-0350). PAC should maximize PD compatibility.

>>>>>>>>>>> End Change <<<<<<<<<<<<<<<<<<<<<<<<<<

## Coexistence

IEEE 802.15.8 shall coexist with other specifications or systems (radio interface technology)at the same frequency band.

IEEE 802.15.8 shall support the coexistence of PDs used for different applications as well as non-PDs in the same spectrum.

## Requirements for high layer and infrastructure interaction

IEEE 802.15.8 may be able to interact with higher layers to access suitable infrastructure, if it exists, e.g. to facilitate the set up and maintenance of communication.

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*Note that we have reporting but forgot triggering of the action – a missing piece*

IEEE 802.15.8 procedures shall be able to be triggered by higher layers

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IEEE 802.15.8 shall support the report to higher layers with updated discovery and association information.

IEEE 802.15.8 shall perform measurements at the request of and report results to higher layers. These measurements may include received signal strength and interference levels.

How to handle discovery and peering in the absence of higher layers, infrastructure access or sufficient pre-configuration information is out of scope for 802.15.8.

# Performance requirements

The performance requirements described in this document shall be met by IEEE 802.15.8 compliant PDs.

## Transmission range

## Areal spectral efficiency

The areal spectral efficiency means that the summation of link spectral efficiency (e.g. point-to-point link) in the certain dimension. IEEE 802.15.8 shall maximize the areal spectral efficiency (*[bps/Hz/km2])* without sacrificing other requirements.

## Data rate

IEEE 802.15.8 shall support data rate up to typically 10 Mbps.

## Error rate

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*What is the requirement here? Without a specific SNR there’s no requirement, while a specific SNR would make it depend on the modulation scheme which is out of scope for TGD. Suggest remove or else move the evaluation section.*

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## Latency

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*Suggest removal, no requirement here*

## ~~Fairness~~ This section left blank to maintain numbering

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## Mobility

IEEE 802.15.8 shall support PDs with various mobility scenarios.

|  |  |
| --- | --- |
| Walking speed (up to 3km/h) | Best performance |
| Running speed (up to 10 km/h) | Graceful degradation |
| Vehicular (up to 60 km/h) | Best effort |

## System overhead

Overhead, including overhead for control signalling as well as overhead related to data communications shall be reduced as far as feasible without compromising overall performance and ensuring proper support of systems features.

## Complexity

Complexity should be minimal to enable mass commercial adoption for a variety of cost sensitive products.

# Regulations

# Evaluation methodology

## Antenna Configuration

PDs shall be equipped with antenna array configurations from one to four antennas.

## Channel models (Refer to DCN #15-12-0459r3 or the latest)

## Simulation scenarios and parameters

The channel model document specifies the following channel model conditions (path loss , small scale fading and scenarios):

- Indoor office, outdoor to indoor and pedestrian, vehicular for the 900 MHz band

- Outdoor to indoor and pedestrian, vehicular, typical urban for 2.4 GHz band

- Model A, B, C, D, E for 5 GHz band.

802.15.4a UWB channel models for UWB band.

## Link-level simulation (PHY)

## System-level simulation (MAC)

### scenarios & parameters for just PDs

This sub-clause is described for discovery phase

### scenarios & parameters for PD links

This sub-clause is described for communication phase (including unicast, multicast, broadcast).

# References