**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | **<Short descriptions of 4 SG formation requests from 802.15 WG>** | |
| Date Submitted | [7 March, 2021] | |
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| Re: | [Response to requests from 802 EC members for further information on SG formation requests from 802.15 WG.] | |
| Abstract | [Short preliminary descriptions of four SG formation requests from 802.15 WG.] | |
| Purpose | [To provide preliminary descriptions of the four project proposals from the IEEE 802.15 WG to allow a more informed IEEE 802 EC vote at the closing plenary of the March 2021 Plenary] | |
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In the opening 802 EC meeting of the March 2021 Plenary there were numerous questions as to the descriptions of the project proposals for which the 802.15 WG will request Study Group formation.  Following on Clint Chaplin’s comment, it is my understanding that the requests for Study Group formation is to examine these project proposals to determine if there are needs for new standards to be developed, and if so, to clearly define those needs.  This email is intended to provide preliminary descriptions of the following four project proposals to allow a more informed 802 EC vote at the closing plenary of the March 2021 Plenary.

1) IEEE Std 802.15.6 amendment: for enhanced dependability, doc [15-21-0030-01](https://mentor.ieee.org/802.15/dcn/21/15-21-0030-01-0dep-amendment-of-ieee802-15-6-wban-ieee-802-15-6a-par-draft.docx), additional information: [15-21-0023-00](https://mentor.ieee.org/802.15/dcn/21/15-21-0023-00-0dep-ig-dep-activity-for-amendment-of-15-6-ban-with-enhanced-dependability.pdf).

Scope of the Project: This amendment to the IEEE Std 802.15.6 body area network (BAN) defines an enhanced dependability BAN (EDBAN), for medical stakeholders, healthcare medical manufactures, research institutions, automotive stakeholders, automotive manufacturers, and car electronic manufacturers.    
For those environments with multiple very small networks (referred to as piconets), EDBAN will address intra-BAN interference, inter-piconet interference between narrowband and wide-band, and inter-piconet interference between multiple wide-band networks.  
Additionally, a simpler with increased reliability media access control (MAC) protocol will be defined that will address the delay times necessary for sensing and control loops.  Finally, the introduction of ranging and localization or positioning capability may be added.   
Use cases of IEEE Std 802.15.6 BAN is primarily medical use and additionally non-medical uses. This amendment for EDBAN adds automotive use for a "vehicular body” to the primary medical use for a human body due to their similar need for enhanced dependability. These use cases are expected to embody multiple BANs where user devices travel though the coverage ranges of other BANs, multiple piconets, where narrowband and wide-band devices dwell within the same coverage range, and interference management among BANs.

Need for Project: Medical healthcare along with automotive equipment and manufacturers need a BAN with an enhanced dependability beyond IEEE Std 802.15.6-2012 due to the increasingly dense coverage of multiple piconets and new capabilities and functionalities while maintaining backward compatibility with IEEE Std 802.15.6-2012.  In developing markets, an EDBAN can also be applied to remote medical healthcare monitoring and therapy to support the fight against pandemics and to support quality of life in an aging population.  In the automotive industry, there is a need for enhanced dependability for automotive sensing and controlling in autonomous vehicular driving and factory automation.

Needs for EDBANs in environments such as multiple piconets and new use cases including:

a)  In cases of colocation of multiple BANs: IEEE Std 802.15.6-2012 may not be sufficiently dependable against contention and interference among collocated BANs. The more BAN uses in dense area, the more contention and inference cause performance degradation.

b)  In case of coexistence with other radios, the ultra wide-band (UWB) physical layer (PHY) of IEEE Std 802.15.6-2012 may not be sufficiently dependable to avoid performance degradation due to interference with coexisting other narrow band and UWB radio networks in an overlapped frequency band.

c)   In case of feedback sensing and control loops: the MAC of IEEE Std 802.15.6-2012 is not sufficiently efficient and stable for remote sensing and feedback controlling loops such as remote vital sensing and diagnosis loop and a remote vehicle and factory sensing and actuators and robotics controlling loop.

d)  Interoperability and transparency with other radio networks, more flexible network topology,  and ability to coexist with other standards such as European Telecommunications Standards Institute (ETSI) SmartBAN

e)  Capability of ranging and positioning enhanced dependability for mobility of EDBAN in various environment needs ranging and tracking capability and for security of EDBAN needs location information.

*802.15 WG Chair’s note:*  *The above description does not explicitly address the issue of timeliness of delivery which could be critical for many of the use cases noted above.  In other words, “better late than never” could easily be an erroneous assumption. The 802.15 WG chair has requested the proposed Study Group to work with the IEEE 802.1 WG for methods combining reliability with deterministic behavior.*

2) IEEE Std 802.15.4 amendment: Enhanced Ultra Wide-Band (UWB) Physical Layers (PHYs) and Associated MAC Enhancements, doc [15-21-0126-01](https://mentor.ieee.org/802.15/dcn/21/15-21-0126-01-nuwb-p802-14-4ab-par-draft-from-myproject.pdf)

Scope of the project: This amendment enhances the Ultra Wide-Band (UWB) physical layers (PHYs) media access control (MAC), and associated ranging techniques while retaining backward compatibility with enhanced ranging capable devices (ERDEVs).  
Areas of enhancement include: additional coding, preamble and modulation schemes to support improved link budget and/or reduced air-time; additional channels and operating frequencies; interference mitigation techniques to support higher density and higher traffic use cases; improvements to accuracy, precision and reliability and interoperability for high-integrity ranging; schemes to reduce complexity and power consumption; definitions for tightly coupled hybrid operation with narrowband signaling to assist UWB; enhanced native discovery and connection setup mechanisms; sensing capabilities to support presence detection and environment mapping; and mechanisms supporting low-power low-latency streaming as well as high data-rate streaming allowing at least 50 Mbit/s of throughput.  
Need for the Project: The application of UWB has expanded and is included in many kinds of devices including high volume consumer platforms. UWB is being applied to an ever wider range of applications using the unique capabilities of UWB to provide very accurate ranging, localization, sensing and data communication with excellent coexistence properties. New applications require added flexibility and scalability varying in size, shape and number of devices in a network from a few devices within a meter or less of each other to hundreds or more devices with distances of up to 100m. This amendment enables use of the standard in application areas previously addressed with non-standard solutions. The project addresses demands of users in the consumer, public health, industrial and transportation sectors using UWB in widely varying environments.

3) New standard focused only on IEEE 802.15.4 Ultra-Wide-Band (UWB) devices, doc [15-21-0132-00](https://mentor.ieee.org/802.15/dcn/21/15-21-0132-00-0000-new-standard-ig-background.ppt)

The formation of a Study Group within IEEE 802.15 will spearhead the interest of the 802.15 WG wishing to create a new standard focusing not only on the PHY, and MAC but also the link layer control (LLC) aspects of a next generation UWB.

This new standard will build upon the UWB present in IEEE Std 802.15.4 (15.4a, 15.4f, 15.4z, and the proposed TG4ab). Although the new standard is intended to be backward compatible with IEEE 802.15.4 UWB devices, it is anticipated that additional functionality that is not present in IEEE Std 802.15.4 will allow a broader group of new users and new markets to benefit from the UWB advantages of providing communications along with ranging.

Although the effort behind the 802.15.12 task force has halted since the Covid 19 pandemic, many of the concepts of an LLC for IEEE 802.15.4 devices defined in the IEEE 802.15.12 effort could provide benefits for UWB devices. These concepts include EtherType, device discovery, providing the MAC with network setup information, and providing specific application interface needs.

4) New standard focused only on IEEE 802.15.4 Narrow Band (NB) devices, doc [15-21-0125-00](https://mentor.ieee.org/802.15/dcn/21/15-21-0125-00-0000-narrow-band-interest-group-request.pptx)

The formation of a Study Group within IEEE 802.15 will spearhead the interest of the 802.15 WG wishing to create a new standard focusing on the content of IEEE Std 802.15.4 covering NB PHYs with the following initial ideas on scope for the NB specification:

* Support Version 1 and 2 frame adopters (e.g. Zigbee Alliance, Wi-SUN, Thread Group, ISA100, etc.)
* Support all other amendments related to use of Narrowband PHYs

The NB Study Group will work with NS-UWB Study Group to ensure that both standards are complementary.