

## 5 Criteria- P802.22b, Amendment to IEEE Std. 802.22-2011

### 1. Broad Market Potential

#### a) Broad sets of applicability

The proposed amendment will enable a number of new broadband applications in television white spaces (TVWS) in the context of wireless regional area networks by combining broadband services and monitoring applications.

#### b) Multiple vendors and numerous users

It is expected that this amendment will be applicable in all markets where the 802.22 technology will be used. 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 ~~for money~~.

### 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 combined broadband services and monitoring applications aimed at wireless regional area networks using television white space bands.

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

Combined broadband services and monitoring applications for wireless regional area networks by using television white space bands are not currently considered by any other wireless standard or project. Hence, this is the only solution to this problem.

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

Yes, since the proposed standard will produce an amendment to the IEEE std. 802.22-2011.

### 4. Technical Feasibility

#### a) Demonstrated system feasibility

TVWS regulations have not been finalized in any regulatory domain. The United States is ahead and testing of database service is on-going. No overall testing and certification programs have been defined, but experimental licenses have been issued. Since there are no regulatory organizations that allow commercial deployment of wireless systems in TVWS bands, fulfilling the requirements to operate in TVWS bands cannot be demonstrated commercially.

However, there are cognitive radio prototypes that have demonstrated fulfilling the requirements to operate in TVWS bands.

Reference 1: <https://mentor.ieee.org/802.22/dcn/11/22-11-0138-00-rasg-singapore-tvws-trial-publication.pdf>

Reference 2: <http://202.194.20.8/proc/MILCOM2010/papers/p2422-mody.pdf>

The physical layer (PHY) and medium access control layer (MAC) technologies used in 802.22, such as orthogonal frequency division multiple access (OFDMA) for PHY and time division multiple access (TDMA) for MAC, have been demonstrated to be feasible by other IEEE 802 standards.

There are entities implementing commercial 802.22 systems, such as:

Carlson Wireless: [http://urgentcomm.com/networks\\_and\\_systems/news/carlson-white-space-radio-20110825/](http://urgentcomm.com/networks_and_systems/news/carlson-white-space-radio-20110825/)

There are a number of examples of successful prototype operation in TVWS by complying with requirements of various regulatory organizations (e.g., Federal Communications Commission (FCC), USA, Infocomm Development Authority (IDA), Singapore, etc.).

#### **b) Proven technology, reasonable testing**

Experimental licenses have been issued for operation in TVWS in many countries (e.g. Federal Communications Commission (FCC), USA, Infocomm Development Authority (IDA), Singapore etc). Communications over TVWS are being tested by regulatory organizations in those countries.

The PHY and MAC technologies used in 802.22, such as OFDMA for PHY and TDMA for MAC, have been thoroughly tested and commercially deployed by other IEEE 802 standards. Cognitive radio technology features to fulfil the requirements to operate in TVWS bands are being tested in prototype form for compliance with requirements of various regulatory organizations (e.g., Federal Communications Commission (FCC), USA, Infocomm Development Authority (IDA), Singapore, etc.).

Reference 1: [http://transition.fcc.gov/Daily\\_Releases/Daily\\_Business/2011/db0914/DA-11-1534A1.pdf](http://transition.fcc.gov/Daily_Releases/Daily_Business/2011/db0914/DA-11-1534A1.pdf)

Reference 2: <https://mentor.ieee.org/802.22/dcn/11/22-11-0138-00-rasg-singapore-tvws-trial-publication.pdf>

#### **c) Confidence in reliability**

Results of TVWS test trial campaigns being carried out by various regulatory organizations provide confidence in the reliability of the proposed project.

Confidence in reliability of operation in TVWS is not known at this time since no commercial deployments have been authorized by any regulator. However, the PHY and MAC technologies used in 802.22 such as OFDMA for PHY and TDMA for MAC, have been deployed by other IEEE 802 standards. Cognitive radio technology features to fulfil the requirements to operate in TVWS bands are being tested for reliability for compliance with requirements of various regulatory organizations (e.g., Federal Communications Commission (FCC), USA, Infocomm Development Authority (IDA), Singapore, etc.).

Reference: [http://transition.fcc.gov/Daily\\_Releases/Daily\\_Business/2011/db0914/DA-11-1534A1.pdf](http://transition.fcc.gov/Daily_Releases/Daily_Business/2011/db0914/DA-11-1534A1.pdf)

#### **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

~~The amendment uses technologies that are well proven in the market in a cost effective manner. IEEE 802.22 uses OFDMA for PHY and a TDMA based MAC. The cost factors to implement an OFDMA PHY and TDMA based MAC are well known today. The mandatory cognitive radio features such as access to database can be easily implemented in software. Other cost factors such as geolocation based on global positioning system (GPS) technology are well known.~~

### b) Reasonable cost for performance

The IEEE 802.22 systems are designed for operation in rural areas where the population density is likely to be low. However, , an IEEE 802.22 base station (BS) covers a large area typically with 30 km radius implying a reasonable cost per geographical unit of coverage. The CPEs are expected to be inexpensive and hence cost for overall network performance would be reasonable.

### c) Consideration of installation costs

~~This amendment will be later combined to the base 802.22 standard resulting in an updated version of IEEE std. 802.22-2011.~~ Installation costs will be those of the updated base standard and are expected to be reasonable.