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| **Radiocommunication Study Groups** |  |
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| Institute of Electrical and Electronics Engineers (IEEE) |
| [Comments on wireless data transmission technologies used for power grid management systems] |
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# Source Information

This contribution was developed by IEEE Project 802®, the Local and Metropolitan Area Network Standards Committee (“IEEE 802”), an international standards development committee organized under the IEEE and the IEEE Standards Association (“IEEE-SA”).

The content herein was prepared by a group of technical experts in IEEE 802 and was approved for submission by the IEEE 802.18 Radio Regulatory Technical Advisory Group, and the IEEE 802 Executive Committee, in accordance with the IEEE 802 policies and procedures, and represents the view of IEEE 802.

# Introduction

This contribution addresses ITU-R WP 1A’s Question ITU-R 236/1 titled “Impact on radiocommunication systems from wireless and wired data transmission technologies used for the support of power grid management systems”. That question was approved in September, 2011, and IEEE 802 had then and has now a number of Working Groups (WG) developing technologies meant for use in Smart Grid management. Detailed information on those technologies will be furnished in another contribution. The focus of this contribution is the mixture of spectrum to be used for Smart Grid management.

# Technical and operating features and the characteristics of wireless technologies and devices in support of power grid management systems

In general, the Power Grid Management Systems have a wide set of requirements based on application space addressed as described in Table 1.

**Table 1. General Requirements of a Power Grid Management System**

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| Smart Grid Applications | Requirements Addressed by 802 Systems |
| Distribution Automation (DA) * Volt-VAR management
* Conservation Voltage Reduction (CVR)
* Sensor monitoring, management and control
* Other transmission control (e. g. synchrophaser)
 | * Higher speeds required
	+ Volt-VAR management , CVR and other DA applications (Tens of kbits/s) Sensor Monitoring and Management (Up to 1 Mbps / node)
* Reliability and security important
* Low latency needed (Few ms for synchrophaser up to Few seconds for others)
* Low round trip delay requirements
* Star, peer to peer and multi-hop support desired
* In general bi-directional communications
* Interference resilience
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| Smart Metering* AMI
 | * Thousands of devices
* Typically lower speeds per node but trending towards higher refresh rates resulting in higher aggregate throughput – e. g. Tens of kbps/ node
* Non real time is okay
* Star, peer to peer and multi-hop support desired
* Interference resilience
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IEEE 802 has developed and is developing a number of standards for wireless data transmission technologies to support Power Grid Management Systems.

For example, the IEEE 802.22 Working Group has established Task Group ‘b’ amendment project for enhanced broadband services and monitoring applications. The new amendment aims to enhance the IEEE 802.22-2011™ Standard capabilities to accommodate applications such as long range and regional area smart grid and critical infrastructure monitoring using cognitive radio technology in Television White Spaces (TVWS). This new standard will bring advanced wireless technologies and applications to rural and under-served areas around the world.

Frequency bands and spectrum requirements needed in support of power grid management systems?IEEE 802 believes that appropriate licensed and license-exempt spectrum needs to be made available for Power Grid Management Systems.

Regulators in many national administrations have recognized the importance of the Television Band White Spaces (“TVWS”) spectrum. There is an on-going discussion about the most appropriate use of the TVWS and the benefits of licensed versus the license-exempt usage as part of a conversation about the future use of the television bands generally. Currently in the Unites States the TVWS frequency band is identified for unlicensed use and the associated technical rules dictate how the devices in that frequency band are required to operate. IEEE 802 has developed and continues to develop standards for a wide variety of applications including smart grid, regional and rural broadband access, local area networks and hotspots, healthcare and others within the regulatory framework established by the regulators including TVWS. In particular, the IEEE 802 standards will ensure that no interference is caused to licensed users.

4. IEEE 802 supports the establishment of a regulatory framework permitting the use of license-exempt technology in a number of frequency bands including those that an administration may designate as being TVWS. We believe that opening up spectrum, to include TVWS, for license-exempt, in addition to licensed use, will spur unique innovations to address the meaningful communications needs of consumers, businesses and government agencies. Spectrum should not remain unused if there are radio technologies that can make use of the spectrum within the established regulatory framework including that established for the use of the TVWS frequency bands.

5. It is worth noting that significant innovations in wireless communications standards such as IEEE 802.11 (Wi-Fi™), and IEEE 802.15.1 (Bluetooth™) were developed for use in frequency bands without exclusive licenses. It should be noted that some wireless cellular service providers use other wireless technologies such as Wi-Fi that operate in license-exempt spectrum. This reduces congestion, provides network redundancy, and can provide high data rates to ensure service quality in a cost-effective manner. IEEE 802 has contributed significantly to the use of unlicensed spectrum and will continue to do so. Provision of more license-exempt spectrum will allow further useful developments.

6. [Across various industries the use of the TVWS spectrum is vital, given its propagation characteristics, improved building penetration and enhanced regional and rural coverage.]

7. In apportioning the frequency bands between licensed and license-exempt use it is important to make certain that a substantial amount of spectrum is kept available for license-exempt use.

8. License-exempt use of TVWS spectrum could support applications in healthcare, education, smart utility networks, disaster recovery, environment monitoring, critical infrastructure monitoring, border protection, homeland security, high speed internet, and other countless innovative areas.

9. IEEE 802 has and continues to develop a number of standards and amendments to standards that provide wireless both license-exempt and licensed communications services in various frequency bands including those that may be designated as TVWS.

# What are the interference considerations to radiocommunications associated with the implementation of wireless and wired technologies and devices used in support of power grid management systems?

The IEEE 802 has developed many wireless technologies that have demonstrated interference resilient communications to enable power grid management without interference to others.

* For example, IEEE 802.11 (Wi-Fi™), and IEEE 802.15.1 (Bluetooth™) have for long, demonstrated that they can co-exist while operating in the same band.
* Although thousands of smart grid devices will be deployed, however, based on their application requirements, the throughput requirements per node may be small, resulting in manageable average spectrum occupancy.
* New cognitive radio sharing technologies developed within the IEEE 802 Standards (e. g. IEEE Std. 802.22-2011™ can make efficient use of spectrum while doing no harm to other primary users operating in these bands or the adjacent bands.
* Features embedded within IEEE 802 standards such as spectrum sensing, spectrum etiquette, channel set management and co-existence will ensure minimal interference to themselves and others.

# How will spectrum availability be affected by interference associated with widespread deployment of such technologies and devices?

The IEEE 802 believes that the spectrum availability will not be affected by interference associated with wide-spread deployment of such technologies and devices.

* Regulators have proposed emission limits for various bands that need to be adhered to in order to be able to use these bands. IEEE 802 technologies are designed to adhere to these specifications so that they do not cause out of band interference.
* Although thousands of smart grid devices will be deployed, however, based on their application requirements, the throughput requirements per node may be small, resulting in manageable average spectrum occupancy.
* New cognitive radio sharing technologies developed within the EEE 802 Standards can make efficient use of spectrum while doing no harm to other primary users operating in these bands or the adjacent bands.
* Features embedded within IEEE 802 standards such as spectrum sensing, spectrum etiquette, channel set management and co-existence will ensure minimal interference to themselves and others.

10. **Conclusion**

**[**IEEE 802 respectfully submits its position endorsing license-exempt use of the Television band White Spaces and other portions of spectrum deemed appropriate for Smart Grid management. We believe that the identification of license-exempt spectrum, to include TVWS spectrum, to cognitive radio sharing technology can spur innovation to address meaningful communications needs of consumers, businesses and governments. IEEE 802 requests that in any on-going allocations proceedings substantial license-exempt devices spectrum be identified in TVWS and any other spectrum deemed appropriate for Smart Grid management systems.]

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