channel modeling for spectral sensing and cognitive radio networks

Mots clés :
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- Unité de recherche : Laboratoire Traitement et Communication de l'Information
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Résumé du projet de recherche (Langue 1)

Cognitive radio is a new paradigm for wireless access and wireless networking. It has been the subject of intense research for about 2 decades, being promised to a bright future according to many researchers and engineers. Among the numerous issues involved, the degree of “intelligence” attributed in a centralized way to the network infrastructure and left to the terminal for contributing to the spectral resource assignment decision is not established. One of the key factors is the ability of the terminal and of the network to sense the spectrum use in order to be able to make educated decisions. Within this context, the assessment of the sensing performance of either network or terminal is paramount to the specification of a cognitive radio system. At the signal processing level, algorithms must be designed in the most efficient way and this has motivated a strong research effort for several years. However, the sensing performance will also depend in a critical way on the characteristics of the radio channel in both the frequency and the spatial domains, which impact the reliability of spectral occupation determination at a location that differs from the location of the sensing device.

Résumé du projet de recherche (Langue 2)

In the RECOSS project, the goal is to design a system of specialized distributed sensors, whose role is to inform the network in real time about the current spectral occupation over a certain geographical area. The targeted application is high throughput communications for security and emergency services, based on an evolution of the PMR towards the LTE standard. However, the thesis subject will go beyond this application and will investigate the scientific issues from a more general point of view. In particular, its main goal is to devise a spatial and frequency wise channel model, able to express the performance and limitations of such a system of sensors and to be used for its design and specification. A simplified result of the study will be the provision of engineering rules, such as commonly used by wireless operators for network planning. The method to develop such a model will be a combination of several approaches. The first will be based on the analysis of the state of the art knowledge in propagation modeling, applied to and complemented by software based simulation of the propagation. The second will involve radio channel measurements, carried out at adequate frequencies and locations in order to identify and analyze the physical effects involved in the frequency and spatial correlations. The imperfect characteristics of the (wideband) sensors will have to be taken into account, whether they are based on single or on multiple antennas. This will result in suitably parameterized statistical channel models, lending themselves to inclusion into simulators of the cognitive radio network. In a variant of this work, the use of the terminals instead of specialized sensors may be considered. The statistical description of the large variability of the terminals radioelectric characteristics will help provide a realistic model of the sensing part of the cognitive network, involving a limited set of model parameters.

Informations complémentaires (Langue 1)

The thesis work is expected to contribute to the upcoming European COST Action “Cooperative Radio Communications for Green Smart Environments” and to produce several publications in international journals and conferences.

Informations complémentaires (Langue 2)

Sujet de thèse attribué à Mr. Xin Zeng