**5 Criteria- P802.22.1a, Amendment to IEEE Std. 802.22.1-2010**

**1. Broad Market Potential**

**a) Broad sets of applicability**

The proposed amendment will enable an advanced beaconing technology that will open up many new frequency bands for sharing while protecting many primary users of the band to include radars, commercial federal/defensecommunications, space to earth satellite links, sensors, etc.

**b) Multiple vendors and numerous users**

This amendment will enable spectrum sharing between federal and commercial users while providing protection to many primary users of the band to include radars, commercial federal/defense communications, space to earth satellite links, RF sensors, etc . It also has broad applicability to purely commercial use cases such as geocaching, policy beaconing etc. The new features of the amendment are expected to bring new equipment vendors.

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

It is expected that the new features of the amendment can be implemented with reasonable cost resulting in overall better value.

**2. Compatibility**

The amendment will be compatible with IEEE 802 family of standards, specifically 802 overview and architecture, 802.1 including 802.1D and 802.1Q.

**3. Distinct Identity**

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

There is no other IEEE 802 standard or project, for advanced beaconing that is currently being used for spectrum sharing between commercial and federal users. This amendment will allow that.

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

Spectrum sharing between federal and commercial users utilizing advanced beaconing approaches is currently not being considered by any other wireless standards or project.

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

Yes, since the proposed standard will produce an amendment to the IEEE std. 802.22.1-2010.

**4. Technical Feasibility**

**a) Demonstrated system feasibility**

Beacons have been reliably used in many different forms since more than 90 years and deployed for protection of many different types of systems that exist today (<http://ed-thelen.org/TJohnson-LFRDF/TJohnson-LFRDF.html>).

IEEE Std. 802.22.1-2010 beacon was designed for the purposes of protecting Part 74 device systems (e. g. wireless microphones) in the Television Bands. Extensive studies were conducted and a beaconing approach was found to be feasible, robust and reliable by a wide variety of participating organizations including the chipset vendors, TV Broadcasters etc.

IEEE 802.22.1-2010 uses direct sequence spread spectrum (DSSS) technology that has been widely adopted in many standards based products for more than a decade. The DSSS PHY and TDMA based MAC technologies have been wide deployed and hence are feasible., it will not require expensive transmit receive switches hence keeping the system complexity low and making it feasible.

 **b) Proven technology, reasonable testing**

Beacons have been reliably used in many different forms since more than 90 years and deployed for protection of many different types of systems that exist today.

IEEE 802.22.1-2010 uses direct sequence spread spectrum (DSSS) which is a proven technology that has been widely adopted in many standards based products for more than a decade and it has been reasonably tested. The cost factors to implement DSSS and TDMA based MAC are well known today.

**c) Confidence in reliability**

IEEE Std. 802.22.1-2010 beacon was designed for the purposes of protecting Part 74 device systems (e. g. wireless microphones) in the Television VHF / UHF Bands. Extensive studies were conducted and a beaconing approach was found to be feasible, robust and reliable by the TV Broadcasters to protect their own systems. Although, the regulators decided to allocate dedicated channels to Part 74 devices, and provide protection via a database service they did consider beaconing to be a viable and a reliable approach.

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

This amendment supports mechanisms to enable coexistence with other 802 systems in the same band. A coexistence assurance document will be produced by the WG as a part of the WG balloting process.

**5. Economic Feasibility**

**a) Known cost factors, reliable data**

IEEE 802.22.1-2010 uses direct sequence spread spectrum (DSSS) technology that has been widely adopted in many standards based products for more than a decade. The cost factors to implement DSSS and TDMA based MAC are well known today.

**b) Reasonable cost for performance**

The IEEE 802.22.1 systems are designed to serve as beacon transmitter and receivers. These beacon transmitters and receivers are expected to be inexpensive. Also, since each these beacons are detectable at a low Signal to Noise Ratio (SNR) (e. g. IEEE Std. 802.22.1-2010 based beacon can be detected at -114 dBm) it is likely to support operation over a large area. Hence the cost of deployment over a large area is likely to be reasonable.

**c) Consideration of installation costs**

Installation costs will be those of the IEEE 802.22-2011 base standard and are expected to be reasonable.