**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 Study Group |
| Abstract | SG LECIM 5C draft  |
| 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).*

Project Study Group 802.15: Low Energy Critical Infrastructure Monitoring: (LECIM) Definition

* Addressing assets and infrastructure essential for the functioning of a society and economy
	+ Water supply, energy production and distribution, agriculture, transportation, security services, bridges, levees, etc.
	+ More at <http://en.wikipedia.org/wiki/Critical_infrastructure>
* Why is monitoring needed?
	+ Preventive maintenance: repairs can be scheduled, costs are reduced
	+ Safety: prevention of catastrophic failures, environmental damage, hazardous leaks/spills
	+ Reliability: reduces outage and speeds restoration of service
	+ Cost reduction through improved operations and efficiency
* Applications represent many millions of low cost low complexity endpoints which cannot be cost effectively addressed by existing technologies due to infrastructure costs, harsh environments including below ground operations and requiring no mains power
1. **Broad sets of applicability:**

The variety of applications that comprise the applications submitted during the work group share many common requirements and functional elements and represent low data rate monitoring and tracking applications in harsh environments, such as the following vertical market applications:

During the study group phase 15 applications were described within the participant members within the application criteria described above.

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

The technologies involved in enabling LECIM can be enabled by a variety of infrastructure/Access Point vendors chipsets can be developed by a variety of vendors and also applications can be provided using this standard by numerous industry players as has been evidenced during the study group phase with participation on international level.

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

The technologies used in LECIM provide a varying level of balance between infrastructure, server and end-point devices which may be stationary or mobile depending on the specific applications the ratio of end-points will be far higher than for other standards efforts. Typically the applications requirements are many devices communicating small amounts of information over large geographic areas which require low infrastructure costs to meet intended use case and business requirements

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 be in compliance with the IEEE 802. Architecture, Management, and Interworking documents as required. There is no specific technology feature anticipated in the standard 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:**

This standard is unique in its objective of providing a low-data rate operations in harsh environments while maintaining low infrastructure cost, operations complexity and operations without mains power.

* Application requirements for critical infrastructure monitoring
	+ Low energy
	+ Low data rate, payload and duty cycle
	+ Low cost infrastructure and endpoints
	+ Low maintenance
	+ High link margin for challenging environments
* Application space is not well served by any existing or planned standards
1. **One unique solution per problem (not two solutions to a problem):**

A brief summary of the distinct nature versus existing and planned standards includes:

802.11 WLAN

* Optimized for computing (and smart phone) applications demanding high data rate, high duty cycle, and high performance in areas such as QOS and roaming
* Small link margin: Local area coverage (hot spots) results in high infrastructure cost
* High power, not suitable for multi-year battery life for small packet/low data rate applications

802.15. 4 2006

* Unlicensed spectrum
* Low complexity
* Compatible data rates
* Not designed for outdoor propagation environment
* Short range
* Requires powered network infrastructure to extend range
* Low capacity of nodes per collector

802.15.4g

* Neighborhood area range
* Higher data rate per node
* Higher power consumption
* Focused on forming connectivity for electric meters
* System trade-offs make use of fact that mains power is available for most end nodes
* Uses mesh for range enhancement
* Large payload not suitable for low energy, low data rate

802.16 WMAN

* Broadband Wireless Access Working Group
* High infrastructure requirement
* Not suitable for multi-year battery
* Principally licensed band operations
1. **Easy for the document reader to select the relevant specification.**

The title of this standard and the scope is distinct enough for document readers to discern the application of this standard.

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.**

Today many LECIM systems have been built using proprietary Wireless SCADA, cellular technology and other proprietary technologies such as narrowband licensed spectrum systems

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

Participants in the study group have proven high link margin low energy operation for wide area outdoor environments and testing results have been published on numerous application proposals and industry publications

1. **Confidence in reliability.**

**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.

**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.**

Due to the applications requirements to be deployed across large geographic areas with minimal infrastructure costs the participants have identified numerous technologies deployed today that are candidates to support LECIM’s requirements

1. **Reasonable cost for performance.**

All network elements are deemed to require low cost components;

* Low cost low complexity end-point chip sets are known to be capable to support application requirements
* Infrastructure networking points and servers are easily within existing computing technology bounds

**c) Consideration of installation costs.**

Due to the relatively fewer network infrastructure elements required due to the low data rate requirements installation costs should represent a relatively small portion of total cost of the system

***References:***