IEEE P802.19

Wireless Coexistence

P1900.7 5C				
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Abstract	
Purpose	
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Explanation of How the Project
"MAC and PHY Specification for Fixed and Mobile Operation of White Space Dynamic Spectrum Access Radio Systems"
Meets the Five IEEE SCC41 Criteria for New Standards Projects

1. Broad market application

Each IEEE ComSoc DYSPAN-SC standard shall address a well defined problem or need, be commercially relevant, have applicability to multiple market segments if possible, and cater to an open market where many vendors can play and many users can benefit.

The proposed standard will enable various applications of white space dynamic spectrum access radio systems supporting fixed and mobile operation in frequency bands, such as TV bandsand radiolocation service bands, subject to compliance to national and international radio regulations in these frequency bands. The proposed standard will ensure interoperability between white space radios produced by different manufacturers.

2. Consistency

Each standard in the IEEE 1900 series of standards shall make a contribution to the P1900 family of standards and be developed to be consistent with other standards in the series.

The proposed standard is the first standard in the IEEE 1900 series of standards that will specify radio interface including medium access control (MAC) sublayer and physical (PHY) layer. The proposed standard will provide a means to support P1900.4a for white space management, P1900.5 for policy languages, and P1900.6 to obtain and exchange sensing related information (spectrum sensing and geolocation information).

3. Distinct Identity

Each IEEE ComSoc DYSPAN-SC standard shall have a distinct identity and does not substantially overlap and/or duplicate the work in other existing industry standards.

Currently, there are three standards/projects with a similar scope: ECMA-392 standard, IEEE P802.22 draft standard, and IEEE P802.11af draft standard. Also, IEEE standard 802.16h is related standard.

Compared to all these standards/projects, the proposed standard will provide a means to support collaboration with the IEEE 1900 series of standards, such as P1900.4a, P1900.5, and P1900.6.

The following table summarizes some of the PHY layer features of ECMA-392 standard, IEEE P802.22 draft standard, IEEE P802.11af draft standard, and IEEE 802.16h standard. Also it shows expected PHY layer features of the new standard.

PHY layer feature	ECMA-392	IEEE P802.22	IEEE P802.11af	IEEE 802.16h	New standard (expected)
Multichannel support	No	No	Yes (only continuous channels)	Yes (only continuous channels)	Yes (also discontinuous channels)
Mobility support	Yes	No	No	Yes	Yes (up to 300 km/h)
Maximum throughput	31.56 Mbps	22.69 Mbps	---	134.4 Mbps	Up to several tens of Mbps
Typical range	---	17-33 km	---	10 km	Up to several tens of km
Channelization	6,7,8 MHz	6,7,8 MHz	5,10,20,40 MHz	1.5 to 28 MHz	TBD
Modulation	OFDM	OFDM	OFDM	SC, OFDM	TBD

The following table summarizes some of the MAC sublayer features of ECMA-392 standard, IEEE P802.22 draft standard, IEEE P802.11af draft standard, and IEEE 802.16h standard. Also it shows expected MAC sublayer features of the new standard.

MAC sublayer feature	ECMA-392	IEEE P802.22	IEEE P802.11af	IEEE 802.16h	New standard (expected)
Multichannel support	No	No	No	No	Yes (also discontinuous channels)
Cellular topology support	No	No	No	Yes	Yes
Mobility and handover support	No	No	No	Yes	Yes
Mesh topology support	Yes	No	Yes	No	Yes
Range for best MAC efficiency	---	17-33 km	Short and mid range	Several km	Up to several tens of km
Power efficiency	Yes	No	No	Yes	Yes
Self-coexistence	Yes	Yes	Yes	Yes	Yes
Multiple access method	CSMA/CS, TDMA	OFDMA	CSMA/CS, TDMA	TDMA, OFDMA	TBD

The following table summarizes the cognitive features required for white space communication of ECMA-392 standard, IEEE P802.22 draft standard, IEEE P802.11af draft standard, and IEEE 802.16h standard. Also it shows expected cognitive features of the new standard.

Cognitive feature	ECMA-392	IEEE P802.22	IEEE P802.11af	IEEE 802.16h	New standard (expected)
Interface with spectrum sensors	Yes	Yes	No	No	Yes
Interface with geolocation device	No	Yes	No	No	Yes
Quite periods for spectrum sensing	Yes	Yes	No	No	Yes

Inter-system coexistence	No	No	No	No	Yes
Interface with TVWS database	Yes	Yes	Yes	No	Yes

It is beneficial to develop a new white space radio system standard because, compared to ECMA-392 standard, IEEE P802.22 draft standard, and IEEE P802.11af draft standard, it will have the following new features:

- Full mobility support including handover etc
- Support of cellular and mesh topologies
- Power efficiency for mobile and low power users
- Multichannel support
- Support of inter-system coexistence.

The new standard will enable efficient implementation of the following usage models as compared to ECMA-392 standard, IEEE P802.22 draft standard, and IEEE P802.11af draft standard:

- Wide Area Connectivity usage model due to simultaneous support of long range and high data rate
- Transportation Logistics, Land Mobile Connectivity, and High Speed Vehicle Broadband Access usage models due to full mobility support and support of cellular topology
- Maritime Connectivity usage model due to full mobility support and support of cellular and mesh topologies.

These usage models drive PHY and MAC layer requirements and parameters that can not be met by simple extensions or modifications of ECMA-392, IEEE P802.22 or IEEE P802af. Therefore, a new standards development effort is required.

IEEE 802.16h standard is designed for license-exempt operation and does not have cognitive features for dynamic spectrum access in white space frequency bands, such as, interface with geolocation device, TVWS database, and spectrum sensors, quite periods for spectrum sensing, and support of inter-system coexistence. Compared to IEEE 802.16h standard, the new standard will have all cognitive features that are required for white space communication.

4. Achievable Scope

To make sure that a standard will be successful, for a IEEE ComSoc DYSPAN-SC project to be authorized, it is required to demonstrate that the problem can be solved technically and that the scope is achievable in a 48 month or less time-frame.

In IEEE ComSoc DYSPAN-SC ad-hoc on White Space Radio, the following topics have been studied in details:

- Usage models
- System requirements

- Missing points in other standards on white space radio
- Collaboration with white space networking / management standards
- Potential frequency bands for white space radio.

The proposed standard will define radio interface including MAC sublayer and PHY layer of white space dynamic spectrum access radio system supporting fixed and mobile operation in frequency bands, such as TV bands and radiolocation service bands, subject to compliance to national and international radio regulations in these frequency bands. The completion of a draft for member ballot within 48 months is realistic.

5. Balanced and committed participation

To uphold the IEEE-SA principle of open, balanced, consensus-based, inclusive participation, a project requesting approval shall be scrutinized for balance in the participants. This means that a diversity of stakeholders should be represented. Also, to ensure successful and timely completion of the standard, the project team shall demonstrate commitment to get the standard completed.

Mailing list of IEEE ComSoc DYSPAN-SC ad-hoc on White Space Radio has around 70 members. During the IEEE ComSoc DYSPAN-SC ad-hoc on White Space Radio operation, the average number of participants has been around 20. Participants represent different interest categories including manufacturers, users, academic/research, and government.