IEEE P802.11
Wireless LANs

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| A PAR Proposal for Wake-up Radio |
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Abstract

This submission includes a PAR proposal for the IEEE 802.11 Wake-up Radio (WUR) Study Group.

# PAR

**P802.11**

**Submitter Email:**
**Type of Project:** Amendment to IEEE Standard 802.11
**PAR Request Date:** November 2016
**PAR Approval Date:** November 2016 **PAR Expiration Date:** November 2020 **Status:** Unapproved PAR, PAR for an amendment to an existing IEEE Standard

**1.1 Project Number:** P802.11TBD
**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 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications-- Amendment: Low-power wake-up radio operation

**3.1 Working Group:** Wireless LAN Working Group (C/LM/WG802.11)
**Contact Information for Working Group Chair**

**Name:** Adrian Stephens
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**Contact Information for Working Group Vice-Chair Name:** Jon Rosdahl
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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
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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:**November 2019
**4.3 Projected Completion Date for Submittal to RevCom:**July 2020

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

**5.2.a. Scope of the complete standard:**The scope of this standard is to define one medium access control (MAC) and several physical layer (PHY) specifications for wireless connectivity for fixed, portable, and moving stations (STAs) within a local area.

**5.2.b. Scope of the project:**This amendment defines a physical (PHY) layer and defines modifications to the medium access control (MAC) layer specifications that enables operation of a wake-up radio (WUR). The wake-up packets carry only control information. The reception of the wake-up packet by the WUR can trigger a transition of the primary connectivity radio (used for transfer of normal 802.11 packets) out of sleep. The WUR, used as a companion radio to the primary connectivity radio, has active receiver power consumption of less than one milliwatt.

This amendment defines operations for 2.4 GHz and 5 GHz bands.

The new amendment enables coexistence with legacy IEEE 802.11 devices operating in the same band.

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

**5.4 Purpose:**The purpose of this standard is to provide wireless connectivity for fixed, portable, and moving stations within a local area. This standard also offers regulatory bodies a means of standardizing access to one or more frequency bands for the purpose of local area communication.

**5.5 Need for the Project:** Low power devices manifest themselves in a number of applications and Internet-of-Things (IOT) usage cases. These use cases include healthcare, smart home, industrial sensors, wearables, etc. Devices used in these applications are usually powered by a battery. Prolonging the battery lifetime while in some use cases also maintaining low latency becomes an imperative requirement. A typical OFDM active receiver consumes tens to hundreds of milliwatts. To further reduce power consumption, devices use power save modes. Devices based on the power save modes of the IEEE 802.11 standard periodically wake up from a sleep state to receive information from an access point (AP) and to know whether there are data to receive from the AP. The longer the devices stay in the sleep state, the lower power the devices consume but at the expense of increased latency of data reception. Therefore, for the 802.11 standard to be competitive, the IEEE 802.11 WG needs to develop power efficient mechanisms to be used with battery-operated devices while maintaining low latency where it is required. This project addresses this need. This project is also expected to benefit traditional devices with WLAN interfaces such as smartphones.

**5.6 Stakeholders for the Standard:** Manufacturers and users of semiconductors, personal computers, enterprise networking devices, consumer electronic devices, home networking equipment, producers of industrial sensors, mobile devices, and cellular operators.

**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.b**

* While this project focuses on the specification of the PHY and the MAC layers of the WUR operation, it is expected that minor changes to the IEEE 802.11 MAC layer may be needed, e.g. the introduction of a new capability element, etc.
* The new amendment utilizes the existing privacy and encryption methods, and if needed includes new functionality to alleviate the possibility of security vulnerabilities.In scenarios where low latency is a requirement, the WUR should decrease overall power consumption of the STA without significant increase in latency (relative to the current maximum latency of the nominal duration of one beacon interval, 102.4 ms) in transferring user data packets.The supported range of the wake-up signal will be no less than the supported range of the primary IEEE 802.11 signal of at least 20MHz payload bandwidth.
* The specification can be expanded to the license-exempt sub-1GHz frequency bands if needed.

In order to enable a wider set of use cases, both AP and non-AP types of STAs can be equipped with a WUR that can receive wake-up packets.