IEEE P802.15
Wireless Personal Area Networks

Project	IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)
Title	PSC Study Group Draft 5C
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Re:	
Abstract	PSC Study Group.
Purpose	To develop a standard within the 802.15 WG.
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<PSC 5 Criteria>

1. Broad Market Potential

a) Broad sets of applicability.

The proposed standard opens up new markets with its capabilities and new advanced features such as its concurrent multi rate information delivery, group broadcasting capability, concurrent multichannel connectivity, superior synchronization capability, low latency and other differentiating features which have not been feasible with the current technologies.
Applications demanding the proposed standard for PSC include multiple peer to peer communication, group games, conferencing, multi-lingual simultaneous interpretation system, personal broadcasting, stereo wireless karaoke, wireless tour guide, wireless audio, drive-in shop operations audio, Mobile VoIP, Internet radio, mobile IPTV, remote control, wireless PBX, and convergence of such applications.
As the speed of data access on the network and the amount of media contents on the web increase, and the activities by a user become diversified in different aspects, there will be increasing demand for seamless connectivity between an individual user and the network and devices surrounding the users as she or he moves around. Due to technical limitation of the currently available standard solutions, these markets have been underserved. Therefore, it is expected that, because of its features optimized for personal space communications, PSC will be a vital component in a new communication paradigm, "5G communications" where a user is the center of all the connectivity. The new communication paradigm will open up additional sets of applications that are not practically feasible with currently available solutions including personalized environment setting, remote personal device management and future ubiquitous & 5G mobile communication

b) Multiple vendors and numerous users

Participation of members from various industry sectors and institutions including international wireless industry, academic researchers, system integrators, consumer electronics companies, and potential end users in the IEEE 802.15 PSC study group demonstrate the broad interest in the utilization of personal space communication technologies. The standard will be optimized to meet the cost and other requirements from these sectors to ensure broadening the markets and increasing the number of target users. Availability of the technology for use at reasonable license fee and a huge potential of new markets will be a base of benefits due to the economy of scale in the long term. The target user base will be large as indicated by the growing demand for ubiquitous connection without human interaction such as remote sensor, remote bio-monitoring and personal environment service.

c) Balanced costs (LAN versus attached stations)

Despite of broader and superior functionalities and capabilities, the technology is of such a simplistic form without much increased complexity. That's why solutions can be implemented and chips can be manufactured at a price comparable to other PAN solutions such as Bluetooth and ZigBee. The proposed project will be developed with the aim that the connectivity costs will be a reasonably small fraction of the cost of the target devices such as sensors, tags, human-interface devices, etc.

2. Compatibility

IEEE 802 defines a family of standards. All standards shall be in conformance with IEEE 802.1 Architecture, Management and Interworking. All logical-link-control (LLC) and media-access (MAC) standards shall be compatible with ISO 10039, MAC Service Definition 1, at the LLC/MAC boundary. Within the LLC Working Group there shall be one LLC standard, including one or more LLC protocols with a common LLC/MAC interface. Within a MAC Working Group there shall be one MAC standard and one or more Physical Layer standards with a common MAC/Physical layer interface. Each standard in the IEEE 802 family of standards shall include a definition of managed objects, which are compatible with OSI systems management standards.

Note: This requirement is subject to final resolution of corrections and revision to current ISO 10039, currently inconsistent with ISO 8802 series standards.

3. Distinct Identity

a) Substantially different from other IEEE 802 standards

There are standards that could serve parts of the PSC, but no single standard supports all combinations of simultaneous use of multiple channels, dynamic scalability of data rates, QoS (reliability and latency), low power consumption, fast device synchronization and association, device management, security control and configurability of topologies adaptable to new services required to address the variety of personal space applications

i) Dynamic scalability of data rates in a frame

Various devices associated to a user in a personal space have their unique services and features demanding variety of data rates with low latency for most cases. This fact requires data rates dynamically scalable in a data frame to be adapted to abrupt service requests for personal environment control without human interruption.

ii) Concurrent broadcasting of multiple various-rate multimedia streams

Multiple streams of low to medium rate multimedia can be simultaneously broadcast within a personal space area to unlimited number of receivers. In addition to the capacity and scalability, such simultaneous broadcast streams do not cause interference to neighboring networks or connectivity between devices. .

iii) Multi-peer group communication

The standard needs to enable m to n media streaming connectivity with up to multiple stereo-audio and multiple stereo voice channels according to the anticipated specification. This is implemented by the unique structure and features that enable a device to listen to multiple channels on the network at the same time.

iv) Low latency

The target one-way latency from a transmitting party to a receiving party is less than 10ms for mono audio and 20ms for stereo audio. Such low latency is essential for highly interactive real time applications

b) One unique solution per problem (not two solutions to a problem)

The Personal Space Communications (PSC) Standard will consist of one Medium Access Control and Physical Layer per problem.
The standard will address a unique solution for personal space communications in free space. The standard will provide short-range communication using the unlicensed band and target various applications such as secure point-to-point communication; indoor location-based services (LBS); secure point-to-multipoint communication (office, home); information broadcast, etc.

c) Easy for the document reader to select the relevant specification

The proposed PSC standard will be a distinct document with clearly distinguishable specifications

4. Technical Feasibility

a) Demonstrated system feasibility

More than one Million chips and devices using the technology standardized as ISO/IEC 29157, which is proposed to be a baseline of extension for PSC, have been already deployed and in use in the market. Products powered with the technology includes Educational Interactive Wireless Microphones, Wireless Microphones for Conferencing, Portable Conference Master, and Wireless Stereo Microphones for both Home and Commercial Karaoke. These products have been introduced to the market for the past five years. As an example, almost all Wireless Home Stereo Karaoke systems sold in the worldwide market are products utilizing the PicoCast, an

ISO version of the proposed PSC technology. These demonstrate feasibility of the proposed technology and its implementation in the form of chips as well as products built with the technology.

b) Proven technology, reasonable testing

The current version of the chip is the result of more than 10 years of R&D. Each version of the past system chips has gone through rigorous testing before being put into the market. The technology is well proven both by laboratory testing and market acceptance.

c) Confidence in reliability

The current chip has gone through 5 times of redesign and repackaging. Considerable improvements in terms of the cost and the final reliability of the chip have been achieved during the past few years, and they have been proved by the real users. Therefore, it is convinced that the performance of the technology is as solid and reliable as can be.

Coexistence of 802 wireless standards specifying devices for unlicensed operation

The proposed PSC can coexist in the same spectrum band with other wireless technologies such as Bluetooth, ZigBee, and WiFi. A "listen-before-transmit" mode is set as a default to avoid interference cased by collision between any hopping channels of other collocated technologies.

5. Economic Feasibility

a) Known cost factors, reliable data

The complexity of both PHY and MAC are comparable to the other competing WPAN technologies. Chips can be produced at a cost comparable to those of other existing technologies.

b) Reasonable cost for performance

In spite of the proposed system's superior performance and many features not to be found in other existing technologies, the costs of end products can be comparable with others and fairly reasonable for vendors and ultimate users.

c) Consideration of installation costs

There's no substantial installation cost involved. As soon as multiple PSC devices come in proximity to each other, automatic master selection and grouping processes will take place to setup an instantaneous connectivity. Although use of AP-like device might be useful in certain application scenarios, no fixed AP-like device is a mandatory requirement for operations in many cases.