

P802.15.4k

Submitter Email: bheile@ieee.org

Type of Project: Amendment to IEEE Standard 802.15.4-2006

PAR Request Date: 02-Oct-2010

PAR Approval Date:

PAR Expiration Date:

Status: Unapproved PAR, PAR for an Amendment to an existing IEEE Standard

1.1 Project Number: P802.15.4k

1.2 Type of Document: Standard

1.3 Life Cycle: Full Use

2.1 Title: Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low Rate Wireless Personal Area Networks (WPANs) Amendment: Physical Layer(PHY) Specifications for Low Energy, Critical Infrastructure Monitoring Networks

3.1 Working Group: Wireless Personal Area Network (WPAN) Working Group (C/LM/WG802.15)

Contact Information for Working Group Chair

Name: Robert F Heile

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Contact Information for Working Group Vice-Chair

None

3.2 Sponsoring Society and Committee: IEEE Computer Society/LAN/MAN Standards Committee (C/LM)

Contact Information for Sponsor Chair

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Contact Information for Standards Representative

None

4.1 Type of Ballot: Individual

4.2 Expected Date of submission of draft to the IEEE-SA for Initial Sponsor Ballot: 03/2012

4.3 Projected Completion Date for Submittal to RevCom: 10/2012

5.1 Approximate number of people expected to be actively involved in the development of this project: 100

5.2 Scope: (See explanatory notes in Section 8.1)

This physical layer amendment to IEEE 802.15.4 addresses principally applications such as critical infrastructure monitoring. These applications have unique requirements that are not fully addressed with the current standard. It defines an alternate PHY and only those MAC modifications needed to support its implementation.

Specifically, the amendment supports all of the following:

' *Operation in any of the regionally available licensed, license exempt, and special purpose frequency bands

' *Simultaneous operation for at least 8 co-located orthogonal networks

' *Application data rate of less than 40 kbits per second

' *Propagation path loss of at least 120 dB

' * >1000 endpoints per mains powered infrastructure

' * Asymmetric application data flow

' * Extreme difference in capabilities and performance between endpoint devices and coordinating devices (collectors)

' -coordinator may support all standardized modulations (MCS) and data rates

' -coordinator may be required to support antenna diversity or antenna beam steering

' -end point must be able to conserve energy

' * Reliable operation in dramatically changing environments (no control over environment)

' -e.g. increased interference due to urban build out, placement of interfering transmitter tower near devices, new chain-link fence

This amendment also provides mechanisms that enable coexistence with other systems in the same band(s) including IEEE 802.11, 802.15 and 802.16 systems.

5.3 Is the completion of this standard dependent upon the completion of another standard: No

5.4 Purpose: The purpose of this amendment is to facilitate point to multi-thousands of points communications for critical infrastructure monitoring devices. The amendment addresses the application's user needs of minimal network infrastructure, and enables the collection of scheduled and event data from a large number of non-mains powered end points that are widely dispersed, or are in challenging propagation environments. To facilitate low energy operation necessary for multi-year battery life, the amendment minimizes network maintenance traffic and device wake durations. In addition, the amendment addresses the changing propagation and interference environments.

5.5 Need for the Project: The response to request for application presentations by the LECIM Interest Group indicate a large and growing market for wireless critical infrastructure applications that fit the objectives of 802.15, but are not satisfied by existing IEEE 802 standards. (See explanatory notes in Section 8.1).

The LECIM Interest Group tutorial held in San Diego, CA, and previous interest group meetings in Beijing and Orlando have had average attendance of more than 50 participants. There has been substantial interest from regions of the world outside of North America, where the regulatory limits on transmitted power are much lower, in addition to broad interest to better address non-mains powered networks, and hard to reach devices.

There have been 6 application presentations, from 10 author companies, with 15 applications described. They are summarized in document 15-10-0533-00-leci-lecim-tutorial-application-presentations.pptx.

The communication link budget, and coexistence characteristics, and data model for this class of applications have not been met with existing 802 standards (See explanatory notes in Section 8.1).

5.6 Stakeholders for the Standard: Semiconductor manufacturers, network equipment manufacturers, wireless device manufacturers, network operators, utility companies, sensor equipment manufacturers, condition based monitoring equipment manufacturers, government agencies, non-government agencies with equivalent interest and the public safety and energy industries., in addition to Location Based Services Suppliers and Users.

Intellectual Property

6.1.a. Is the Sponsor aware of any copyright permissions needed for this project?: No

6.1.b. Is the Sponsor aware of possible registration activity related to this project?: No

7.1 Are there other standards or projects with a similar scope?: No

7.2 Joint Development

Is it the intent to develop this document jointly with another organization?: No

8.1 Additional Explanatory Notes (Item Number and Explanation): 5.2 Scope

While the current 802.15.4 standard has many of the desired properties for this application space, some of the baseline assumptions of the 802.15.4 standard are not consistent with the requirements of this application space such as asymmetric link budgets (due to elevated noise floor), or the use of data rates and encodings on a per device basis. Furthermore, since these types of applications are often setup by professional installers, it would be advantageous to allow the installer to optimize the configuration of parameters to suit each device.

The current 802.16 M2M PAR calls for changes to the MAC, and no substantial change to its PHY. While it does state the enhancements lower power consumption at the subscriber station, support by the base station of significantly larger numbers of devices, and efficient support for small burst transmissions, it does not change the PHY, and as such it will not meet the large path loss, minimal infrastructure requirements, and multi-year battery life required by LECIM applications.

5.5 Need for Project

Document numbers for IEEE posted Utility presentations regarding their Wireless Smart Metering Utility Network experiences are:

- a. 15-10-0053 LECIM applications
- b. 15-10-0186 Container tracking
- c. 15-10-0291 Wireless environment in agriculture
- d. 15-10-0297 Remote monitoring
- e. 15-10-0299 Soil Monitoring
- f. 15-10-0307 Applications in China

In addition to the applications covered in the presentations, the interest group identified several other potential applications, including:

Structural monitoring (bridges, levees, etc.)

Wastewater monitoring

Machine/Server room monitoring

First Responder monitoring