

**P802.15.4w**

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**Submitter Email:** [bheile@ieee.org](mailto:bheile@ieee.org)**Type of Project:** Amendment to IEEE Standard 802.15.4-2015**PAR Request Date:** 17-Jan-2018**PAR Approval Date:****PAR Expiration Date:****Status:** Unapproved PAR, PAR for an Amendment to an existing IEEE Standard

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**1.1 Project Number:** P802.15.4w**1.2 Type of Document:** Standard**1.3 Life Cycle:** Full Use

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**2.1 Title:** Standard for Low-Rate Wireless NetworksAmendment for a Low Power Wide Area Network (LPWAN) extension to the Low Energy Critical Infrastructure Monitoring (LECIM) Physical layer (PHY)

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**3.1 Working Group:** Wireless Personal Area Network (WPAN) Working Group (C/LM/WG802.15)**Contact Information for Working Group Chair****Name:** Robert Heile**Email Address:** [bheile@ieee.org](mailto:bheile@ieee.org)**Phone:** 781-929-4832**Contact Information for Working Group Vice-Chair****Name:** PATRICK KINNEY**Email Address:** [pat.kinney@kinneyconsultingllc.com](mailto:pat.kinney@kinneyconsultingllc.com)**Phone:** 847-960-3715

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**3.2 Sponsoring Society and Committee:** IEEE Computer Society/LAN/MAN Standards Committee (C/LM)**Contact Information for Sponsor Chair****Name:** Paul Nikolich**Email Address:** [p.nikolich@ieee.org](mailto:p.nikolich@ieee.org)**Phone:** 8572050050**Contact Information for Standards Representative****Name:** James Gilb**Email Address:** [gilb@ieee.org](mailto:gilb@ieee.org)**Phone:** 858-229-4822

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**4.1 Type of Ballot:** Individual**4.2 Expected Date of submission of draft to the IEEE-SA for Initial Sponsor Ballot:** 07/2019**4.3 Projected Completion Date for Submittal to RevCom****Note:** Usual minimum time between initial sponsor ballot and submission to Revcom is 6 months.: 02/2020

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**5.1 Approximate number of people expected to be actively involved in the development of this project:** 60**5.2.a. Scope of the complete standard:** This standard defines the physical layer (PHY) and medium access control (MAC) sublayer specifications for low-data-rate wireless connectivity with fixed, portable, and moving devices with no battery or very limited battery consumption requirements. In addition, the standard provides modes that allow for precision ranging. PHYs are defined for devices operating various license-free bands in a variety of geographic regions.**5.2.b. Scope of the project:** This amendment defines a Low Power Wide Area Network (LPWAN) extension to the IEEE Std 802.15.4 Low Energy, Critical Infrastructure Monitoring (LECIM) PHY layer to cover network cell radii of typically 10-15 km in rural areas. It uses the LECIM PHY Frequency Shift Keying (FSK) modulation schemes with extensions to lower bit-rates (e.g. payload bit-rate typically <30 kb/s). Additionally, it extends the frequency bands to additional sub-GHz unlicensed and licensed frequency bands to cover the market demand. For improved data integrity in channels with high levels of interference, it defines mechanisms for the fragmented transmission of Forward Error Correction (FEC) code-words, as well as time and frequency patterns for the transmission of the fragments. Modifications to the Medium Access Control (MAC) layer, needed to support this PHY extension, are defined.**5.3 Is the completion of this standard dependent upon the completion of another standard:****5.4 Purpose:** The standard provides for ultra low complexity, ultra low cost, ultra low power consumption, and low data rate wireless

connectivity among inexpensive devices. In addition, one of the alternate PHYs provides precision ranging capability that is accurate to one meter. Multiple PHYs are defined to support a variety of frequency bands.

**5.5 Need for the Project:** There is significant commercial interest in LPWANs on the part of Wireless Carriers, Utilities, and others around the world as part of their Internet of Things (IoT) arsenal. According to analyst reports, LPWANs are increasingly being used to achieve cost-effective connectivity for billions of devices spread over large areas where low power (i.e. long battery life or harvested energy) and long range are important factors and where data rate and low latency are not.

A main functional requirement for LPWANs is achieving improved link margin of typically 155 dB - 160 dB to deal with interferers and achieve distances of typically 10 km - 15 km in rural areas using a low transmit power (typically 14 dBm), while maintaining low energy consumption. This translates to minimum required receiver sensitivities on the order of -140dBm or better. These needs have driven the increased use of sub-GHz bands over the recent years by various proprietary solutions.

Current standards have not been designed for a very high link margin in license-exempt frequency bands with strong interference while minimizing power consumption and achieving multiyear battery life. To compound matters, interference issues are expected to increase with wide deployment of IEEE Std 802.11ah. The end result is the inability to achieve the required transmission reliability in such scenarios. This amendment is needed to close this gap and to provide adequate receiver sensitivities of typically -140 dBm while still delivering multiyear battery life.

**5.6 Stakeholders for the Standard:** Chip Vendors, Product Manufacturers, Wireless Carriers, Utilities, Cities, Agriculture, Infrastructure/Environmental Monitoring Organizations.

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### 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

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**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

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### 8.1 Additional Explanatory Notes: 5.5 Need for Project:

1. IEEE Std 802.11ah, Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Sub 1 GHz License Exempt Operation
2. -140 dBm is the typical sensitivity in current Low Power Wide Area Systems. A bit-rate of 1 kb/s is sufficient for many LPWA IoT applications.