**IEEE P802.15**

**Wireless Personal Area Networks**

|  |  |  |
| --- | --- | --- |
| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | SG3e Technical Guidance Document | |
| Date Submitted | [February, 2015] | |
| Source | Thomas Kürner | E-mail: t.kuerner@tu-bs.de |
| Re: |  | |
| Abstract | SG3e System Requirements and Evaluation Criteria to be developed | |
| Purpose | Supporting document for the development of the amendment 3e of IEEE 802.15.3 | |
| 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. | |

|  |  |
| --- | --- |
| **List of contributors** | |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

Table of Contents

[1 Definitions: 4](#_Toc408826416)

[2 General Guidelines 4](#_Toc408826417)

[3 Introduction 7](#_Toc408826418)

[4 Applications 7](#_Toc408826419)

[5 Technical Requirements 7](#_Toc408826420)

[6 Evaluation Criteria 7](#_Toc408826421)

[7 References 7](#_Toc408826422)

# Definitions:

|  |  |
| --- | --- |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# General guidelines

This technical guidelines document (TGD) describes the technical aspects that SG3e (High-Rate Close Proximity HRCP) standard must fulfill, such as performance-related issues, reliability issues and availability issues. These types of requirements are often called quality of service (QoS) requirements; other requirements are usually maintenance-level requirements or external constraints, sometimes called compliance. Technical requirements are summarized as any other specifications; they have a name and a unique identifier. Technical requirements are documented in the same manner as any specifications, including a description, an example, a source or references to related technical requirements and a revision history.

SG3e needs to effectively define and manage requirements to ensure they are meeting needs of the applications, while proving compliance.

Ideally, requirements are:

• Correct (technically and legally possible)

• Complete (express a whole idea or statement)

• Clear (unambiguous and not confusing)

• Consistent (not in conflict with other requirements)

• Verifiable (it can be determined that the system meets the requirement)

• Traceable (uniquely identified and trackable)

• Feasible (can be accomplished within cost and schedule)

• Modular (can be changed without excessive impact)

• Design-independent (does not pose a specific solution on design)

Each requirement must first form a complete sentence, containing a subject and a predicate. These sentences must consistently use the verb “shall”, “will” or “must” to show the requirement's mandatory nature, and “should” or “may” to show that the requirement is optional. The whole requirement specifies a desired end goal or result and contains a success criterion or other measurable indication of the quality.

The TGD needs to capture these levels of user requirements, maintaining intelligent traceability and change impact analysis between them.

Typical constraint requirements can specify:

• Performance

• Interfaces

• Security

• Safety

• Reliability

• Availability

• Maintainability

An efficient way of writing better requirements is to ensure they are clearly mapped to test cases. Making sure each requirement is clearly verifiable from the start, not only helps prepare later phases of the project, it also puts the developer in the correct state of mind. Requirements and their associated tests must also indicate what the system should not do, and what happens at the limits (degraded mode).

This rule also applies for compliance requirements: indicating how they shall be tested is a good way to write better requirements.

The TGD need to implement a reliable and repeatable change control process that helps turn this challenge into an opportunity.

By providing examples and counter-examples of good requirements and documents, IEEE can enhance the quality, consistency, and completeness of the requirements. These can originally be templates, industry standards and rules inside a repository, such as the IEEE server.

Requirement typical sentence construction

Defects to avoid:

* Vagueness
* Weakness
* Over specification
* Subjectivity
* Multiplicity
* Unclear meaning
* Implicit meaning

Some words to be used with caution:

“adequate”, “applicable”, “appropriate”, “approximate”, “bad”, “best practice”, “between”, “clearly”, “compatible”, “completely”, “consider”, “could”, “down to”, “easy/easily”, “effective”, “efficient”, “equivalent”, “excellent”, “good”, “his/her”, “however”, “ideal”, “etc”, “in order to”, “include but shall not be limited to”, “least”, “like”, “low”, “maximise”, “may”, “most”, “minimum/mal”, “must”, “nearly”, “necessary”, “needed”, “normal”, “or”, “possible/bly“, “practicable”, “provide”, “quality”, “readily”, “relevant”, “safe/ly“, “same”, “should”, “significant”, “similar”, “so as”, “subject to”, “substantial”, “sufficient”, “suitable”, “support”, “target”, “typical”, “up to”, “user friendly”, “whether”, “will”, “with”, “worse”.

# Introduction

This document provides the technical contents of the project to develop the amendment 3e to IEEE 802.15.3 to enable [to be filled in] according to the PAR and CSD of this project [ref. to PAR and CSD]. This document will provide guidance on how to respond to a call for proposals.

# Applications

Close proximity P2P applications such as file exchange enable high speed transfer of large data files (photo, video, images, etc.) between two electronic devices, such as smartphones, digital cameras, camcorders, computers, TVs, game products, and printers. Using this technology, data can be sent at high speed with a single touch. A user can push any data file from her/his mobile device to another mobile/stationary devices by means of a touching action.

## Kiosk downloading

Kiosk terminals (including interactive signages) located in public spaces can function as electronic data dispensers providing high-speed file downloading services The user stops in front of the kiosk terminal, selects a content (e.g., from a list shown in the kiosk menu) and lays his/her portable device on the indicated area of the terminal. The file of the selected content is transmitted wirelessly and stored in the user’s portable device. In general, total transmission time should be kept under about 3 seconds to avoid making the user feel the waiting time.

## Ticket gates

Ticket gates (wickets, toll gates) are a related use case, in train stations, stadiums, theme parks and other venues where the customers/passengers use tickets or tokens having non-contact communication functions. In this use case, the user does not fully stop in front of the kiosk for the non-contact communications but instead touches the specified spot while walking through the gate. The initial setup shall be capable of completing within 2 msec. In order to avoid misconnecting the tickets with unintended terminals such as those associated with adjacent lanes, the maximum transmission range has to be specified in the system. Defining an upper limit for the transmission range is essential for ticket gates, and this value should be kept, without any steering or beamforming, within 100 mm for the minimum required rate.

## Wireless data storage

Wireless storage devices include wireless flash memory devices, wireless SSD (solid-state drive) devices, game cards and other electronic devices.

# Technical Requirements

The proposer shall show that all the requirements specified below are satisfied in the submitted proposal.

## Functional requirements

### Connection topology

For the Close Proximity system, the connection is always limited to two devices and the topology is required to be Point-to-Point (P2P).

### Media access mechanism

The close proximity P2P system shall have the following features to achieve its basic requirements:

* Connection setup without any network identifiers
* Network topology always limited to two devices
* Connection setup time of 2msec or less, prior to entering active state, to meet application requirements
* A means of ensuring spatial division from other systems without beamforming
* CSMA/CA not required prior to data transmission
* No periodic management frame transmission after connection establishment.
* A method to estimate whether a peer device drew apart and a procedure to promptly dissolve connection and change to a standby state when such estimation is made.

.

### QoS

Because of the P2P connectivity, QoS mechanisms are not applicable.

### Security

Because of the limitation of the transmission range, security mechanisms for the PHY and MAC layers can be omitted for a close proximity P2P system.

### Power management

A close proximity P2P communication is expected to have extremely short active time where at least one of the two P2P devices in the system will be mobile/handheld. In this regard, the mobile device in the system shall be designed to have low power consumption in standby state. The device on the other side, such as kiosks, signages and ticket gates, should be designed to have low average power consumption. No special power management schemes are required.

## Performance requirements

### Operational frequency band

The system shall use the 60GHz unlicensed band. The channel plan is based on that of IEEE802.15.3c. Ch2 and Ch3 in this band are designated as unlicensed bands in many countries. Hence the system should support the use of these two channels. Channel bonding may be used.

### Transmission range

The maximum transmission range will define the close proximity area to allow the touch operation but should be kept within 100 mm, without any steering or beamforming, when operating at the minimum required rate. Likewise, the two P2P devices should disconnect if the separation between the two becomes larger than this close proximity area.

### Spectral efficiency

MIMO may be used.

### Data rate

The data rates should be sufficient to support the proposed use cases in conjunction with the operational frequency plan and channel model, operating at PHY rates up to 100 Gbps. Data rates are described in the Applications Requirements Document (ARD.

### Link budget

The propagation loss is based on free-space communication under far field, with no obstacles except for terminal cases. Coding gain and target packet error rate would be determined depending on the PHY and protocol technologies. The reference table below contains basic information in regards to link budget calculations.

The proposer should show evidence that the system meets the requirement in Section 5.2.2 (Transmission range). For example, the proposer may show the maximum transmission range by indicating that the system margin drops below 0 dB at that distance.

Example Link Budget:



# Regulatory requirements

The output RF power levels and other regulations for each country which allow the use of the unlicensed 60 GHz band shall be followed.

# Evaluation criteria

All the requirements and conditions specified in Sections 4 to 6 must be satisfied in order for a proposal to be considered and evaluated as a valid submission.

# References

[1] TG6 Technical Requirements Document IEEE 802. 15-08-0644-08-0006

[2] Applications Requirmements Document (ARD), <https://mentor.ieee.org/802.15/dcn/14/15-14-0304-00-003d-applications-requirement-document-ard.docx>