IEEE P802.22
Wireless RANs

|  |
| --- |
| 5C for Enhanced Broadband and Monitoring Amendment |
| Date: 2011-11-09 |
| Author(s): |
| Name | Company | Address | Phone | email |
| M. Azizur Rahman | NICT | 3-4 Hikari no oka, Yokosuka, Kanagawa, Japan | +81-46-847-5060 | aziz.jp@ieee.org |
| Chang Woo Pyo | NICT |  |  |  |
| Xin Zhang | NICT |  |  |  |
| Chunyi Song | NICT |  |  |  |
| Hiroshi Harada | NICT |  |  |  |
| Apurva Mody | BAE Systems | USA |  |  |
| Sung Hyun Hwang | ETRI | Korea |  |  |
| Gwangzeen Ko | ETRI |  |  |  |
| Shigenobu Sasaki | Niigata University | Niigata, Japan |  |  |
| Gerald Chouinard | CRC | Canada |  |  |
|  |  |  |  |  |

Abstract

This document presents the revised response to the five criteria (5C) for Enhanced Broadband and Monitoring Amendment. This is based on 98r3. This document incorporates resolution to the comments from 802.19 and 802.11 WGs as contained in Document: 22-11-0139 Rev3-RASG

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

**Notice:** This document has been prepared to assist IEEE 802.22. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

**Release:** The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE’s name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE’s sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.22.

**Patent Policy and Procedures:** The contributor is familiar with the IEEE 802 Patent Policy and Procedures

<[**http://standards.ieee.org/guides/bylaws/sb-bylaws.pdf**](http://standards.ieee.org/guides/bylaws/sb-bylaws.pdf)>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair Apurva Mody <apurva.mody@ieee.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.22 Working Group. **If you have questions, contact the IEEE Patent Committee Administrator at <****patcom@ieee.org****>**.

**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/>

 **b) Proven technology, reasonable testing**

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>

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

**c) Confidence in reliability**

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>

**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 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**

Installation costs will be those of the updated base standard and are expected to be reasonable.