

## Future dynamic spectrum management framework considering technology innovation: Korea spectrum policy case

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### Extended abstract

The vision of ubiquitous communications tells us that it is opening the world where wireless communication is becoming more important in our life. By increasing importance of the wireless communication, the demand and value of spectrum resource will be significantly increased, and the age of wideband, flexible, and agile systems is now dawning. Although technologies have been dramatically developed, spectrum resource is scarce and limited. That means we should use our limited spectrum resource as efficiently as possible.

Traditional spectrum is mostly managed by an exclusive licensing method. In this method, License is given to the regulator who grants exclusive use for the specific service during an extended period of time and also cannot be transferred to another party. It has also been realized that static long-term licensing of spectrum for use by a single standard hinders fast innovation cycles, since new technologies generally move faster than regulations. From the results, recently there have been several proposals to overcome those limitations of legacy spectrum policies. The discussions for efficient use in the spectrum are many and long-standing. Among experts, Michele C. Farquhar<sup>1</sup>, Gregory L. Rosston<sup>2</sup>, and Thomas W. Hazlett<sup>3</sup> recommended in their papers a number of regulatory and statutory changes, such as the elimination of use restrictions for new wireless allocations, replacement of existing use restrictions with power limits, enhancement of rules about interference limits. In the OECD (2004)<sup>4</sup> and Ofcom (2004)<sup>5</sup> reports, spectrum trading and liberalization are mentioned and in case of Ofcom, liberalization of spectrum is getting more importantly issued. However, there is still not enough comparative analysis and verification between those different spectrum management alternatives.

Meanwhile, substantial strides have been made in radio technology, including wideband

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<sup>1</sup> Michele C. Farquhar, Ari Q. Fitzgerald, "Legal and regulatory issues regarding spectrum rights trading", Telecommunications Policy 27 (2003) 527-532

<sup>2</sup> Gregory L. Rosston, "The long and winding road: the FCC paves the path with good intentions", Telecommunication Policy 27 (2003) 501-515

<sup>3</sup> Thomas W. Hazlett, "Liberalizing US spectrum allocation", Telecommunication Policy 27 (2003) 485-499

<sup>4</sup> DSTI/ICCP/TISP(2004)11, "Secondary markets for spectrum: Policy issues"

<sup>5</sup> Ofcom Consultation document, "Spectrum Liberalization", Nov. 2004

radio, such as spread spectrum and ultra wideband (UWB), cognitive radio which is the one of several applications of software defined radio (SDR) and mesh networks including ad-hoc networks and other forms of peer-to-peer infrastructure architectures. The developers of these technologies note that the products based on the technologies undermine the current system of administrative allocation of exclusive-use licenses, and call for an “open range,” or commons, approach to the spectrum that would do away with exclusive use. “Removing the fences,” in this view, will lead to more efficient use of the spectrum.

Under these circumstances, dynamic spectrum policy is one of the candidates for the next evolutionary step toward more individually empowered, more efficient use of the spectrum resource. This dynamic spectrum policy can be the same logic as Internet development with its openness, and it is getting more realistic with the development of various spectrum use techniques. Furthermore, dynamic spectrum policy will improve not only social efficiency but also personal utility. However, this concept of the approach to dynamic spectrum policy is different from legacy static approach from the perspectives of technology, economy and policy issues. There should be sufficient discussions of the public or private property rights for the spectrum.

In this paper we analyze dynamic spectrum policy framework to improve efficiency in spectrum use from the perspectives of technology, economy and policy issues. In these three categories, different license and license exempt use are analyzed in the perspective of techno-economic way. As a first step towards this study, this paper aims to compare the welfare characteristics between different spectrum alternatives, and investigate technology innovation effects considering new technology paradigm changes. To examine and compare these, this study develops an agent-based spectrum management model with different wireless industry scenarios. Through the agent-based modeling, problems such as spectrum coordination or strategic interaction can be investigated and structured dynamically.

Furthermore, as a second step, this study tries to find a dynamically harmonized and optimized spectrum management regime for the future wireless environment. The optimal solution is suggested based on the agent-based simulation results. To be more specific, this study explains the current spectrum policy and future plans in Korea, one of the leading countries in the IT industry, and applies dynamic spectrum framework to the current Korea spectrum policy. With this framework, we can examine the welfare consequences of policymakers’ choices regarding controls on entry and the engineering specifications of wireless devices with new innovative technologies. Moreover, this study tries to adapt dynamic spectrum policy in technology, economy and policy perspective ways. From this work finally this paper suggests the realistic and efficient dynamic spectrum policy model for the future wireless communication environments.

## **bibliographical notes**

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