**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
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| Re: | Low Energy Critical Infrastructure Monitoring (LECIM) Study Group | |
| Abstract | SG LECIM 5C | |
| Purpose | Draft document for study group | |
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**FIVE CRITERIA**

1. **Broad Market Potential**

*A standards project authorized by IEEE 802 shall have a broad market potential. Specifically, it shall have the potential for:*

*a) Broad sets of applicability.*

*b) Multiple vendors and numerous users.*

*c) Balanced costs (LAN versus attached stations).*

1. **Broad sets of applicability:**

There is significant interest for Low Rate Wireless Personal Area Networks (LR-WPAN) in the low energy critical infrastructure monitoring market. Examples of applications in this market are:

Water leak detection, wastewater monitoring, bridge/structural integrity, streetlight control systems, faulted circuit indicators, soil monitoring, oil & gas pipeline monitoring

1. **Multiple vendors and numerous users:**

There are a number of vendors that provide variety of proprietary solutions for Low Energy Critical Infrastructure Monitoring (LECIM) applications. Standardization is needed for interoperability.

The breadth of membership of this WPAN Low Rate Study Group, demonstrates the interest in this class of WPANs. Members include international wireless industry leaders, academic researchers, semiconductor manufacturers, system integrators, and end users. Already there are many vendors addressing LECIM wireless networks and are promoting the current study group.

The target user base will be large as indicated by the growing demand for wireless monitoring of almost all devices.

1. **Balanced costs (LAN versus attached stations):**

The proposed amendment to IEEE 802.15.4 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, and other monitoring devices.

1. **Compatibility**

*IEEE 802 defines a family of standards. All standards shall be in conformance with the IEEE 802.1 Architecture, Management, and Interworking documents as follows: 802 Overview and Architecture, 802.1D, 802.1Q, and parts of 802.1f. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with 802.*

*Each standard in the IEEE 802 family of standards shall include a definition of managed objects which are compatible with systems management standards.*

This amendment will not affect the IEEE 802.15.4 standard’s compliance with the IEEE 802 Architecture, Management, and Interworking documents as required. There is no specific technology feature anticipated in the amendment that could preclude this compliance.

1. **Distinct Identity**

*Each IEEE 802 standard shall have a distinct identity. To achieve this, each authorized project shall be:*

*a) Substantially different from other IEEE 802 standards.*

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

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

1. **Substantially different from other IEEE 802 standards:**

IEEE 802.15.4 supports wireless sensor and control applications. Without this amendment, IEEE 802.15.4 will not adequately support the low energy critical infrastructure monitoring application requirements such as:

* Simultaneous operation for at least 8 co-located orthogonal networks
* Propagation path loss of at least 120 dB
* 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

The current IEEE 802.16 M2M PAR calls for changes to the MAC, and no substantial change to its PHY. While it does state the enhancements as 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.

IEEE 802.22 is intended to provide broadband services to rural subscribers, which does not address the need for multiyear battery life.

IEEE 802.11 is designed for higher data rates which limit both range and battery life to less than that required by LECIM applications.

1. **One unique solution per problem (not two solutions to a problem):**

The proposed amendment to IEEE 802.15.4 will provide a unique solution for the low energy critical infrastructure monitoring market.

1. **Easy for the document reader to select the relevant specification.**

The proposed amendment to IEEE 802.15.4 will be a clearly distinguishable specification.

1. **Technical Feasibility**

*For a project to be authorized, it shall be able to show its technical feasibility. At a minimum, the proposed project shall show:*

*a) Demonstrated system feasibility.*

*b) Proven technology, reasonable testing.*

*c) Confidence in reliability*.

1. **Demonstrated system feasibility.**

Many systems are in operation that have been built using proprietary wireless Supervisory Control And Data Acquisition (SCADA), cellular and proprietary technologies such as high processing gain DSSS, and narrowband licensed systems.

1. **Proven technology, reasonable testing.**

The main components of radio technology and signaling are in use today.

1. **Confidence in reliability.**

There are a variety of proprietary systems in operation today, and their reliability is factored into the services offered.

**Coexistence of 802 wireless standards specifying devices for unlicensed operation**

The WG will create a coexistence assurance document as a part of the WG balloting process.

1. **Economic Feasibility**

*For a project to be authorized, it shall be able to show economic feasibility (so far as can reasonably be estimated), for its intended applications. At a minimum, the proposed project shall show:*

*a) Known cost factors, reliable data.*

*b) Reasonable cost for performance.*

*c) Consideration of installation costs.*

1. **Known cost factors, reliable data.**

High volume critical infrastructure monitoring applications will drive volume production and provide a low cost source of components. IEEE 802.11, IEEE 802.15.1, and IEEE 802.15.4 are examples of the industry’s ability to create low cost radios.

1. **Reasonable cost for performance.**

Based on test results, prototype, and production solutions meet expected size, cost, and power requirements. The cost and performance of single chip radios such as IEEE 802.15.4 is well understood, and this amendment is expected to have a similar complexity.

**c) Consideration of installation costs.**

For LECIM applications, the infrastructure is typically professionally installed. The standard will address the needs of professional installer in addition to providing for non-skilled installation.