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## On the Spectrum Market Value as Production Factor for Smart Technologies

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### Abstract

The basic and required production factor for wireless communication technologies is the radio spectrum. Using the radio spectrum for different technologies, industries or services is regulated/managed by ITU at international level and by national authorities at national or state level. The paper deals with the valuation of radio spectrum as the scarce resource for the information society as well as for spectrum market pricing. Each smart wireless solution also intelligent transport systems and technologies needs the spectrum but it is necessary to know his value or price. They determine the costs of solution as well as the accessibility of technologies. Several procedures and models are used to estimate the value of radio spectrum. They vary in a different rate depending on the complexity of information including the time dimension which is required in processing. At the same time their application is determined by the subject that estimates the value, i.e. national regulatory authority or operator. The regulatory authority and operators have the different information about technology, market, cost etc. e.g. information asymmetry is significant in this area. The results obtained on the ground of the application of benchmarking and results of analysis of 281 auctions in selected EU countries are presented in submitted contribution.

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## 1. Introduction

Radio spectrum is the part of the electromagnetic spectrum from 8.3 kHz to 3000 GHz allocated to 40 Radio communication services in line to the Radio Regulations (RR) of the International Telecommunications Union (ITU) [1]. It is an essential input to all wireless services, with major contribution to economic and social development. These spectrum-based services includes mobile communications (such as cell phones and mobile broadband), fixed communications (such as broadcasting and wireless data links), and detection applications (such as radar) [2]. It is a natural, renewable and often scarce resource (especially below 1 GHz), which means its offer is limited [3]. Since radio spectrum is scarce the National Regulatory Authorities (NRAs) have to assign this resource wisely; in the most cases\* NRAs represent the supply-side of radio spectrum market. With the constant rapid growth of mobile communications services such as wireless data services and increasing data consumption radio spectrum becomes more and more valuable. Spectrum is no longer associated with abstract technology but is more and more regarded as a valuable resource in our information society [4].

Appropriate spectrum values and price helps to promote spectrum efficiency. Market reveals the price of spectrum in the process of awarding the licenses to service providers. Price emerges through an authentic market transaction such as an auction or secondary trading. One of the most used approaches which can help examine the value of spectrum is benchmark. But is it a good indicator of spectrum market price?

In the present paper we shall attempt to analyze the results of more than 280 spectrum auctions, including bands suitable for 3G and 4G wireless services, to find out how benchmark can help to determine the market price of spectrum.

## 2. Theoretical background

To search the value of radio spectrum, we need to understand the nature of its value. Theoretical basis for spectrum value says it is not inherently valuable; rather its value derives from its use in deploying wireless services. As the profitability of spectrum-based services increases, the value of deployable spectrum assets also increases [2]. Hence spectrum valuation is neither static nor a set science, but it is kinetic [5].

To estimate the value of radio spectrum several procedures and models are used. They vary in a different rate depending on the complexity of information which is required in processing. Every model has its strengths and weaknesses. To subsequent determination of the price we need the market. There is no price without the market as well as there is no value without a (subjective) valuator. The market looks for the price and creates the market price.

However, we should have in mind that financial experts show us that there are few misconceptions about valuation. One of them says that valuation is an objective search for “true” value. There is nothing like true value since all valuations are biased [6]. Radio spectrum market have two sides – governments and their agencies (NRAs), which are responsible for spectrum allocation and mobile operators which want to satisfy consumer demand for telecommunications and radio spectrum is crucial input for their business. Both parties attempt to estimate the value of spectrum while mobile operators have considerable information advantage over NRAs. As NRAs act as regulators, the market reveals a significant information asymmetry and the principles of free market cannot be applied to spectrum [10, 12].

However, some of the principles of radio spectrum management have changed in the last two decades and with the launch of first spectrum auction in New Zealand (1996) many governments have gradually employed auctions in the process of awarding spectrum licenses. Key findings say that auctions employ a price mechanism to allocate spectrum and can be used to increase efficiency and revenue maximization [7, 11]. As long as the “seller” of spectrum license is also the regulator (except the case of Secondary markets) there cannot exist efficient market. Auctions allow market mechanism to get involved into the pricing process and the final prices of spectrum paid by operators are market-based. In an efficient market, the market price is the best estimate of value. The purpose of any valuation model is then the justification of this value [6].

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\* In some countries radio spectrum can be traded in secondary markets. Usage rights can be shift from low-value uses to higher value uses.

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