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DISSERTATION

**SPECTRUM TRADING: IS IT A SOLUTION FOR ALL AUTHORISATIONS? A
COMPARISON OF THE UK AND TURKISH LEGAL REGIMES**

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LIST OF ABBREVIATIONS

Competition Appeal Tribunal	CAT
European Commission	EC
European Conference of Postal and Telecommunications Authority	CEPT
European Union	EU
Everything Everywhere	EE
Extended Global System for Mobile Communications	E-GSM
Global System for Mobile Communications	GSM
High Speed Packet Access	HSPA
International Mobile Telecommunications-2000	IMT-2000
Information Communications and Technologies Authority	ICTA
International Telecommunication Union	ITU
Long Term Evolution	LTE
Mobile Network Operator	MNO
Mobile Virtual Network Operator	MVNO
National Regulatory Authority	NRA
Office of Communications	Ofcom
Private Mobile Radio	PMR
Telecom Italia Mobile	TIM
Telefónica O2 UK Limited	O2
Telsim Mobil Telekomünikasyon Hizmetleri A.Ş.	Telsim
Transfer Notification Register	TNR
Universal Mobile Telecommunications System	UMTS
United Kingdom	UK
Worldwide Interoperability for Microwave Access	WiMAX
Wireless Access Policy for Electronic Communications Services	WAPECS
Wireless Telegraphy Act Register	WTR

ABSTRACT

Spectrum is an indispensable input for the wireless infrastructure and services, increasing demand for which enhances the importance of spectrum management and requires this resource to be used more efficiently. It is thought that, there exists a necessity to develop a new approach for the effective and efficient use of spectrum, through a more convenient method which is executed not by the regulators but the market itself, taking into account the limited ability of the regulators to cope with the rapid developments in technology. Spectrum trading is considered as one of the instruments for ensuring the efficient use of spectrum.

Frequency bands open to transfer of rights of use and the approaches to implementing spectrum trading differ among countries. In the European Union trading of rights of use was allowed by most of the Member States after 2002 and functioning secondary markets are generally of PMR frequencies.

Within the scope of the dissertation; spectrum trading, which has already been introduced by some countries, is examined within the context of the UK and Turkish legal regimes and their comparison. Although the growing trend towards spectrum trading and the need for ensuring the efficient use of spectrum indicate that the implementation of spectrum trading will be beneficial, legal challenges should be considered in order to avoid its likely adverse legal impacts.

By taking into account its potential benefits and risks to market, users and operators, in addition to transition challenges for its introduction depending on the nature of existing rights of use and their current users, an answer to the question of whether spectrum trading is a universal solution for all authorisations in order to ensure the efficient use of spectrum in all circumstances, is tried to be provided.

1. INTRODUCTION

In this dissertation, the issue of whether spectrum trading is a solution for all authorisations will be analysed. In this context, legal regimes of the United Kingdom (UK) and Turkey on spectrum trading will be compared. Within the scope of this chapter the key issues of the dissertation will be briefly presented including the reasons for the comparison to be made between the legal regimes of the UK and Turkey, the basics of the spectrum, its management and allocation and the need to change the way of spectrum management.

There are several reasons for the comparison to be made between Turkey and the UK. Firstly, while the UK is a Member State which faithfully transposes EU regulations to her national legislation and adopted spectrum trading in 2004, Turkey is a candidate country which is in a process of harmonising its legislation related to electronic communications with the EU potentially in order to be a Member State. Furthermore, Turkey with its dynamic economy provides incentives for new players to invest in the Turkish market in contrast to the mature markets with lesser investment prospects for new entrants in many EU Member States, notably the UK. Therefore facilitating the development of secondary spectrum market can be one of the instruments to attract potential new players to Turkish market with a more effective spectrum management. Within this context, experiences of the UK on spectrum liberalisation and trading can be beneficial for Turkey.

In addition, Vodafone, a UK headquartered company, is one of the largest communications operators both in Turkey and the UK. The most important examples of the transfer of spectrum took place by Vodafone. In 2005 Vodafone took over assets, commercial and economic entirety of the second biggest GSM operator (Telsim) of Turkey in terms of number of mobile subscriptions, including the concession agreement, for \$4.55 billion. It was the biggest transaction regarding the transfer of spectrum that took place in Turkey to date. Furthermore, in 2000 Vodafone's takeover of Mannesmann for £112 billion (US\$177.6 billion) was the largest merger in Europe¹, which was essential for Vodafone to enter the German mobile market. It was the first time so large a German company had been taken over by a foreign company².

¹ Gaughan P.A., (2011), "Mergers, Acquisitions and Corporate Restructurings", 5th edition, John Wiley & Sons, Inc., p.8

² *Ibid*

Furthermore, as a significant communications operator both in Turkey and the UK, Vodafone's position related to spectrum refarming can shed light on concerns regarding the implementation of spectrum trading. In both countries, reactions of the mobile network operators (MNOs) towards liberalisation of GSM bands reflects the difficulty of implementing spectrum trading due to the existing authorisations -especially 2G and 3G authorisations- with regard to allowing the operators to trade and use the spectrum with a technology neutral manner.

In addition in the UK, merger of France Telecom and Deutsche Telekom (operating as Orange and T-Mobile UK respectively in the UK) to establish Everything Everywhere (EE) which was holding a large portion of 1800 MHz is important to reflect its impacts on spectrum trading. Furthermore, merger of Orange and T-Mobile also indicates the effects of the decision of the European Commission (EC) related to this merger on spectrum trading and importance of having valuable frequencies for new technologies such as LTE. Following the merger of Orange and T-Mobile, Office of Communications' (Ofcom) attempts to refarm the 1800 MHz band for LTE and WiMAX technologies and objections of certain operators one of which is Vodafone, can be good indicators to reflect operators' effects on transition of regulatory environment.

1.1. The basics of the spectrum and its management

Spectrum is a scarce resource which is vital for the provision of wireless electronic communications services. In recent years, the importance of the spectrum has increased because of the increasing demand on wireless infrastructure and services. Spectrum is a key input not only for mobile, wireless and satellite communications, TV and radio broadcasting and wireless Internet access but also many other applications for other public services such as defence, security, etc³. In addition, rapid technological developments and convergence increased the need for its extensive use. Therefore, it has gained a crucial role in both economic and social life. Although it is difficult to estimate the real economic value of

³ Communication from the Commission to the Council, the European Parliament and the European Economic and Social Committee and the Committee of the Regions, a market-based approach to spectrum management in the European Union, COM(2005) 400 final, 14.9.2005, p.4
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0400:FIN:EN:PDF>

spectrum, total value of spectrum dependent services reflects its importance which was estimated as approximately €250 billion in 2007⁴.

Radio spectrum, is a subset of the electromagnetic waves, which ranges between the frequencies from 9 KHz to 3000 GHz⁵ (Table 1). Within this wide range different frequencies have different characteristics and are suitable for different uses⁶. Typically; higher frequency signals have greater capacity while it is difficult for them to travel long distances due to higher attenuation, and as the lower frequency signals travel further and penetrate deeper in buildings, they are therefore more suitable for covering large areas⁷. Since the allocated frequency band has important impact on the costs of services or applications such as operational costs, there is higher demand for lower parts of the spectrum⁸. Furthermore, because of the specific characteristics of particular frequencies some parts of the spectrum are less suitable for some applications or services⁹.

Table 1: Radio frequencies and their characteristics

Band	Frequency	Range	Use	Bandwidth	Interference
VLF	3-30 kHz	1.000's km	Long range radio-navigation	Very narrow	Wide Spread
LF	30-300 kHz	1.000's km	Same as VLF strategic communications	Very narrow	Wide Spread
MF	300-3.000 kHz	2-3.000 km	Same as VLF strategic communications	Moderate	Wide Spread
HF	3-30 MHz	Up to 1.000 km	Global broadcast and Point to Point	Wide	Wide Spread
VHF	30-300 MHz	2-300 km	Broadcast, PCS, Mobile, Wan	Very Wide	Confined
UHF	300 MHz-	< 100 km	Broadcast, PCS,	Very Wide	Confined

⁴ Commission Staff Working Document, (2007), Impact Assessment, Accompanying document to COM(2007)697, COM(2007)698, COM(2007)699, SEC(2007)1473, p.48

⁵ "Introduction to Spectrum Management Overview", InfoDev (Information for Development) & ITU Joint Project, ICT Regulation Toolkit, <http://www.ictregulationtoolkit.org/en/Section.2656.html>

⁶ Analysys, DotEcon, Hogan & Hartson, (2004), "Study on Conditions and Options in Introducing Secondary Trading of Radio Spectrum in the European Community", p.12

⁷ *Ibid* p.13

⁸ Commission Staff Working Document, (2010), Impact Assessment, Accompanying document to the Proposal for a Decision of the European Parliament and of the Council Establishing the First Radio Spectrum Policy Programme, SEC (2010) 1034 final, Brussels, 20.09.2010, p.11

⁹ *Ibid*

Band	Frequency	Range	Use	Bandwidth	Interference
	3.000 MHz		Mobile, Wan		
SHF	3-30 GHz	Varies 30 km to 2.000 km	Broadcast, PCS, Mobile, Wan, Satellite Communication	Very Wide up to 1 GHz	Confined
EHF	30-300 GHz	Varies 20 km to 2.000 km	Microcell, Point to Point, PCS and Satellite	Very Wide up to 1 GHz	Confined

Source: “Spectrum as a Technical Resource”, InfoDev (Information for Development) & ITU Joint Project, ICT Regulation Toolkit¹⁰

Spectrum management is required to prevent the interference derived from the uncoordinated use of radio spectrum which causes a waste of radio spectrum that is considered as contrary to the public interest¹¹. Ensuring the maximum benefit to society from spectrum and responding rapidly to the change in technology and demand with the way of spectrum use, are the objectives of spectrum management in the EU¹². Spectrum management basically purposes to maximise the value that society gains from radio spectrum by allowing efficient users, in addition to prevent interference between different users¹³. Because of the increasing demand for the use of spectrum, spectrum management started to focus on not only to preventing disruption and interference but also to maximising the value of such a scarce resource¹⁴.

Since the availability of spectrum is finite, spectrum management has taken place at national level under the guidance of various international standards¹⁵. Furthermore, international planning and coordination is required for spectrum management as the possibility of interference extends beyond national boundaries¹⁶. Within this context, at the highest level the international framework for the use of the radio frequency spectrum is laid out by the International Telecommunication Union (ITU), a specialized agency of United Nations¹⁷.

¹⁰ <http://www.ictregulationtoolkit.org/en/Section.2658.html>

¹¹ Koenig C., Bartosch A., Braun J.D., (2002), “EC Competition and Telecommunications Law”, Kluwer Law International, International Competition Law Series, p.519, 520

¹² *Supra* n.4, p.54

¹³ Cave M., Doyle C., Webb W., (2007) “Essentials of modern spectrum management”, Cambridge University Press, p.3

¹⁴ Farr & Oakley, (2006), “EU Communication Law”, 2nd edition, Thomson Sweet & Maxwell, p. 77

¹⁵ *Ibid*

¹⁶ *Supra* n.13, p. 5

¹⁷ Walden I. (edt.), (2009), “Telecommunications Law and Regulation”, Walden I., “International Telecommunications Law”, Chapter 15, 4th edition, Oxford University Press, p.728

Furthermore, there are also international bodies for the cooperation of regions on spectrum management which can be seen as local versions of the ITU¹⁸. As examples of these regional bodies, EC and European Conference of Postal and Telecommunications Authority (CEPT) are in charge of spectrum management at the EU level¹⁹. Usually their coordination is more specific and they designate a band to a specific standard such as “GSM”²⁰. Certain EC Directives and Decisions impose restrictions on the usage possibility of specific frequency ranges²¹. While the decisions of CEPT and ITU are not binding for the states provided that they will not cause interference if they deviate from them, Directives and Decisions of the EU on spectrum management are binding for Member States²². Member States should comply with the usage of a band which is subject to a Directive or is judged to be harmonised under the proposed Spectrum Decision until the band in question is removed from the list of harmonised bands²³.

Due to its wide range of use, demand for particular frequencies has started to exceed the supply. In addition to excess demand, inefficient management and use of spectrum can also cause scarcity²⁴. Therefore, the increasing demand for the use of spectrum requires this resource to be used and managed more efficiently, triggering the reforms for a more effective spectrum management. Most of the valuable parts of the spectrum are already allocated to certain services and assigned to individual users in many countries²⁵. Because of the primary assignment of spectrum, it became difficult to find spectrum for new uses and expansion of existing uses²⁶. Despite the technological developments to increase the efficiency of spectrum, technical availability of the spectrum is still insufficient²⁷. Therefore, it is required to develop technical, business and regulatory mechanisms, one of which is spectrum trading, to ensure more efficient spectrum management²⁸.

¹⁸ *Supra* n.13, p. 6

¹⁹ London economics, (2008) ‘Economic Impacts of Increased Flexibility and Liberalisation in European Spectrum Management’, p.3

²⁰ *Supra* n.13, p.6

²¹ Stumpf U., Nett L., (2003), “The Economics of Frequency Trading”, Wik Consult Conference Paper, p.9

²² *Supra* n.13, p.6

²³ Cave, M. (2002) “Review of Radio Spectrum Management: An Independent Review for the UK Department of Trade and Industry and HM Treasury”, Ofcom, London, p.9

²⁴ *Supra* n.8, p.9

²⁵ Wellenius B., Neto I., (2006), “The radio spectrum: opportunities and challenges for the developing world”, info, Vol.8, Iss:2, pp.18-33, p.19

²⁶ Xavier, P., Ypsilanti, D., (2006) "Policy issues in spectrum trading", info, Vol. 8 Iss: 2, pp.34 – 61, p.34

²⁷ *Supra* n.11, p.519

²⁸ Weiss M., (2006) "Secondary use of spectrum: a survey of the issues", info, Vol. 8 Iss: 2, pp.74 – 82, p.74

1.2. Allocation of spectrum

The traditional “command and control” approach for spectrum management which mainly focuses on avoiding interference and is based on assignment of individual rights of use and allocation of the various bands to defined service categories, has a difficulty to keep up with the growth of the communication services and other industries utilising radio communications²⁹. Within this approach the state decides the type of services and technologies that can be used in specific frequencies, who receives rights of use for particular frequencies, duration and other conditions of rights of use for particular frequencies³⁰. Lack of flexibility in spectrum management has caused “bottlenecks” for new radio technologies due to the difficulty to follow technological evolutions³¹. In addition, the unlicensed model - also known as a “commons model” - has been deployed for services and technologies such as WiFi, where there are many small, non-commercial users and the costs of interference are considered to be small relative to the cost of granting exclusive rights of use³². The users are exempt from spectrum assignment if they will not interfere significantly with each other when they use the spectrum without coordination³³. Due to the competing demands to use spectrum, comparative procedures such as auctions started to be used for the determination of the spectrum users³⁴.

Because of the cumbersome nature of the administrative approach and the low applicability of licence exemption approach, the market oriented approach, already argued by Coase³⁵, has gained attraction to meet the requirements of the rapidly changing communications technology and services. With this approach, including the main focus of this dissertation, the spectrum trading, which means the transfer of rights of use after the primary assignment in a secondary market³⁶, it is aimed to allow:

- rapid access to spectrum,

²⁹ *Supra* n.6, p.3,4

³⁰ *Ibid*, p.3

³¹ Communication from the Commission to the Council and European Parliament, a forward-looking radio spectrum policy for The European union: second annual report, COM(2005) 411 final, Brussels, 6..2005, p.6 http://eur-lex.europa.eu/LexUriServ/site/en/com/2005/com2005_0411en01.pdf

³² *Supra* n.6 p.26

³³ *Supra* n.13, p.5

³⁴ *Supra* n.17, p.319, 320

³⁵ Coase, R. (1959), “The Federal Communications Commission”, *Journal of Law and Economics*, Vol.2, pp.1-40, <http://old.ccer.edu.cn/download/7874-1.pdf>

³⁶ *Supra* n.13, p. 85

- the determination of the spectrum value and best use by the market itself, and
- the transfer of spectrum rights more rapidly within the market realities,

in order to achieve a more effective management of spectrum.

This approach basically consists of service and technological neutrality and entails the shifting of responsibility for interference management from the regulators towards the market itself³⁷. The market oriented approach intends to increase flexibility, transparency and the speed of the response to technological innovations³⁸.

Spectrum trading is one of the spectrum management mechanisms in market-based approach which grants access to spectrum to those who value it most and can use it more efficiently³⁹. Beside its benefits, there are also concerns related to spectrum trading that need to be considered by policy makers and spectrum management authorities. Furthermore, to handle the transition from existing spectrum management to an environment in which spectrum rights of use are tradable is an important issue required to be considered by the regulators⁴⁰. Despite high expectations on its benefits, the expected benefits of spectrum trading have not already happened in the EU.

1.3. Structure of the dissertation

The remainder of the dissertation comprises four further chapters. In the second chapter, spectrum trading will be explained including the definition and scope of spectrum trading, types of spectrum trading, its potential benefits and costs related to it.

The third chapter explores the transition issues including how to handle existing spectrum users to adopt spectrum trading and how to time the transition will be assessed. With regard to existing users, the approaches of band clearance and conversion of existing rights of use into tradable rights of use will be assessed. Furthermore, examples of the similar implementations

³⁷ *Supra* n.23, p.12

³⁸ Gentzoglani A. and Henten A., (2010), "Regulation and Evolution of Global Telecommunications Industry", Feijoo C., Ramos S. and Gomez-Barroso J., "Next generation mobile networks deployment and regulation in the European Union", Edward Elgar Publishing Limited UK, USA, p.306

³⁹ Caicedo, C.E., Weiss M.B.H, (2007), "Spectrum Trading: An Analysis of Implementation Issues", Proceedings of the IEEE Symposium on Dynamic Spectrum Access Networks, p.579

⁴⁰ *Supra* n.6, p.119

of these approaches towards existing users in the UK and Turkey will also be evaluated. In this context, in addition to experiences of both countries on liberalisation of 900 MHz and 1800 MHz and conversion of existing authorisations into flexible ones, transition from analog to digital television and auction of 800 MHz and 2.6 GHz in the UK will also be assessed in the dissertation.

In the fourth chapter, certain regulatory developments on spectrum trading in the EU will be described. Turkish and the UK legal regimes related to the spectrum trading will be evaluated and the legal regimes and implementations of both countries on spectrum trading will be compared. Within this context, effects of the merger of T-Mobile and Orange and the related decision of the EC on spectrum trading in the UK will be assessed. Furthermore, certain implementations related to the transfer of spectrum in mobile communications market of Turkey will also be explored.

Finally, the fifth chapter will make a conclusion on key issues in spectrum trading and argue that it is not a universal solution, taking into account the characteristics of the market including, method and conditions of spectrum assignment, scope of use and harmonisation of the bands, provided services, the level of competition etc.

2. SPECTRUM TRADING

One of the market based spectrum management mechanisms is the spectrum trading. While market based methods are used at the primary issue of a spectrum license such as competitive or comparative selection procedures, they can also be used when spectrum rights are allowed to be sold and bought in the duration of a license through trading and when the change of use of the relevant spectrum for different services is permitted (sometimes called liberalisation)⁴¹.

2.1. Definition and scope of spectrum trading

Spectrum trading (also known as secondary markets) is the process by which the holder of a spectrum right of use transfers part or all of the rights and obligations associated that usage

⁴¹ Cave M., Foster A., Jones R. W., (2006), "Radio Spectrum Management: Overview and Trends", p.8

right to third parties⁴². In secondary markets spectrum holders aggregate and disaggregate their spectrum according to their commercial needs through trading of rights of use⁴³.

The spectrum trading concept consists of two distinct processes: transferring the spectrum usage rights in secondary markets originally assigned by the authorities (spectrum trading), and changing the uses and technologies to which these rights were allocated (spectrum liberalisation)⁴⁴.

Spectrum trading markets allow access to spectrum to those who value it most⁴⁵. Furthermore, through spectrum trading unused spectrum can be allocated to the ones that use it actively⁴⁶. It can be beneficial for closing the gap between market demand and supply under current spectrum distribution⁴⁷. Although spectrum auctions are important step towards market-based mechanisms, since they just solve the primary assignment problem to maintain economically optimal spectrum consumption, spectrum users need to be able to adjust their spectrum holdings based on changes in technologies and markets over time⁴⁸.

Spectrum trading combined with liberalisation of frequencies addresses both the allocation and assignment aspects of spectrum use⁴⁹ since it leaves assignment and allocation decisions to market forces. While spectrum trading allows the market to determine who has access to spectrum over time, liberalisation of spectrum use allows the market to determine how spectrum is used over time⁵⁰. Without liberalisation, spectrum trading will be limited to transfer of existing rights of use and without spectrum trading liberalisation will only allow

⁴² Ofcom, “A Statement on spectrum trading: Implementation in 2004 and beyond”, p.3

⁴³ Thanki R., (2009), “The economic value generated by current and future allocations of unlicensed spectrum”, Perspective Associates, p.17

⁴⁴ Wellenius B., Neto I., (2007), “Managing the Radio Spectrum: Framework for Reform in Developing Countries”, The World Bank Global Information and Communication Technologies Department Policy Division, Policy Research Working Paper No: 4549, p.16

⁴⁵ Bykowsky M., (2003), “A secondary market for the trading of spectrum: promoting market liquidity”, Telecommunications Policy, Volume 27, Issue 7, August 2003, Pages 533–541, p.533, 534

⁴⁶ Stumpf U., Nett L., (2003), “Institutional arrangements for spectrum trading”, COMMUNICATIONS & STRATEGIES, no. 50, 2nd quarter 2003, p. 193.

⁴⁷ Forge, S., Blackman C., Bohlin E., (2006), “Benchmarking Impacts of EU Policy: Options for Economically Efficient Management of Radio Spectrum”, Final Report, SCF Associates Ltd., UK, p.7

⁴⁸ Weiss M.B.H and Lehr W.H., (2009), “Market Based Approaches for Dynamic Spectrum Assignment”, http://d-scholarship.pitt.edu/2824/1/JSAC_Weiss_and_Lehr.pdf, p.3

⁴⁹ *Supra* n.39, p.579

⁵⁰ *Supra* n.6, p. 36

existing spectrum users to switch technologies and services; alternative users would not be able to access spectrum⁵¹.

Although without liberalisation, spectrum trading has considerable benefits, with liberalisation spectrum trading provides the spectrum users with the freedom to adopt new technologies and offer new services⁵². However, since the existence of international allocations of spectrum, in some cases, change of use in other words liberalisation may not be possible⁵³. Allowing spectrum trading within the harmonised bands also contributes to spectrum efficiency since existing users could buy and sell unused spectrum among each other⁵⁴.

2.2. Possible benefits and costs of spectrum trading

Although the approaches to implement spectrum trading differ among countries, in any case, spectrum trading brings competition, complexity, risks and opportunities⁵⁵. While trading of an existing usage right creates some complications for spectrum management authorities, spectrum trading combined with liberalisation creates more concerns in addition to its greater benefits⁵⁶. National regulatory authorities (NRAs) should take into account the national circumstances, objectives and priorities in deciding whether and how to introduce spectrum trading since it is not equally suitable for all types of radio services⁵⁷.

Where the costs related to spectrum trading was estimated around EUR 150 million per annum, benefits of spectrum trading combined with liberalisation was estimated about EUR 8-9 billion per annum in a study conducted for the EC⁵⁸. Furthermore, the benefits of spectrum trading was estimated to be 10 times higher in case the combination of tradability and flexibility of usage⁵⁹. However, despite the strong theoretical case, the existing evidence analysing the effects of spectrum trading is somewhat limited⁶⁰. No robust ex post evaluations

⁵¹ *Ibid*

⁵² OECD, (2005), "Secondary Markets For Spectrum: Policy Issues", p.4

⁵³ *Supra* n.23, p.107

⁵⁴ *Ibid* p.108

⁵⁵ Lichtenberger, E., (2003), "Spectrum Trading in Germany, Austria and the UK: The Influence of Regulatory Regimes and Evaluation of Criteria on Competition in the European Mobile Telecommunication Sector", p.1

⁵⁶ *Supra* n.6, p.36

⁵⁷ *Supra* n.55, p.2

⁵⁸ *Supra* n.6, p.222

⁵⁹ *Supra* n.3, p.6

⁶⁰ *Supra* n.19, p.47

(either quantitative or qualitative) of trading regimes have occurred⁶¹. Member States which adopted spectrum trading, allowed trading in general only as pilot projects or in frequency bands with moderate economic value and reduced capacity for provoking interferences⁶². However due to the existing limitations, current results of spectrum trading can be inconclusive about its effects in the future for different countries⁶³.

2.2.1. Benefits of spectrum trading

The benefits envisaged with the implementation of spectrum trading can be summarised under several titles as follows:

Efficiency: The most important argument in favour of spectrum trading is efficiency⁶⁴. It is considered that trading of spectrum usage rights can correct economic inefficiencies of initial assignments and yield a faster response to changing user demands and technologies⁶⁵. Therefore, it can also correct some of the artificial scarcities arising from the primary allocation of spectrum⁶⁶. Trading of spectrum usage rights provides the efficient assignment and use of spectrum⁶⁷. Existing spectrum users will have the chance to sell or change the use of spectrum whenever there is an alternative user or new technology that offers a greater return⁶⁸. This creates incentives for all parties involved in the use of spectrum including sellers, buyers, manufacturers etc. to continually monitor opportunities for better use of it⁶⁹. Spectrum trading combined with liberalisation will enable the market to decide how much spectrum should be allocated to different uses⁷⁰.

Transparency: Spectrum trading also improves transparency regarding the value of spectrum⁷¹. Both existing and alternative users⁷¹ will be aware of the value of spectrum and design their activities appropriately⁷². Firms will be aware of the opportunities regarding

⁶¹ *Ibid*

⁶² *Supra* n.38, p.307

⁶³ *Ibid*

⁶⁴ *Supra* n.19, p.16

⁶⁵ *Supra* n.25, p.21

⁶⁶ Van Caspel, M. (2002), "Spectrum trading: increasing the efficiency of spectrum usage", p.2

⁶⁷ *Supra* n.19, p.16

⁶⁸ *Supra* n.6, p.36

⁶⁹ *Ibid*

⁷⁰ *Supra* n.52, p.4

⁷¹ *Supra* n.25, p.21

⁷² *Supra* n.19, p.16

market entry⁷³, since they have the opportunity to bargain for spectrum with the existing users and figure out its value in the market whenever they plan to enter the market.

Competition: Spectrum trading can facilitate competition⁷⁴. It would be easier to access spectrum through trading rather than being granted by a regulator⁷⁵. In some frequency bands, entry of new operators is constrained due to lack of spectrum and spectrum trading can remove this barrier to entry⁷⁶. Spectrum trading allows faster spectrum access for innovators and new players⁷⁷. The threat of new entry reduces prices and encourages incumbent operators to invest for new services⁷⁸. Also, new projects of firms are not restricted through a lack of available spectrum⁷⁹. Furthermore, spectrum trading provides the opportunity to improve the rollout of new services⁸⁰ of the users that require more spectrum for the provision of new services.

Innovation: Regulators have limited ability to cope with the rapid developments in technology. Since the market has greater knowledge about new technologies and it is easier to access spectrum through trading of spectrum, innovation and faster adjustment to new technologies are expected to increase through spectrum trading⁸¹. Spectrum trading promotes the development of new technologies and boost innovation in spectrum use and related products and services⁸².

2.2.2. Costs of spectrum trading

In addition to its benefits, spectrum trading has also certain costs. Concerns related to the implementation of spectrum trading can be summarised as follows:

⁷³ *Supra* n.6, p.37

⁷⁴ "Spectrum Trading", InfoDev (Information for Development) & ITU Joint Project, ICT Regulation Toolkit, <http://www.ictregulationtoolkit.org/en/Section.2836.html>

⁷⁵ *Supra* n.6, p.37

⁷⁶ Valletti T.M., (2001) "Spectrum property rights", info, Vol. 3 Iss: 5, pp.375 – 380, p. 378

⁷⁷ The RSPG Opinion on Secondary Trading of Rights to Use Radio Spectrum, 19 November 2004, RSPG04-54 Rev. (final), p.8

⁷⁸ *Supra* n.23, p.106

⁷⁹ *Ibid*

⁸⁰ *Ibid* p.100

⁸¹ *Supra* n.19, p.16

⁸² *Supra* n.52, p.4

Interference: In spectrum trading once the spectrum usage rights were transferred, the new licensee has to ensure meeting the interference limits of the original licences⁸³. One of the important concerns related to spectrum trading is harmful interference which lies at the centre of the debate on spectrum management regimes⁸⁴ and considered as the most difficult issue to be solved⁸⁵. In terms of spectrum trading, interference is more of an issue in bands that are currently subject to a high degree of planning and coordination⁸⁶. Interference causes inefficient use of spectrum and restricts its users⁸⁷. Clearly defined property rights and appropriate measures are required to prevent harmful interference⁸⁸ especially in the case of spectrum trading.

Standardisation: Standardisation of technology and equipments is another concern arising from spectrum trading. It is more complicated when same services are provided at different frequencies in different countries⁸⁹. Standardisation has advantages both for the supply side in terms of economies of scale in equipment manufacture and network installation and for the demand side in terms of ability of end-users to roam across networks nationally and internationally⁹⁰. There is an argument that harmonisation will encourage the adoption of a standardised technology and standardisation reduces costs and benefits of the consumers⁹¹.

Harmonisation: Adopting internationally harmonised band plans promotes wireless broadband networks and services since harmonisation facilitates the commercial launch of broadband services⁹². Because harmonisation allows providers to take advantage of economies of scale in equipment and device manufacture, thus reduces the costs of deployment and the prices for consumers⁹³. Furthermore, it facilitates the roll-out of new

⁸³ *Supra* n.23, p.110

⁸⁴ Hwang, J.S and Yoon, H.Y., “Analysis of Future Spectrum Management Alternatives Considering Technology Innovation”, p.5

⁸⁵ Cave, M. and Webb, W., (2003), “Designing property rights for the operation of spectrum markets”, Papers in Spectrum Trading No.1, Warwick Business School, p.2

⁸⁶ *Supra* n.26, p.49

⁸⁷ *Supra* n.46, p.197

⁸⁸ *Ibid*

⁸⁹ Falch, M., Tadayoni, R., (2004), “Economic versus technical approaches to frequency management”. Telecommunications Policy, 28 (2), 197–211, p.203

⁹⁰ *Supra* n.6, p.40

⁹¹ Cave, M., (2006) “New spectrum-using technologies and the future of spectrum management: a European policy perspective”, p.222

http://www.cullen-international.com/cullen/cipublic/presentations/martin_cave_communications_next_decade.pdf

⁹² Kelly T. & Rossotto C.M. (edt), (2012), “Broadband Strategies Handbook”, The World Bank, p. 100

⁹³ *Ibid*

services⁹⁴. Globalisation and mobility requires services to be served across borders⁹⁵. While it is necessary to coordinate the use of spectrum with immediate neighbours, it is also sometimes necessary with more distant countries for some services such as satellite services⁹⁶. In addition, international harmonisation also requires cross-border movement of certain wireless equipment and roaming services⁹⁷. Trading must take place in compliance with international obligations related to the harmonisation of bands⁹⁸. Besides its benefits international harmonisation also constrains the change of use of spectrum⁹⁹. The constraints on change of use of spectrum cause regulatory delay and act as a barrier to the development of new services for the harmonised spectrum¹⁰⁰. Therefore, on the one side flexible use of spectrum increases the economic efficiency of spectrum, on the other side it threatens the benefits of harmonisation¹⁰¹. This shows that it is important to find a balance between the flexible spectrum management and the benefits of harmonisation and standardisation¹⁰².

Competition concerns: There are concerns on whether trading of spectrum usage rights may damage the efficiency of the initial assignment of spectrum by encouraging anticompetitive practices¹⁰³. The secondary markets require effective competition with many buyers and sellers¹⁰⁴ in order to function well and provide with the expected outcomes. Maximising the opportunities for spectrum requires, the fully use of spectrum rather than being hoarded and prevention of firms having market power from limiting competition in end-user markets¹⁰⁵. However, spectrum trading can encourage incumbent operators to control key and high-value spectrum bands which results in spectrum hoarding and concentration of wireless broadband market¹⁰⁶. For instance, incumbent operators may acquire market power¹⁰⁷ or may try to exclude rivals from providing a competing service through hoarding much more spectrum¹⁰⁸.

⁹⁴ *Supra* n.26, p.51

⁹⁵ *Ibid*, p.50

⁹⁶ *Ibid*

⁹⁷ *Supra* n.92, p.100

⁹⁸ *Supra* n.46, p.197

⁹⁹ ITU, (2004), "Radio Spectrum Management for a Converging World", Background Paper, p.24

¹⁰⁰ *Supra* n.52, p.29

¹⁰¹ *Supra* n.26, p.51

¹⁰² *Ibid*

¹⁰³ Leese, R., Levine P., Rickman N., (2002), "The Economic Effects of Spectrum Trading", Royal Economic Society Annual Conference 2002 123, Royal Economic Society, p.32

¹⁰⁴ *Supra* n.52, p.23

¹⁰⁵ Cave, M., (2010), "Anti-competitive behaviour in spectrum markets: analysis and response", Telecommunications Policy, Vol.34 (No.5-6). pp. 251-261, p.251

¹⁰⁶ *Supra* n.92, p.100

¹⁰⁷ *Supra* n.76, p.378

¹⁰⁸ Valletti T.M., (2001), "Spectrum Trading", Telecommunications Policy, Volume 25, Number 10, October 2001, pp. 655-670, p.656

The threat of consolidation could deter new entrants¹⁰⁹. General competition law is considered adequate in countries where spectrum trading has already been implemented¹¹⁰. However, in case it is required, regulators may need to apply ex-ante remedies in specific frequency bands where necessary¹¹¹.

According to an ECC Report, the frequency bands for which most transactions occur are below 450 MHz (PMR/PAMR bands) and above 2 GHz (2,200-2,300 MHz, 2,500-2,690 MHz, 3,410-3,600 MHz)¹¹². In the report, it is considered that the impact of trading may be different according to the number of rights of use in a band¹¹³. While the competition issues do not seem to arise as long as spectrum is used by many different users for the secondary trading in bands where the number of licences is high (for instance in PMR bands), competition issues may be critical for trading in bands where the number of licences is small, such as the mobile bands like GSM or IMT-2000 bands¹¹⁴. Therefore, a regulatory approval of transactions on a case by case basis in such bands can be a necessary measure¹¹⁵.

High transaction costs: One of the issues which impede trading of spectrum is high transaction costs which cause a barrier to entry and prevent the number of trades that otherwise may have occurred¹¹⁶. Lack of information on the spectrum available for sale, search costs, the cost of due diligence and regulatory compliance, legal costs, stamp duties and other taxes etc. are the examples of transaction costs¹¹⁷.

Windfall gains: While extension of the rights regarding spectrum usage (or relaxing regulatory restrictions) promotes efficiency and reduces entry barriers, it also raises the concerns regarding windfalls¹¹⁸. The conversion of the existing licences to tradable ones may result in incumbent licensees receiving capital gains which cause concerns among the general public, especially when the primary assignment was not obtained through an auction

¹⁰⁹ *Supra* n.52, p.30

¹¹⁰ *Supra* n.26, p.51

¹¹¹ *Supra* n.52, p.30

¹¹² ECC Report, (2011), "Description of Practices Relative to Trading of Spectrum Rights of Use", <http://www.erodocdb.dk/docs/doc98/official/pdf/ECCRep169.pdf>, p.17

¹¹³ *Ibid*

¹¹⁴ *Ibid*

¹¹⁵ *Ibid*

¹¹⁶ Crocioni, P., (2009), "Is allowing trading enough? Making secondary markets in spectrum work", Telecommunications Policy, Vol.33 (No.8). pp. 451-468, p.454

¹¹⁷ *Supra* n.52, p.12

¹¹⁸ Hazlett T. (2004) "Property Rights and Wireless License Values", AEIBrookings Joint Center for Regulatory Studies, Working Paper 04-08, p.34

process¹¹⁹. Therefore, the windfall gain can be considered as a political barrier to regulatory reform¹²⁰. A windfall gain is said to be made, when there exists a difference between the price paid by a user and the price at which the spectrum is later sold to another user, but the difference in price is not because of a value added by the former user¹²¹. The imposition of taxes for net gains in traded spectrum is a possible remedy but may have a negative effect on the encouragement of spectrum trading¹²².

Public policy goals: Many public policy goals are usually cited as being incompatible with spectrum trading¹²³. There may be concerns regarding the public services for example. Spectrum reserved for public services may be lost under a system of spectrum trading and liberalisation¹²⁴. It may be preferable to dedicate spectrum for certain public services such as defence that are exempt from trading¹²⁵. In general countries where trading of spectrum has been implemented, transfer of spectrum usage rights is not possible if the spectrum requested to be traded are dedicated to activities related to defence and security of the state, emergency services, maintenance of the public order, civil aviation, maritime communications and navigation¹²⁶.

2.3 Types of spectrum trading

There exist several types of spectrum trading in terms of the characteristics of the transfer of rights of use. When the usage rights are transferred to another user, the rights and obligations may pass completely from the seller to the buyer or the rights and obligations may continue concurrently to be rights and obligations of the seller and the buyer¹²⁷. Furthermore, transfer of rights and obligations under a usage right can be for a short or a long term; and it could be permanent or the usage right could return back to the original licensee at the end of a predetermined term¹²⁸. Economists usually recommend unlimited time for usage rights of

¹¹⁹ *Supra* n.99, p.15

¹²⁰ *Supra* n.118, p.3

¹²¹ *Supra* n.23, p.115

¹²² *Supra* n.52, p.31

¹²³ *Supra* n.46, p.197

¹²⁴ *Supra* n.26, p.52

¹²⁵ *Supra* n.6, p.40

¹²⁶ *Supra* n.52, p.31

¹²⁷ *Supra* n.55, p.5

¹²⁸ Radiocommunications Agency, (2002), Implementing Spectrum Trading, A Consultation Document, UK, p.10

spectrum to maximise the benefits of spectrum trading¹²⁹ because the shorter the time period available to recover the investment of buyer in order to use the acquired spectrum, the greater is the risk in acquiring the spectrum in question¹³⁰. However depending on the initial assignment terms and conditions, the transfer of the rights of use for an unlimited period might not be legally possible¹³¹. Moreover, transfers for unlimited periods make the revision of frequency user plans, the refarming of spectrum and the compliance with ITU regulations more difficult¹³².

In case the rights and obligations continue concurrently to be rights and obligations of the buyer and the seller, they could agree on who would use what portion of the rights, in order not to cause interference¹³³. In order to boost the amount of spectrum to be traded, holders of spectrum should be allowed flexible to decide on how they should trade¹³⁴. For example, a frequency which is leased in a particular location may wish to be used by the leaser itself elsewhere or a spectrum holder may wish to lease its spectrum until it is technically or economically ready to use the spectrum¹³⁵. In this way, idle spectrum can be used through such arrangements¹³⁶.

There are various ways for transferring rights of use. The basic ones are¹³⁷:

Sale – Ownership of the right of use is permanently transferred to another party.

Buy-back – A usage right is sold to another party with an agreement to buy back at a fixed time in the future.

Leasing – The right to exploit the usage right is transferred to another party for a predetermined time period but ownership and some control of the usage right remains with the original rights holder.

Mortgage – The usage right is used as collateral for a loan and the ownership of the usage right is transferred in case of default.

¹²⁹ *Supra* n.21, p.11

¹³⁰ *Supra* n.116, p. 463

¹³¹ *Supra* n.21, p.11

¹³² *Ibid*

¹³³ *Supra* n.55, p.5

¹³⁴ *Supra* n.23, p.109

¹³⁵ *Ibid*

¹³⁶ *Ibid*

¹³⁷ *Supra* n.6, p.68

Options and futures – There may be options to buy or sell spectrum according to contractually defined conditions. A right to buy or sell a usage right at a fixed price on a future date can be an example.

Furthermore there are four types of secondary market trading mechanisms which include¹³⁸:

Bilateral negotiation: The seller and the buyer directly negotiate the terms of the sale;

Auctions: Rules of the auction have been announced by the seller and the buyers have the opportunity to acquire the spectrum usage rights by bidding in the auction;

Brokerage: Buyers and sellers use a broker to negotiate, with their consent, the contractual terms under which the transfer of usage rights can take place;

Exchange: A commercial trading platform, similar to a stock market, where transfers take place according to specific rules established by the members, might be established.

In addition, it is possible to combine these mechanisms¹³⁹. With regard to spectrum trading a number of transactions are the consequence of mergers and acquisitions, and some are intra-group asset transfers¹⁴⁰. Transactions related to changes of use are comparatively rare¹⁴¹. None of the countries where spectrum trading was implemented realize the potential of full-fledged spectrum markets yet¹⁴².

3. TRANSITION ISSUES

From a legal point of view, the most challenging issue related to the introduction of spectrum trading is transition problems. The important questions are how to handle existing spectrum users and how to time the transition¹⁴³. In this chapter, beside the approaches towards existing users, implementation of these approaches in the UK and Turkey will be assessed since they reflect the difficulty to introduce spectrum trading especially for the bands having high value and being used by the incumbent operators.

¹³⁸ ITU, (2008), “GSR 2008 Discussion Paper”, 8th Global Symposium for Regulators, p.20 http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR08/discussion_papers/Spectrum_Sharing_web.pdf

¹³⁹ *Supra* n.74

¹⁴⁰ Cave M., Foster A., Jones R. W., (2007), “Radio Spectrum Management”, ITU, ICT Regulation Toolkit, Executive Summary, p.35

¹⁴¹ *Ibid*

¹⁴² *Supra* n.44, p.16

¹⁴³ *Supra* n.6, p.119

3.1. Approach towards existing spectrum users

Band clearance and conversion of existing rights of use into tradable rights of use are the two basic approaches that can be used to handle existing spectrum users when transitioning to a spectrum trading regime¹⁴⁴.

3.1.1. Band clearance

According to the authorisation regime of the EU, property of scarce resources such as frequency belongs to national domain and usage rights do not constitute property rights, and therefore it can be seen as a concession by the governments to the operators¹⁴⁵. Within this context, NRAs maintain their power to reclaim the existing licences from current users and replace them with new users and/or uses¹⁴⁶. As usage rights do not constitute property rights they may be revocable by the government due to certain reasons in different countries including the breaches of the conditions of authorisations, change of use of the frequency band for “refarming”, a need to comply with commitments regarding international cooperation/harmonisation, etc¹⁴⁷.

One of these powers which can be used by the regulators to create tradable rights of use is the clearing of the frequency bands used by existing users¹⁴⁸. In case of a clean spectrum, the spectrum authority is free for designing the new rights without the complication of amending old licenses, and the new rights holders are free from interference problems arising from legacy uses¹⁴⁹. Although from a technical perspective the process of band clearance is straightforward, from a legal and political perspective it is difficult to implement in practice due to the existing operators¹⁵⁰. It may be necessary to compensate the existing operators whose rights of use are terminated earlier¹⁵¹. Furthermore, in the EU current spectrum rights of use are annually renewable or have long durations¹⁵². Based on the long term or renewable

¹⁴⁴ *Ibid* p.120

¹⁴⁵ *Supra* n.112, p.7

¹⁴⁶ *Supra* n.6, p.91

¹⁴⁷ *Supra* n.112, p.8

¹⁴⁸ *Supra* n.6, p.121

¹⁴⁹ *Supra* n.44, p.33

¹⁵⁰ *Supra* n.6, p.92

¹⁵¹ *Ibid*

¹⁵² *Ibid*

spectrum rights of use, spectrum holders made significant investments¹⁵³. Therefore, they may need lengthy notice period to clean the bands¹⁵⁴. Furthermore, the unavailability of alternative bands for incumbent operators to migrate is another difficult problem¹⁵⁵. In addition, if some spectrum is released back into the market following the band clearance process, regulators should also consider manner and timetable to reassign this spectrum¹⁵⁶. Regulators will also need to address the impact of the trading and/or liberalisation of a band on their roadmap to reassign the band¹⁵⁷. Within this context, using mechanisms of caps to facilitate market entry or using a single process or allowing an operator to obtain a blend of spectrum across different bands are the issues that need to be considered by the regulators to assign a band after the clearance¹⁵⁸. As a result, band clearance process can be too expensive for governments due to the high compensations required to be paid to the incumbent operators¹⁵⁹ and can be too lengthy and time-consuming.

Many countries are engaging in spectrum refarming, in order to maximize the spectrum efficiency, the ability to meet the market demand or necessity of international harmonisation of spectrum use¹⁶⁰. Through refarming existing spectrum users are moved out of a band for the purpose of re-assigning the spectrum to new uses¹⁶¹. The experiences of countries on refarming of certain bands reflect the difficulty to introduce the trading of rights of use via clearance of existing users' frequency bands.

3.1.2. Conversion of existing rights of use into tradable rights of use

The main tool to handle existing users is converting the existing rights of use into tradable ones¹⁶². This comprises changing existing conditions of a right of use to include the right to trade and/or liberalisation¹⁶³. This approach is more attractive to incumbent operators than band clearance because it gives them freedom to decide when and whether they vacate a band

¹⁵³ *Ibid*

¹⁵⁴ *Ibid*

¹⁵⁵ *Ibid*

¹⁵⁶ *Supra* n.92, p.98

¹⁵⁷ *Ibid*

¹⁵⁸ *Ibid*

¹⁵⁹ *Supra* n.6, p.92

¹⁶⁰ ECC Report, (2002), "Refarming and trading in a changing radiocommunication world", p.8
<http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP016.PDF>

¹⁶¹ *Supra* n.92, p.103

¹⁶² *Supra* n.44, p.33

¹⁶³ *Supra* n.6, p.123

and/or migrate to another band¹⁶⁴. Also this approach can facilitate the rapid introduction of spectrum trading.¹⁶⁵

However, converting existing rights of use into tradable ones, especially with technology and service neutral manner, is not easy due to the measures to manage interference and resolving what to do with additional obligations (e.g., roll-out, coverage) attached to the existing rights of use¹⁶⁶. It is complex to amend or incorporate existing rights and obligations into a trading framework¹⁶⁷. In case of overriding policy reasons, trading should not open up loopholes that enable spectrum users to avoid their obligations¹⁶⁸.

With regard to interference management, transfer of rights of use without liberalisation usually does not cause any complication because straightforward change of user of the license without liberalisation does not change the transmission parameters of the original licence¹⁶⁹. However, allowing spectrum trading with liberalisation creates additional complications and requires regulators to clearly determine rights and obligations of both new and converted rights of use¹⁷⁰. Otherwise any ambiguity in responsibilities related to the interference management diminishes the value of spectrum and adversely affects the trading of rights of use¹⁷¹. Incumbent operators can have incentives to use the problem of interference to deter market entry¹⁷².

Furthermore, conversion of existing rights of use into tradable rights of use may result in windfalls for existing users¹⁷³. Adopting flexible-use rules for existing rights of use requires regulators to evaluate the competitive implications of such liberalisation and the possible safeguards that would need to be put in place¹⁷⁴. The regulator should determine whether the conversion of existing rights of use into more flexible ones would provide a competitive advantage to existing operators vis-à-vis their rivals or whether operators should be allowed to

¹⁶⁴ *Ibid*, p.124

¹⁶⁵ *Ibid*

¹⁶⁶ *Supra* n.44, p.33

¹⁶⁷ *Supra* n.6, p.124

¹⁶⁸ *Ibid*

¹⁶⁹ *Ibid*

¹⁷⁰ *Ibid*

¹⁷¹ *Ibid* p.125

¹⁷² Hazlett T.W., (2001), "The Wireless Craze, The Unlimited Bandwidth Myth, The Auction Faux Pas, and the Punchline to Ronald Coase's 'Big Joke'", An Essay on Airwave Allocation Policy, AEI-Brookings Joint Center for Regulatory Studies, p.32

¹⁷³ *Supra* n.44, p.22-23

¹⁷⁴ *Supra* n.92, p.98

retain all or part of the liberalized spectrum¹⁷⁵. The regulator should consider the possible mechanisms (e.g. regulatory obligations and fees) to control the possible windfall gains of the existing operators if allows the existing operators to retain the spectrum¹⁷⁶. While operators having authorisations at little or no cost might have windfall gains through spectrum trading, the operators having authorisations at high prices for example, in auctions for a restricted number of mobile operating licenses, might have windfall losses since spectrum trading and flexible use can undermine the market value of their authorisations¹⁷⁷. This situation is politically unacceptable and has anticompetitive effects¹⁷⁸. Using market-based mechanisms in primary assignment, increasing or reducing spectrum fees, imposing a tax on windfall gains or allowing tax credits in response to windfall losses are some of the approaches to reduce the windfall gains and losses¹⁷⁹. Those approaches are not satisfactory enough since they can adversely affect the incentive to trade and can delay the introduction of trading¹⁸⁰.

Furthermore, transferring the responsibility from government to market regarding spectrum uses and prices, reduces the opportunity for governments to gain revenues from spectrum licensing and use¹⁸¹. On the other hand, in the long run spectrum trading is considered to increase the fiscal revenues due to faster growth and reflecting efficiency gains from improved spectrum management¹⁸².

3.1.3. Examples of the similar implementations of the approaches towards existing spectrum users in the UK and Turkey

Managing the transition to a framework for spectrum trading has impact not only on spectrum holders but also on consumers, employees and suppliers¹⁸³. Mishandling the transition can cause disruption of services, such as delay of new services, service quality problems etc.¹⁸⁴ Countries have experiences related to band clearance, re-assignment of the cleared band and conversion of existing spectrum rights of use into more flexible ones. Those experiences can

¹⁷⁵ *Ibid*

¹⁷⁶ *Ibid*

¹⁷⁷ *Supra* n.44, p.22

¹⁷⁸ *Ibid*

¹⁷⁹ *Supra* n.6, p.127

¹⁸⁰ *Ibid*

¹⁸¹ *Supra* n.44, p.22

¹⁸² *Ibid*

¹⁸³ *Supra* n.6, p.132

¹⁸⁴ *Ibid*

enlighten the difficulty of introducing spectrum trading with existing spectrum holders. Within this context, attempts of regulators and reactions of different operators in the UK and Turkey can reflect the challenges in the transition period including the power of incumbent operators and regulators, competition concerns, adjustment to new technologies, etc.

- *Liberalisation of 900 MHz and 1800 MHz and conversion of existing authorisations in the UK:*

In October 2009, the GSM Directive was amended by Directive 2009/114/EC removing the restriction that reserved the 900 MHz spectrum exclusively for GSM services¹⁸⁵. Following the amendment of the GSM Directive, EC adopted a technical implementation measure, EC Decision 2009/766/EC¹⁸⁶, pursuant to the Radio Spectrum Decision on harmonisation of the 900 MHz and 1800 MHz bands with the aim to provide the technical conditions that enable the UMTS systems with traditional GSM systems till 9 May 2010.

In the UK all MNOs hold 2.1 GHz spectrum in varying amounts that is suitable for the provision of higher speed data services using 3G/UMTS/HSPA, but only Telefónica O2 UK Limited (O2) and Vodafone hold additional spectrum in 900 MHz band suitable for these services¹⁸⁷. In 1800 MHz band, EE holds large amount of spectrum, while O2 and Vodafone both hold small amounts of spectrum¹⁸⁸. On the other hand, although the 1800 MHz spectrum is authorised for 3G/UMTS/HSPA use, there is no user equipment available to support such use at present¹⁸⁹.

In the liberalisation process of the GSM bands for UMTS services in the UK, O2 has appealed to the Competition Appeal Tribunal (CAT) against Ofcom's failure to accept its application

¹⁸⁵ Council Directive 87/372/EEC of 25 June 1987 on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community (GSM Directive); Directive 2009/114/EC of the European Parliament and of the Council of 16 September 2009 amending Council Directive 87/372/EEC on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community, OJ L 274/25, 20.10.2009

¹⁸⁶ Commission Decision of 16 October 2009 on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community, OJ L 274/32, 20.10.2009

¹⁸⁷ Ofcom, (2012), "Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences to allow use of LTE and WiMAX Technologies", p.7

<http://stakeholders.ofcom.org.uk/binaries/consultations/variation-900-1800mhz-lte-wimax/summary/condoc.pdf>

¹⁸⁸ Berwin SJ, "CAT rules against O2 in appeal", 9.11.2010 <http://www.inhouselawyer.co.uk/index.php/it-telecommunications-outsourcing/8216-cat-rules-against-o2-in-appeal>

¹⁸⁹ *Supra* n.187, p.7

for a variation of its licence to allow it to use 3G technology in the 900 MHz and 1800 MHz frequency bands¹⁹⁰. In *O2 v Ofcom* case, the CAT dismissed the appeal brought by O2 and ruled that the relevant EU legislation, which required member states to “make available” these bands for UMTS technology by 9 May 2010, did not create a directly effective right for O2 to deploy 3G services on these bands¹⁹¹. In the CAT’s view EU legislation is related to the technical harmonisation rather than licensing¹⁹².

Later, in January 2011 Ofcom allowed 900 MHz and 1800 MHz licences to be used for 3G¹⁹³. Since the liberalised 900 MHz spectrum licences are effective in providing 3G connections and not all of the MNOs had the original 900 MHz 2G licences except Vodafone and O2, Ofcom had originally planned to redistribute 900 MHz¹⁹⁴. Planning the redistribution of 900 MHz prompted the two operators to launch legal action against Ofcom¹⁹⁵. Later Ofcom dropped its plan due to the release of 800 MHz spectrum in the next auction which would give the opportunity to access sub-1 GHz spectrum to operators¹⁹⁶. Although the operators Three and EE which do not have 900 MHz argued that the liberalisation would cause distortion of competition, O2 and Vodafone argued that the advantage they might have from liberalisation is overstated¹⁹⁷. Furthermore, Ofcom decided to recalculate 900 MHz licence fees after the auction of 800 MHz and 2.6 GHz rather than at the time of liberalisation and therefore Vodafone and O2 will effectively underpay for 3G capable spectrum from January 2011 until the new licence fees are set after the auction¹⁹⁸. Therefore, O2 and Vodafone will have the advantage of selling their underpaid frequencies at current market prices.

On 18 April 2011, the Decision 2011/251/EU amended the EC Decision 2009/766/EC in order to ensure compliance of both LTE and WiMAX technologies until 31 December 2011 in addition to UMTS with the provisions of the amended GSM Directive¹⁹⁹. EC has also

¹⁹⁰ *Telefonica O2 UK Ltd v Office of Communications & Anor*, Court of Appeal - United Kingdom Competition Appeals Tribunal, October 07, 2010, [2010] CAT 25

¹⁹¹ *Supra* n.188

¹⁹² *Ibid*

¹⁹³ UK Parliament website, 3.11.2011

¹⁹⁴ <http://www.publications.parliament.uk/pa/cm201012/cmselect/cmcomeds/1258/125806.htm#a3>

¹⁹⁵ *Ibid*

¹⁹⁵ BBC News, “Date set for 4G airwaves auction”, 17.11.2010 <http://www.bbc.co.uk/news/technology-11776901>

¹⁹⁶ *Supra* n.193

¹⁹⁷ *Ibid*

¹⁹⁸ *Ibid*

¹⁹⁹ Commission Decision of 18 April 2011 amending Decision 2009/766/EC on the harmonisation of the 900 MHz and 1 800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic

called for redistribution of the existing spectrum assignments in the GSM bands between mobile operators, in order to avoid competition distortions and to modify channelling arrangements for deployment of UMTS and LTE²⁰⁰.

Furthermore, due to the decision of CAT, the obligation in the EC Decision 2011/251/EU only extends to putting in place any measures necessary to ensure that the 900 MHz and 1800 MHz bands are available throughout EU Member States to be authorised for use with LTE and WiMAX technology by 31 December 2011²⁰¹. However, authorisation of certain undertakings to use 2G bands for LTE and WiMAX only takes place after implementation of new authorisations and/or the amendments of the rights of use under the Authorisation Directive²⁰².

Within this context EE, which was established after the merger of France Telecom and Deutsche Telekom and holds a large portion of 1800 MHz band, requested Ofcom to authorise the use of LTE technology under its licence for 1800 MHz spectrum²⁰³. In response to the request, Ofcom published its consultation on 13 March 2012 related to EE's application to change its 1800 MHz spectrum licences to allow the use of LTE and WiMAX technologies with its consideration that there is "no material risk of a distortion of competition if EE is permitted to use the 1800 MHz band to deploy LTE and/or WiMAX technologies"²⁰⁴. Ofcom made its consideration by assessing the current mobile spectrum holdings and technologies, EC decision on T-Mobile/Orange merger and the timeframes for the availability of other spectrum in future²⁰⁵.

The EC granted clearance for the merger of France Telecom and Deutsche Telekom following the commitments given by them to divest 2x10 MHz of 1800 MHz spectrum by no later than 30 September 2013 and a further 2x5 MHz of 1800 MHz spectrum by no later than 30

communications services in the Community, OJ L 106/9, 27.04.2009; Radio Spectrum Committee Working Document, 9.12.2010

http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/_document_storage/rsc/rsc34_public_docs/rsc34_60.pdf

²⁰⁰ Cullen International, (2011), 'Supply of services in monitoring regulatory and market developments for electronic communications and information society services in Enlargement Countries, 2011-2013' p.39

²⁰¹ Ofcom, (2012), "Second consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues", Consultation Document, p.12

<http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/summary/combined-award-2.pdf>

²⁰² *Ibid*

²⁰³ *Ibid*

²⁰⁴ *Supra* n.187, p.1

²⁰⁵ *Ibid* p.6

September 2015²⁰⁶. In this process, EC considered the incremental effect of Orange-T-Mobile concentration on the assumption that the 1800 MHz spectrum would be authorised for LTE use in advance of the 800 MHz and 2.6 GHz spectrum becoming available for LTE and considered that the commitments of the companies sufficient to address the competition concerns²⁰⁷.

Ofcom considered that the EC was satisfied that the commitments addressed the competition concerns and in its merger decision the EC clearly assumed that EE would be able to offer LTE services in advance of the divestment spectrum actually being divested²⁰⁸. Furthermore, Ofcom assessed that the winners of 800 MHz and 2.6 GHz spectrum in the forthcoming auction would be able to compete with EE (and the acquirer of the divestment spectrum, if not a winner of 800 MHz and 2.6 GHz spectrum) in the provision of LTE services from late 2013²⁰⁹. Also Ofcom considered that the period of time between the availability for use of the first divestment spectrum and the 800 MHz and 2.6 GHz spectrum is some 3 months at most and therefore there is little material difference in position between the ability of the acquirer of the divestment spectrum, and the winners of the 800 MHz and 2.6 GHz spectrum (if different) from being able to compete effectively with EE²¹⁰.

In the circumstances, Vodafone, O2 and Three stated their objections to the refarming of 1800 MHz²¹¹. Vodafone argued that giving the largest player permission to use its existing spectrum for 4G services before the auction of 800 MHz and 2.6 GHz bands or before the divestment of the spectrum as required by the EC is a surprise²¹². Due to the objections from rival operators, Ofcom has been forced to extend its consultation period²¹³. At the end, on 21 August 2012 Ofcom published its decision to vary EE's 1800 spectrum licences to allow use

²⁰⁶ EC, (2010), "Regulation (EC) No 139/2004 Merger Procedure – Case No COMP/M.5650, T-Mobile/Orange" http://ec.europa.eu/competition/mergers/cases/decisions/M5650_20100301_20212_247214_EN.pdf

²⁰⁷ *Supra* n.187, p.7

²⁰⁸ *Ibid*, p.17

²⁰⁹ *Ibid*

²¹⁰ *Ibid*

²¹¹ BBC News, "Mobile firms attack 'early 4G' on Everything Everywhere", 9.5.2012

<http://www.bbc.co.uk/news/technology-18008666>

²¹² White G., "4G mobile may arrive this year following Ofcom ruling", 13.3.2012

<http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/9141669/4G-mobile-may-arrive-this-year-following-Ofcom-ruling.html#> ,

²¹³ Curtis S., "Ofcom puts the brakes on Everything Everywhere's 4G plans", 27.3.2012

<http://news.techworld.com/networking/3347216/ofcom-puts-the-brakes-on-everything-everywheres-4g-plans/>

of LTE and WiMax technologies²¹⁴. In its decision Ofcom stated that “liberalisation of EE’s 1800 MHz spectrum without delay is unlikely to result in a material risk of a distortion to competition to the detriment of consumers” and considered that it “will deliver significant benefits to consumers”²¹⁵. Vodafone and O2 were hugely disappointed with the decision and Vodafone said it was “shocked” at Ofcom’s decision²¹⁶. In addition, at the same date of the Ofcom’s decision, EE announced that it will sell some of its 1800 MHz bands to Three due to the condition of the EC for the merger of Orange and T-Mobile²¹⁷. In this way, beside the profit that EE gains from the sale of some spectrum to Three, it also has the opportunity to lead LTE in the UK.

Ofcom’s decision greatly based on the EC’s decision related to the merger of Orange and T-Mobile but from another point of view, Ofcom’s decision on allowing EE to start providing LTE services before other operators, might have been taken with an instinct to find a balance with its decision on the use of 900 MHz band for 3G services which was in favour of O2 and Vodafone.

➤ *Liberalisation of 900 MHz and 1800 MHz in Turkey:*

The decision of the Information Communications and Technologies Authority (ICTA), NRA of Turkey, on the strategy proposal about the use of 900 MHz and 1800 MHz bands not only for GSM but also for IMT-2000/UMTS services, has been published in September 2011. According to the decision, use of 900/1800 MHz bands may be allowed after additional frequency assignment at these bands to operators. The decision proposes assigning of spectrum from the E-GSM band which was previously used for military purposes but cleared by ICTA for allocation to mobile services in addition to the 1800 MHz band 2 x 60 MHz of which is already free. The E-GSM band is proposed to be assigned to an operator which has only 2 x 2,4 MHz at the 900 MHz band but 2x15 MHz at the 1800 MHz band to set the stage for sustainable competition regarding IMT-2000/UMTS services at the 900 MHz band. ICTA also proposes to assign the other two 900 MHz operators, one of which is Vodafone,

²¹⁴ Ofcom, (2012), “Decision to vary Everything Everywhere’s 1800 MHz spectrum licences to allow use of LTE and WiMax technologies” <http://stakeholders.ofcom.org.uk/binaries/consultations/variation-900-1800mhz-lte-wimax/statement/statement.pdf>

²¹⁵ *Ibid* p.15, 45

²¹⁶ BBC News, “Everything Everywhere gets 4G go-ahead from Ofcom”, 21.8.2012 <http://www.bbc.co.uk/news/business-19328653>

²¹⁷ *Ibid*

additional spectrum at 1800 MHz band, in order not to have them deprived of an opportunity to receive spectrum at 1800 MHz band which is very likely to be used for LTE services in Europe.

However, pursuant to Article 9/6 of the Electronic Communications Law numbered 5809, it is only possible to grant spectrum through tenders, at the valuable bands such as 900, 1800 or 2100 MHz bands where the frequency is considered scarce. Therefore ICTA will have to apply spectrum caps by restricting the 900 MHz operators from bidding for E-GSM band and the 1800 MHz operator from bidding for the 1800 MHz band. In order to open GSM bands (both at 900 MHz and 1800 MHz) for 3G services, it is proposed to auction 2x8.6 MHz of spectrum in the E-GSM band (880-890 MHz paired with 925-935 MHz) to operators that currently hold less than 10 MHz of spectrum in the 900 MHz band to avoid competition distortions²¹⁸. Similarly, two blocks of 2x15 MHz in the 1800 MHz band are planned to be auctioned to operators that do not have frequencies in this band²¹⁹.

However, the 900 MHz operators object the proposal as they do not want the smallest operator to gain any advantage by receiving additional spectrum at the 900 band. For instance, Vodafone submitted its objection to ICTA related to the proposal for the liberalisation of 2G bands. According to her, the proposal of ICTA is likely to have the effect of imposing on Vodafone and Turkcell heavy costs of switching a significant part of their GSM services to the 1800 MHz band, and of limiting 3G competition in the interim. Therefore, both of these effects are likely to raise prices for end users. The liberalisation process of 900 MHz and 1800 MHz is still continuing in Turkey.

- *Transition from analog to digital television and auction of 800 MHz and 2.6 GHz in the UK:*

One of the recent issues of spectrum refarming is transition from analog to digital television which is widely known as the “digital dividend”²²⁰. In this process countries examining procedures to re-allocate spectrum that becomes available for existing and new operators who want to use the 470-862 MHz band currently used for broadcasting, for new services such as

²¹⁸ *Supra* n.200, p.39

²¹⁹ *Ibid*

²²⁰ *Supra* n.92, p.103

mobile TV and extending wireless electronic communication services into rural areas²²¹. Digital dividend spectrum is suitable to provide mobile services to rural areas and has effective in-building performance in urban areas²²². The availability of spectrum in the 800 MHz band (790 to 862 MHz) arises from the decision to clear the band of terrestrial television broadcasting and programme-making and special events services and release it for mobile services²²³. The 800 MHz Decision²²⁴ determined the configuration of the spectrum and requires Member States to make 800 MHz band available for networks other than high power broadcasting networks²²⁵. Several EU countries one of which is the UK decided to make 790-862 MHz band available for wireless broadband and other services²²⁶.

In the auction process of 800 MHz and 2.6 GHz bands, Ofcom has proposed an auction mechanism having caps and floors on the amount of spectrum each mobile network operator can hold in order to achieve effectively competitive mobile market which benefits consumers with at least four mobile operators²²⁷. Both O2 and Vodafone which have 900 MHz objected to the proposal and have threatened with legal action since EE and Three which do not have 900 MHz will have an advantage bidding for the 800 MHz spectrum at the auction²²⁸. Due to the objections, Ofcom delayed the auction to get an extra round of consultation that was scheduled for early 2012²²⁹. The auction was expected to start in the last quarter of 2012²³⁰. Ofcom has finally issued its assessment of future mobile competition and award of 800 MHz and 2.6 GHz in 24 July 2012²³¹. Ofcom revised its proposals in its first consultation and reserved some of the available spectrum in the auction for a fourth operator other than EE, O2

²²¹ EC, Information Society,

http://ec.europa.eu/information_society/policy/ecommm/radio_spectrum/topics/ecs/wapecs/index_en.htm

²²² *Supra* n.92, p.103

²²³ Ofcom, (2012), "The award of 800 MHz and 2.6 GHz spectrum", Information Memorandum, p.5

<http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/statement/IM.pdf>

²²⁴ EC Decision of 6 May 2010 on harmonised technical conditions of use of the 790 to 862 MHz band for terrestrial systems capable of providing electronic communications services in the European Union (2010/267/EC)

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:117:0095:0101:EN:PDF>

²²⁵ *Supra* n.223, p.5

²²⁶ Analysys, DotEcon, Hogan & Hartson, (2009), "Exploiting the digital dividend-a European Approach", p.20

http://ec.europa.eu/information_society/policy/ecommm/radio_spectrum/document_storage/studies/digital_dividend_2009/dd_finalreport_executivesummary.pdf

²²⁷ UK Parliament website, 3.11.2011

<http://www.publications.parliament.uk/pa/cm201012/cmselect/cmcomeds/1258/125807.htm>

²²⁸ *Ibid*

²²⁹ *Ibid*

²³⁰ *Ibid*

²³¹ Ofcom, (2012), "Statement of Ofcom regarding assessment of future mobile competition and award of 800 MHz and 2.6 GHz" <http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/statement/Statement-summary.pdf>

or Vodafone²³². In this way a possible new entrant has a possibility to get the reserved spectrum²³³. The rules of auction will not guarantee that either EE or a fourth market participant will obtain sub-1GHz spectrum²³⁴. The consultation of Ofcom on the draft auction regulations is to close on 11 September 2012²³⁵.

The auction process of the UK to allocate 800 MHz and 2.6 GHz bands indicates the difficulty of regulators to ensure the competitive market in the re-allocation process of a spectrum. This process in the UK is a good example to reflect the complex nature of the clearance of a band for new uses and re-allocation of it in order not only to ensure efficient use of spectrum but also to ensure competitive market.

3.2. Timing of the spectrum trading

There are two basic alternatives for the timing of the introduction of spectrum trading. While in “big bang” approach liberalisation and trading are launched simultaneously for all applicable bands and uses, in the phased approach spectrum trading and liberalisation are introduced progressively across all applicable spectrum uses and bands²³⁶. Countries where spectrum trading has already been implemented have preferred to adopt a progressive phased approach to its introduction²³⁷. A step-by-step approach to trading not only gives regulators time to facilitate spectrum reorganisation but also gives markets the opportunity to become familiar with the new regime²³⁸. Furthermore, to achieve the full potential benefits of spectrum trading, removing the restrictions on the rights of use is required in the long term²³⁹.

Introducing spectrum trading in some bands is easier than others especially in vacant and cleared bands since there is no disruption of existing users²⁴⁰. However, in other bands regulators should give notice periods to incumbent operators to vacate the bands or to change

²³² Ofcom, 2012, “Assessment of future mobile competition and award of 800 MHz and 2.6 GHz”, p.3 <http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/statement/Statement-summary.pdf>

²³³ Burns E., “UK’s Ofcom to Hold 4G Auction Of”, 24.7.2012 Airwaves <http://www.redorbit.com/news/technology/1112662769/uks-ofcom-to-hold-4g-auction-of-airwaves>

²³⁴ Bratby R., “UK 4G spectrum auctions put back again” <http://www.telecomstechnews.com/blog-hub/2012/feb/08/uk-updates-rules-for-800-mhz-and-26-ghz-auctions/>

²³⁵ *Supra* n.231, p.8

²³⁶ *Supra* n.6, p.130

²³⁷ *Supra* n.52, p34

²³⁸ *Supra* n.26, p.54

²³⁹ *Ibid*

²⁴⁰ *Supra* n.6, p.131

the terms of rights of use of the operators²⁴¹. Since transfer of rights of use without liberalisation usually does not adversely affect interference, it can be permissible in most of the bands immediately²⁴². However, due to its impacts regulators prefer to apply phased approach for introducing liberalisation with spectrum trading.

As stated in the examples related to transition approaches in the UK and Turkey, it is difficult to reorganise the spectrum which has been used by the incumbent operators or to liberalise the band which has been used for one purpose. Impacts of spectrum trading and liberalisation vary from country to country and band to band. It is difficult to implement big bang approach in high value bands which are used by incumbent operators as can be seen in refarming process of certain bands.

4. COMPARISON OF THE UK AND TURKISH LEGAL REGIMES ON SPECTRUM TRADING

In this chapter firstly EU regulatory framework on spectrum trading will be explained. Later legislation of the UK and Turkey on spectrum trading will be assessed and comparative analysis of the UK and Turkish legal regimes and implementations related to spectrum trading will be made.

4.1. EU regulatory framework on spectrum trading

As a result of the fundamental technological, market and regulatory developments, the EU adopted a new strategic approach towards promoting an optimal use of radio spectrum in liberalised and competitive European markets; via reducing access barriers to frequencies, and by removing existing artificial restrictions²⁴³. Liberalising spectrum and introducing market-based mechanisms for its use and allocation is the long-standing objective of the EC²⁴⁴.

²⁴¹ *Ibid*

²⁴² *Ibid*

²⁴³ Chochliouros I., Spiliopoulou A., Chochliouros S., Doukoglou T., (2007), "European Challenges towards Forming and Promoting an Innovative Radio-Spectrum Policy in a Fully Converged Electronic Communications Market", The Journal of The Communications Network, Volume 6, Part 2, p.1

²⁴⁴ Oxera Consulting Ltd, (2012), "Spectrum Trading Issues – A framework for competition assessments", Report prepared for Commission for Communications Regulations, p.1
http://www.comreg.ie/_fileupload/publications/ComReg1276b.pdf

In the EU, the radio spectrum is managed mainly by Member States at the national level and in international coordination²⁴⁵. Radio spectrum policy and management are regulated by the Framework Directive 2002/21/EC, the Authorisation Directive 2002/20/EC as amended by the Better Regulation Directive 2009/140/EC and the Radio Spectrum Decision²⁴⁶. The introduction of market based mechanisms, including service and technology neutrality principles and the possibility to trade spectrum, points out a tendency to allow market forces and users to decide on how to use and assign the spectrum rather than the government²⁴⁷. The Radio Spectrum Decision established a common regulatory framework for radio spectrum policy in the EU²⁴⁸. The Decision aims to “ensure the coordination of policy approaches and, where appropriate, harmonised conditions with regard to availability and efficient use of the radio spectrum....” at the EU level²⁴⁹.

Spectrum trading is introduced in the EU under Article 9 of the Framework Directive 2002/21/EC. Before the enactment of the Better Regulation Directive 2009/140/EC, the Framework Directive 2002/21/EC permits not requires Member States to introduce spectrum trading provided that the competition is not distorted as a result of any trade and spectrum trades do not change the use of spectrum harmonised by the EU²⁵⁰. Therefore, the actions of the Member States regarding spectrum trading were governed by the Radio Spectrum Decision and the Framework Directive 2002/21/EC²⁵¹. In EU, the EC wants to create a liberalised spectrum market in which operators are free from restrictions associated to the rights of use on spectrum usage and enable to trade their rights of use with other operators or third party band managers²⁵².

²⁴⁵ *Supra* n.3, p.6

²⁴⁶ Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive), Article 9(3); Directive 2002/20/EC of the European Parliament and of the Council of 7 March 2002 on the authorisation of electronic communications networks and services (Authorisation Directive), OJL 108 L 108/21, 24.4.2002; Directive 2009/140/EC of the European Parliament and of the Council of 25 November 2009 amending Directives 2002/21/EC on a common regulatory framework for electronic communications networks and services, 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities, and 2002/20/EC on the authorization of electronic communications networks and services (Better Regulation Directive), Article 9(b), OJL 337 L/37, 18.12.2009; Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community, OJL 108 L 108/1, 24.4.2002.

²⁴⁷ Caicedo, C.E., Weiss M.B.H, (2010), “The Viability of Spectrum Trading Markets”, IEEE, p.1

²⁴⁸ Nihoul O., Rodford P., (2011), “EU Electronic Communications Law, Competition and Regulation in the European Telecommunications Market”, Oxford University Press, 2nd edition, p.153

²⁴⁹ Article 1 of the Radio Spectrum Decision

²⁵⁰ *Supra* n.42, p.14

²⁵¹ *Supra* n.13, p.101

²⁵² Hale A., (2007), “The Future of EU Spectrum Policy”, TelcomFinance, Issue 153, p.1

In order to foster flexibility in terms of service and technology neutrality, more reliance on market forces through spectrum trading and greater harmonisation of spectrum use, the Framework Directive 2002/21/EC was amended with the Better Regulation Directive 2009/140/EC²⁵³. With the amendments of the Better Regulation Directive 2009/140/EC new Article 9(b) of the Framework Directive requires Member States to permit spectrum trading in bands that the EC identifies²⁵⁴. The Framework Directive 2002/21/EC as amended with the Better Regulation Directive 2009/140/EC allows the common identification of bands for which usage rights may be made tradable²⁵⁵. Furthermore, Member States may allow spectrum trading in other bands or conversely may determine that spectrum trading does not apply where right to use radio frequencies was initially obtained free of charge²⁵⁶.

Article 9b(1) of the Framework Directive as amended by the Better Regulation Directive 2009/140/EC leaves the decision to NRAs to determine how the conditions of individual spectrum rights of use will continue in spectrum trading regime²⁵⁷. Furthermore, spectrum trading can only be allowed with the condition not to change the use of spectrum for the harmonised bands which are subject to an EC Directive or a Decision²⁵⁸.

Furthermore, according to Article 9.7 of the Framework Directive 2002/21/EC as amended by the Better Regulation Directive 2009/140/EC Member States lay down rules to prevent spectrum hoardings.

One of the objectives of the EC is increasing the flexibility of spectrum rights of use. With regard to flexible use of spectrum, Articles 9.3 and 9.4 of the revised Framework Directive requires Member States to all types of technology and electronic communications services may be used in the radio frequency bands. Until Better Regulation Directive 2009/140/EC, several steps have been taken towards flexible use of spectrum in the EU. The principle of

²⁵³ Oberst G.,(2010)‘Impact of the amended EU regulatory framework on spectrum and mobile issues’, Communications Law Newsletter, May 2010, p.16
<http://www.hoganlovells.com/files/Publication/06bb4b14-4b69-4309-bfde-6c0cd6053c9d/Presentation/PublicationAttachment/6b887a6e-3287-426a-bbfc-16321391484c/CommunicationsLawCommitteeNewsletterMay2010.pdf>

²⁵⁴ *Ibid*, p.16

²⁵⁵ *Supra* n.8, p.37

²⁵⁶ *Supra* n.253, p.16

²⁵⁷ *Supra* n.244, p.41

²⁵⁸ *Supra* n.23, p.71

flexibility is slowly being introduced in the use of spectrum and has been under the notion of Wireless Access Policy for Electronic Communications Services (“WAPECS”)²⁵⁹. Within this context, the EC identified five sets of frequency bands including 470-862 MHz; 880-915 MHz / 925-960 MHz as well as 1710-1785 MHz / 1805-1880 MHz; 1900-1980 MHz / 2010-2025 MHz / 2110-2170 MHz; 2500-2690 MHz (the 2.6 GHz band); and 3.4-3.8 GHz to be suitable for applying the technology and service neutrality principles to in the first instance²⁶⁰. Member States should comply with the usage of harmonised bands while implementing spectrum trading. Although the benefits of spectrum trading is considered to be higher in case the combination of tradability and flexibility of usage, there are more complex legacy issues to be solved to implement combination of tradability and flexibility of usage due to existing users in practice.

4.2. Spectrum trading in the UK

The Framework Directive 2002/21/EC was transposed into the UK law via section 168 of the Communications Act and enabled the introduction of spectrum trading in the UK²⁶¹. Section 168 was superseded by section 30 of the Wireless Telegraphy Act 2006, under which trading is now authorised and regulated²⁶².

Spectrum trading which enables spectrum rights of use holders under the Wireless Telegraphy Act to transfer all or part of their rights and obligations under the licenses to another party was introduced in the UK through the publication of the Wireless Telegraphy (Spectrum Trading) Regulations 2004 (2004 Trading Regulations) and Wireless Telegraphy (Register) Regulations 2004 (2004 Register Regulations) came into force on 23 December 2004²⁶³. Since 2004 several amendments have been made to these regulations to extend the spectrum transfers to further licence classes²⁶⁴. The 2004 Trading Regulations made transfers possible by detailing the possible transfer types, tradable license classes and trading procedures that need to be followed etc²⁶⁵. Spectrum trading has been governed by the 2004 Spectrum Trading Regulations in addition to section 30 of the Wireless Telegraphy Act till the adoption

²⁵⁹ *Supra* n.8, p.18

²⁶⁰ *Supra* n.252, p.5

²⁶¹ Section 168 of the Communications Act <http://www.legislation.gov.uk/ukpga/2003/21/section/168>

²⁶² Ofcom, (2012), “Notice of proposals to make Wireless Telegraphy Trading and Register Regulations”, p.18 <http://stakeholders.ofcom.org.uk/binaries/consultations/wireless-telegraphy-trading/summary/main.pdf>

²⁶³ *Ibid*, p.3

²⁶⁴ *Ibid*

²⁶⁵ *Ibid*

of the Wireless Telegraphy (Spectrum Trading) Regulations 2012 which come into force 13 September 2012 and revoke and replace 2004 Spectrum Trading Regulations²⁶⁶. Ofcom has adopted a phased approach to implement spectrum trading²⁶⁷.

The Framework Directive 2002/21/EC as amended by the Better Regulation Directive 2009/140/EC enables NRAs to allow spectrum users to transfer or lease their usage rights to third parties²⁶⁸. The revised Framework Directive transposed into the UK law in 26 May 2011 through Electronic Communications and Wireless Telegraphy Regulations 2011²⁶⁹ and introduced spectrum leasing as a new type of transaction²⁷⁰.

Spectrum trading has two forms in the UK. One of them is spectrum transfer in which a new user is granted a license by Ofcom to use spectrum following a commercial transaction with an existing licensee involving the transfer of all or part of the licence rights and associated obligations to another party²⁷¹. The other one is spectrum leasing in which existing licensee let someone else to exercise his rights to use the spectrum within and subject to the terms and conditions of the licence under a contract without obtaining a further licence from Ofcom²⁷².

Types of spectrum trading in the UK are²⁷³;

Outright total transfers in which all the rights and obligations under a licence are transferred to a third party;

Outright partial transfers in which only some of the rights or obligations are transferred to a third party and the rest remain with the original owner;

²⁶⁶ Wireless Telegraphy (Spectrum Trading) Regulations 2012, S.I. 2012 No. 2187 <http://www.legislation.gov.uk/ukxi/2012/2187/made>, Ofcom, (2012), “Ofcom’s decision to make Wireless Telegraphy Trading and Register Regulations”, p.13 http://stakeholders.ofcom.org.uk/binaries/consultations/wireless-telegraphy-trading/statement/TradingRegister_statement.pdf

²⁶⁷ *Supra* n.13, p.97

²⁶⁸ Ofcom, (2010), “Simplifying spectrum trading- reforming the spectrum trading process and introducing spectrum leasing”, Interim Statement, p.10 <http://stakeholders.ofcom.org.uk/binaries/consultations/simplify/statement/statement.pdf>

²⁶⁹ The Electronic Communications and Wireless Telegraphy Regulations 2011, S.I. 2011 No. 1210 <http://www.legislation.gov.uk/ukxi/2011/1210/made>

²⁷⁰ Ofcom, (2011), “Simplifying Spectrum Trading-Spectrum leasing and other market enhancements”, Final statement, p.4 <http://stakeholders.ofcom.org.uk/binaries/consultations/simplify/statement/statement-spectrum-leasing.pdf>

²⁷¹ *Ibid*, p.1

²⁷² *Ibid*, p.1

²⁷³ *Supra* n.262, p.4

Concurrent total transfers in which all the licence rights and obligations are transferred to a third party while continuing at the same time to apply also to the original holder; and

Concurrent partial transfers – some of the licence rights and obligations are transferred to a third party while continuing at the same time to apply to the original holder and the rest of the rights and obligations remain with the original holder.

The choice of the type of transfer depends on the requirements of the parties²⁷⁴. Outright or concurrent transfers may be either total or partial²⁷⁵. Partial trading is restricted in certain licence classes due to the necessity to ensure compatibility with spectrum planning and frequency assignment processes²⁷⁶. The rights or obligations may be divided by frequency band, geographical coverage or time in partial transfers²⁷⁷. Types of transactions that are permitted for each tradable licence category and, in some cases, the minimum units into which assignments may be subdivided in partial transfers are specified in the Trading Regulations²⁷⁸.

In the UK, trading is totally voluntary and no licensee is forced to trade by Ofcom²⁷⁹. Ofcom has also adopted the liberalisation for use of spectrum wherever possible to strengthen the benefits of trading²⁸⁰.

Before the adoption of the 2012 Trading Regulations, transferring rights of use required Ofcom's approval²⁸¹. When a spectrum trade is proposed or has taken place, Ofcom publishes information regarding the trade on two online databases, the Wireless Telegraphy Act Register (WTR) and the Transfer Notification Register (TNR)²⁸². While the WTR provides information about individual licenses which can be traded, the TNR provides information on licenses which have been traded or are in the process of being traded²⁸³. Although Ofcom

²⁷⁴ *Supra* n.268, p.7

²⁷⁵ *Supra* n.262, p.4

²⁷⁶ *Supra* n.268, p.8

²⁷⁷ *Ibid*, p.7

²⁷⁸ *Ibid*

²⁷⁹ *Supra* n.42, p.3

²⁸⁰ *Supra* n.13, p.97

²⁸¹ Marcus J.S., Nett L., Scanlan M., Stumpf, U, Cave M., Pogorel G., (2005), "Towards More Flexible Spectrum Regulation", Wik Consult, Study for the Federal Network Agency, p.78

²⁸² Akalu R., Arias, A. D., (2012) "Assessing the policy of spectrum trading in the UK", info, Vol. 14 Iss: 1, pp.36 – 54, p.45

²⁸³ Ofcom Spectrum Information System, <http://spectruminfo.ofcom.org.uk/spectrumInfo/>

prefers to share information about whatever is being traded with market, the price paid for the spectrum right of use trades is not published²⁸⁴.

Ofcom considered the requirements of the existing spectrum transfer process including advance notification of trades, obtaining Ofcom's consent, publication of details of proposed and actual transfers and the issue of new licences as a barrier to trades and published a consultation to simplify spectrum trading on 22 September 2009²⁸⁵. Following the consultation, Ofcom published an interim statement on 15 April 2010 to simplify transfer process and introduce spectrum leasing²⁸⁶. On 29 June 2011, Ofcom published a final statement to simplify spectrum trading²⁸⁷. In the statement, Ofcom proposed to remove the need to obtain its consent for spectrum transfer process of currently tradable license classes except 2G and 3G licenses²⁸⁸. Furthermore, Ofcom initially proposed to introduce leasing for certain auctioned and Business Radio Area Defined licences and vary existing licenses instead of making rules through Trading Regulations to introduce spectrum leasing to monitor how spectrum leasing develops and assist interference investigation and enforcement²⁸⁹. Ofcom prefers to make further consideration on leasing of 2G and 3G licenses²⁹⁰. On December 2011, Ofcom introduced leasing for the first time, initially for certain auctioned and Business Radio Area Defined licences²⁹¹.

On 20 June 2011 Ofcom enabled MNOs to trade their 2G and 3G bands (900 MHz, 1800 MHz and 2100 MHz)²⁹². Mobile spectrum trading rules are arranged in the Wireless Telegraphy (Mobile Spectrum Trading) Regulations 2011 which came into force on 4 July 2011²⁹³. Ofcom requires prior consent and ex-ante competition check on each mobile spectrum trade due to its different nature and considered that there was a material risk that

²⁸⁴ *Supra* n.282, p.45

²⁸⁵ Ofcom, (2009), "Simplifying spectrum trading-Regulatory reform of the spectrum trading process and introduction of spectrum leasing", Consultation Document
<http://stakeholders.ofcom.org.uk/binaries/consultations/simplify/summary/simplify.pdf>

²⁸⁶ *Supra* n.268

²⁸⁷ *Supra* n.270

²⁸⁸ *Ibid*, p.1

²⁸⁹ *Ibid*, p.30

²⁹⁰ *Ibid*

²⁹¹ *Supra* n.262, p. 4

²⁹² Oberst G., "UK Spectrum Trading", 1.7.2011 <http://www.hlspectrumreview.com/2011/07/articles/spectrum-management/uk-spectrum-trading/>

²⁹³ *Ibid*, The Wireless Telegraphy (Mobile Spectrum Trading) Regulations 2011, S.I. 2011 No. 1507
<http://www.legislation.gov.uk/uksi/2011/1507/made>

concentration of mobile spectrum holdings could affect downstream competition²⁹⁴. Furthermore, Ofcom preferred to consider the competition assessment of a mobile spectrum transfer on a case-by-case basis²⁹⁵. Despite the requests of MNOs Ofcom decided not to set out detailed criteria for competition assessments²⁹⁶. One of the reasons for the requirement of prior consent of Ofcom is to prevent licensees from circumventing competition rules which are likely to be put in place for the upcoming auctions of 800 Mhz and 2.6 GHz bands²⁹⁷.

Other than Mobile Spectrum Trading Regulations 2011, in June 2012 a further step was taken by Ofcom to liberalise the spectrum trading with a notice of proposals to make Wireless Telegraphy Trading and Register Regulations 2012 that would revoke and replace the Spectrum Trading Regulations 2004 and Register Regulations 2004, as amended²⁹⁸. The proposed regulations would consolidate many of the provisions of the previous regulations into a single instrument and thereby would reduce the regulatory burden on stakeholders²⁹⁹. Mobile Spectrum Trading Regulations 2011 are not in the scope of the Proposed Regulations³⁰⁰. Furthermore, the Proposed Trading Regulations would remove the need for Ofcom to consent to a transfer of rights to use spectrum³⁰¹. However, transfer of 2G and 3G bands will remain subject to Ofcom's consent³⁰². Furthermore, the new licensee would be subject to the same terms and conditions of the old licence and subject to the restrictions on use of spectrum as the old licensee³⁰³. Ofcom refers to this as "no change of use" and this restricts the new licensee's right to use the spectrum in a similar way to the previous licensee in practice³⁰⁴. Furthermore, the Proposed Trading Regulations would also extend the ability to transfer all or part of the rights to use spectrum under a Wireless Telegraphy Act 2006 licence to the maritime and satellite earth station licence classes³⁰⁵. Following the consultation process, on 5 September 2012, Ofcom published its decision which included the proposed regulations to make Wireless Telegraphy Trading and Register Regulations 2012 that revoke

²⁹⁴ Ofcom, (2011), "Statement on proposal to make 900 MHz, 1800 MHz and 2100 MHz public wireless network licences tradable", Statement, p.5 <http://stakeholders.ofcom.org.uk/binaries/consultations/trading-900-1800-2100/statement/900-1800-2100-statement.pdf>

²⁹⁵ *Ibid*, p.6

²⁹⁶ *Ibid*

²⁹⁷ *Supra* n.292

²⁹⁸ *Supra* n.262, p.1

²⁹⁹ *Ibid*, p.2

³⁰⁰ *Ibid*, p.17

³⁰¹ *Ibid*, p.1

³⁰² *Ibid*

³⁰³ *Ibid*, p.11

³⁰⁴ *Ibid*

³⁰⁵ *Ibid* p.1

and replace the 2004 Trading Regulations, as amended and Register Regulations 2012 that revoke and replace the 2004 Register Regulations, as amended³⁰⁶. These regulations come into force on 13 September 2012³⁰⁷. In addition to the realising its plans to facilitate spectrum trading, Ofcom has also made some minor editorial changes to the draft Trading Regulations and Register Regulations on which they consulted³⁰⁸.

Despite the detailed legal framework and faithful adoption of EU regulatory framework, there is no functioning secondary market in the UK and for most bands there is no significant number of transactions. Most of the transactions are related to the transfer of spectrum at PMR bands in which there is high number of users and licences³⁰⁹. The widespread trading of spectrum rights of use has not happened as expected. Some of the reasons argued for less trading includes efficient initial allocation of spectrum, insufficient liberalisation, licence duration, etc.³¹⁰.

With regard to mobile spectrum trading, although O2 and Vodafone the only operators holding 900 MHz are pleased for the allowance of spectrum trading at 2G and 3G bands, it is difficult for them to sell their spectrum voluntarily because of the value of the spectrum they hold³¹¹. Ofcom had initially planned to redistribute the spectrum allocated to O2 and Vodafone, but the two operators threatened Ofcom by a legal action and due to the release of 800 MHz in the forthcoming auction and the merger of T-Mobile and Orange, Ofcom dropped its plans³¹². Ofcom may force them to trade through the auction process of 4G by arranging caps on the amount of valuable 4G spectrum they can acquire³¹³. Furthermore, since Ofcom decided to recalculate 900 MHz license fee after the auction of 800 MHz and 2.6 GHz, following the allowance of the spectrum trading in mobile spectrum bands O2 and Vodafone entitled to sell the frequency the value of which is underpaid by them. Since Three has the least spectrum to trade contrary to its rivals, it is less enthusiastic about spectrum trading³¹⁴.

³⁰⁶ *Supra* n.266, p.3; Wireless Telegraphy (Register) Regulations 2012, S.I. 2012/2186
<http://www.legislation.gov.uk/ukxi/2012/2186/contents/made>

³⁰⁷ *Ibid*

³⁰⁸ *Ibid* p.4,12,17

³⁰⁹ *Supra* n.112, p.13

³¹⁰ Akalu, R., (2010) "Why there have been so few spectrum trades in the UK: lessons for Europe", info, Vol. 12 Iss: 1, pp.10 - 17, p.10

³¹¹ BBC News, "Mobile firms can trade spectrum", 21.6.2011 <http://www.bbc.co.uk/news/uk-13855655>

³¹² *Ibid*

³¹³ *Ibid*

³¹⁴ Har-even, B., (2011), "Regulator approves UK mobile spectrum trading"
<http://www.telecoms.com/29488/regulator-approves-uk-mobile-spectrum-trading-2/>

EE will be the biggest beneficiary of mobile spectrum trading in the UK³¹⁵. As a condition of the clearance of the merger of Deutsche Telecom and France Telecom, the EC required EE to divest quarter of its frequencies within a time schedule. As the Mobile Spectrum Regulations 2011 enables MNOs to transfer their spectrum to third parties at 900 MHz, 1800 MHz and 2100 MHz, the Financial Times speculated that one of the first transactions to take place according to the Mobile Spectrum Trading Regulations 2011 will be probably the sale by EE of the required %25 of the 1800 MHz³¹⁶. On 21 August 2012 EE announced an agreement with Three related to the sale of the 2x15 MHz of 1800 MHz spectrum following the allowance of EE by Ofcom to offer LTE in its existing 1800 MHz frequencies at any point from 11 September 2012³¹⁷. Ofcom and the EC will review whether this divestment satisfies the merger commitments of the France Telecom and Deutsche Telecom³¹⁸. Although it is not known how much Three has agreed to pay for the 1800 MHz spectrum³¹⁹, the Financial Times has previously speculated that the sale could net £450 million for EE but EE has claimed that it was too sensitive to comment³²⁰. Any amount made from the sale of the 1800 MHz spectrum will be pure profit of EE as the 1800 MHz spectrum that EE holds had been allocated at no initial cost and originally been allocated to its component companies T-Mobile and Orange in 1991³²¹. EE is paying licence fee for this spectrum per year and has paid an estimated £160 million to date³²². In this way, through spectrum trading a private company will gain profit from the sale of a public asset and it is not known whether this sale will be used for consumer benefits or investments in its network³²³. In order to get a more efficient outcome from the divestment, it might be necessary to ensure that the spectrum is reallocated efficiently and that any social costs of the divestment do not outweigh the efficiencies generated by the spectrum trade³²⁴.

³¹⁵ *Supra* n.311

³¹⁶ UK Parliament website, 23.08.2012

<http://www.publications.parliament.uk/pa/cm201012/cmselect/cmcomeds/1258/125806.htm#a4>

³¹⁷ Sahota D., "3UK to buy 1800MHz spectrum from Everything Everywhere", 21.8.2012

<http://www.telecoms.com/48383/3uk-acquires-ees-1800mhz-spectrum-but-faces-wait-to-use-it/>

³¹⁸ Rushton K., "Everything Everywhere agrees spectrum sale to Three", 21.8.2012

<http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/9490513/Everything-Everywhere-agrees-spectrum-sale-to-Three.html>

³¹⁹ *Ibid*

³²⁰ *Supra* n.316

³²¹ *Ibid*

³²² *Ibid*

³²³ *Ibid*

³²⁴ *Supra* n.244, p.47

4.3. Spectrum trading in Turkey

In order to get a clear view of the Turkish legislation on spectrum trading, it is considered beneficial to explore the Turkish authorisation and spectrum allocation regulations which present some degree of deviation from the EU legislation.

In Turkey, the Ministry of Transport, Maritime and Communications has the authority to set the strategy and policies regarding electronic communications services which are based on scarce resources such as numbers, internet domain names, satellite position and frequency allotment³²⁵. ICTA has the authority to plan and allocate frequencies, satellite positions and numbers necessary for the provision of electronic communications services and installation and operation of the electronic communications network and infrastructures, by taking into consideration the policy determined by the Ministry³²⁶. According to Article 9 of the Electronic Communications Law numbered 5809, current authorisation types are notification and notification with rights of use. Licences granted during the previous regime were converted into notifications and/or rights of use. However, differently from the EU authorisation regime, existing concession agreements signed during the previous regime for allocation of nation-wide frequencies to limited number of operators, are still in force and are not converted into rights of use.

Within this context there are three GSM and IMT-2000 MNOs, Turkcell, Vodafone and Avea, each of which has signed two concession agreements separately for GSM and IMT-2000 services with ICTA. The nation-wide scarce resources allocated to such operators under the concession agreements do not constitute property rights and just give them the right to use the scarce resources. Nature of rights of use is also confirmed by the legal authorities in certain cases. For example, in 2007, Turkcell initiated a lawsuit against ICTA for the revocation and stay of execution of the Number Portability Ordinance. In this lawsuit Turkcell claimed that the Ordinance was contradictory to the Constitution and the Telegraph and Telephone Law numbered 406 since the numbers were allocated to her for 25 years within concession agreements, the fees for the numbers were paid within the tender price and therefore the Ordinance violated the property rights of Turkcell on numbers and so his acquired rights protected under the Constitution. The Council of State rejected Turkcell's claim and stated in

³²⁵ Electronic Communications Law numbered 5809, Article 5

³²⁶ *Ibid*, Article 6

its decision that the Ordinance is lawful and it conforms with public interest taking into consideration that the numbers are the scarce resources property rights of which belong to the public and the operators only gain their rights of use through authorisations, and the Ordinance aims to create competition within the market players and protection of consumers³²⁷.

Regarding spectrum trading; ICTA is entitled to “perform spectrum management including spectrum planning and frequency assignment, registration and pricing as well as spectrum trading including the revocation of allocated frequency and resale thereof and to exercise the regulations necessitated by spectrum monitoring and inspection for the effective and efficient use of frequencies”³²⁸.

Furthermore, Article 20/3 of the By-Law on Authorisation in the Electronic Communications Sector (By-Law on Authorisation) provides that “If the operator intends to transfer all the frequencies and numbers it uses under the scope of non-limited rights of use, the operator shall apply to the Authority for permission with application form filled by the company which will take over the resources and which meets the provisions of Article 7 with other information and documents asked by the Authority. If the company that will take over all the frequencies and numbers is an authorised operator, the right of use application form is not required. If the Authority provides a letter approving the transfer of the resources, a right of use certificate shall be prepared for the company which will take over the resources within one month following the date of permission. The Authority, relevant to its investigations for the transfer of rights, shall consider market conditions, competition conditions and market shares and other relevant issues. In case the operator intends to transfer a part of its frequencies under the framework of spectrum trading, if the company to take over the frequencies is an authorised operator, the transfer process shall be realised after the approval of the application of both operators, by the Authority. If the second company is not an operator, it has to bear conditions specified under Article 7 and apply to the Authority for approval of transfer of frequencies by filling right of use application form determined by the Authority with other information and documents asked by the Authority...”. This provision of By-Law on Authorisation allows the operator to transfer the whole or part of frequencies it uses under the scope of non-limited rights of use, within the framework of spectrum trading

³²⁷ *Turkcell v ICTA*, 13th Chamber of the Council of State, E.2007/4817, K.2009/5991

³²⁸ *Supra* n.325, Article 40/2

provided that the transfer is approved by the ICTA. The criteria of ICTA to evaluate this transaction are the issues related to competition. Furthermore, trading of spectrum is voluntary.

On the other hand, there are no provisions related to the transfer of the frequencies; for the operators authorised by assigning limited rights of use and for the operators with concession agreements (2G/3G operators). However, with the provision of Temporary Article 4 of the By-Law on Authorisation which states “Transfer of concession agreement: If the operator having concession agreement intends to transfer the concession agreement, it shall apply to the Authority with information and documents proving that transferee company bear conditions specified under Article 7 of this By-Law and other information and documents requested by the Authority. If the Authority provides written allowance regarding transfer of concession agreement, concession agreements shall be signed with the transferee company within one month after taking the opinion of the Council of State... ”, operators authorised with concession agreements are allowed to transfer their rights of use together with the concession agreements.

Within the framework of the legislation stated above, although spectrum trading is provided under the Electronic Communications Law, secondary legislation only comprises spectrum trading for the frequencies under the scope of the non-limited rights of use. Transfer of spectrum rights of use under concession agreements are only allowed by the transfer of concession agreements. While partial transfer of frequencies are possible under the scope of non-limited right of use, partial transfer of frequencies are not allowed for the spectrum rights of use under the concession agreements.

Furthermore, concession agreements have specific issues that need to be considered by the Ministry and ICTA before the introduction of spectrum trading. There are specific rights and obligations arranged under the concession agreements. For example ICTA cannot change the concession agreements of operators without the consent of operators and operators should transfer all their equipments to the government at an operational state after the expiry of the licenses. All concessions agreements with the amendments should be sent to the Council of State in order to take its opinion before being signed. Although the Council of State shall give

its opinion within 2 months³²⁹, this process takes a longer time in practice. Even though the opinion of the Council of State is not binding, ICTA prefers to wait for her opinion and act in line with it, even if it is submitted to ICTA after the legal deadline of 2 months, taking into account that there might occur permanent legal problems if the Council of State gives an opinion opposing the terms of the proposed agreements. Therefore, execution and amendment of a concession agreement is a too difficult and lengthy process. In case the partial transfer of frequencies is allowed, the concession agreements should be amended and sent to the Council of State. Taking the opinion of the Council of State in this process causes delays in the transactions related to spectrum trading. In a sense this process adds another stage of approval to the transfer of spectrum which might decrease the level of benefits expected from spectrum trading, the most important advantage of which is the rapid transfer of rights of use in order to keep pace with the technological developments.

Furthermore, the authorisation type of transferee of the spectrum at GSM and IMT-2000 bands is another discussion. Although the Electronic Communications Law numbered 5809 foresees the existing concession agreements will be in force until their expiry, it does not entitle ICTA to sign new concession agreements and restrict the methods of authorisation with notification and granting of rights of use. Therefore, since the transferee will not be authorised with a concession agreement, the operators having similar frequencies will be subject to different rights and obligations under different types of authorisations. This can cause competition concerns.

The most important transaction with regard to transfer of spectrum was conducted with the acquisition of Telsim by Vodafone in Turkey. In 2005, Vodafone took over assets, commercial and economic entirety of the second biggest GSM operator of Turkey in terms of number of mobile subscriptions, including the concession agreement for a consideration of \$4.55 billion³³⁰. On the other hand, transfer of the spectrum of Telsim was not conducted between two private companies on a solely commercial basis. Owner family of Telsim, was active in a variety of sectors including energy and banking³³¹. As they did not comply with the regulations in other sectors such as banking, Saving Deposit Insurance Fund (SDIF), a governmental agency, took

³²⁹ Article 48 of the Law on Council of State

³³⁰ Vodafone, Press Release,

http://www.vodafone.com/content/index/media/group_press_releases/2006/press_release13_12.html

³³¹ Atiyas İ, Doğan P. (2007), "When good intentions are not enough: Sequential entry and competition in the Turkish mobile industry", *Telecommunications Policy* 31 (2007) 502–523, p.505

over Telsim³³². In this context, following the preparation of the necessary legislation, Telsim with its assets, commercial and economic entirety was sold to Vodafone as a result of the tender held by SDIF.

Another important transaction in Turkey is the merger of two GSM operators in 2003, a subsidiary of Turk Telekom which was a %100 state owned operator (operating as “Aycell”) and a subsidiary of Telecom Italia Mobile (TIM) (operating as “Aria”) to establish the TT&TIM which subsequently created new commercial and brand name “Avea”. Due to roaming policy which was rendered ineffective by legal challenges by the incumbent MNOs, TIM threatened to withdraw from Turkey and filed a lawsuit with the ICC against the ICTA (formerly Telecommunications Authority), asking for about \$ 3 billion in damages for the promised roaming services³³³. After TIM withdrew the lawsuit the announcement related to the merger of Aycell and Aria was made in 2003³³⁴. In order to achieve this merger process, the Telegraph and Telephone Law numbered 406 was amended to arrange the process of the merger of Aycell and Aria and Temporary Article 7 was incorporated to the Law. By-Law on the Procedures and Principles regarding the Implementation of Temporary Article 7 of the Telegraph and Telephone Law numbered 406 was published for the details of the merger process. In the merger process the frequency bands owned by one of the companies were returned to the government while all assets of the two companies were given to Avea.

Although spectrum trades occur in a commercial basis and the regulator intervene in the process for a few reasons such as competition concerns³³⁵, the transfer of mobile spectrum in Turkey did not conduct on a solely commercial basis. In both of the transactions related to the transfer of mobile spectrum the government has a key role rather than the market.

With regard to flexible use of spectrum, although there is no prohibition for the flexible use of spectrum, EC recommended Turkey to incorporate a specific article into Electronic Communications Law. Currently, there is no implementation of flexible use of spectrum. Differently from EU authorisation regime, licenses are restricted within specific service and technology boundaries and the operators can provide only the services for which they are

³³² *Ibid*

³³³ *Ibid*, p.519

³³⁴ *Ibid*

³³⁵ *Supra* n.244, p.ii

authorised. However, studies are underway by ICTA to establish a more service and technology neutral authorisation regime.

On the other hand, as explained in more detail earlier in the dissertation, Turkey is in the process of the liberalisation of 900 MHz and 1800 MHz bands for IMT-2000 services. Furthermore, in August 2012 Avea which holds 2x15 MHz in 1800 MHz applied to ICTA for LTE trial deployment which might be in order to positively motivate the 900 MHz operators that negatively act against the spectrum tenders proposed by ICTA for E-GSM and 1800 MHz bands.

4.4. Comparative analysis of the UK and Turkish legal regimes

Legislation of Turkey on spectrum trading is not as detailed as the legislation of the UK. In Turkey the frequency bands subject to spectrum trading and the trading procedure have not been determined yet in the secondary legislation, although spectrum trading is foreseen in the Electronic Communications Law numbered 5809. However, in the UK spectrum trading was introduced in 2004 and governed under the Spectrum Trading Regulations which include the details of trading process in addition to the Wireless Telegraphy Act 2006. UK adopted a phased approach to implement spectrum trading and amended its regulations to expand trading for further license classes till 2004. Furthermore, with the adoption of Spectrum Trading Regulations 2012 which come into force in 13 September 2012, Ofcom consolidated the previous legislation related to spectrum trading and removed the need to obtain Ofcom's consent for spectrum trading except the transfers of spectrum at 2G and 3G bands.

Therefore, while spectrum trading in the UK is no more subject to consent of Ofcom except the transfer of spectrum at 2G and 3G bands as from 13 September 2012, in Turkey, spectrum trading is subject to approval of the ICTA. Furthermore, the process of trading in the UK is more transparent. With regard to 2G and 3G bands, while UK adopted specific trading regulations to implement trading, in Turkey transfer of such bands is only allowed by the transfer of concession agreements.

Furthermore, while in the UK Ofcom adopted more flexibility relating to the types of trading i.e. total, partial and concurrent transfers and allows mobile spectrum bands to be traded with

all types, in Turkey total and partial transfer of spectrum is only allowed under non-limited rights of use and partial transfer of 2G and 3G bands is not possible.

Due to the reasons stated with regard to the legislation relating to spectrum trading, current position of the UK is much better than Turkey.

On the other hand, although the detailed legal framework and high expectations, the UK is currently unable to achieve a functioning secondary market. In both countries most of the transactions related to the transfer of spectrum are at PMR bands. Furthermore, until quite recently while transfer of spectrum at 2G and 3G bands only conducted through mergers and acquisitions in both countries. On 21 August 2012 EE and Three agreed on the sale of % 25 of 1800 MHz band that EE was required to divest³³⁶.

Regardless of the legal framework on spectrum trading, in both countries it is difficult to achieve a functioning secondary market for 2G and 3G bands due to their value for operators in case the existence of a voluntary trading environment. Furthermore, availability of 2G and 3G bands in both countries is different. While in Turkey there are three MNOs all of which is providing 2G and 3G services, in the UK there are four MNOs one of which is only authorised for 3G services. In 2008 there was not an excess demand in 3G auction of Turkey and only 2G operators participated in the auction. Therefore, currently there is not any scarcity for 3G bands. Furthermore, there is still 2x60 MHz of free spectrum in 1800 MHz band in Turkey.

In addition, liberalisation of such bands is different in Turkey and the UK. Differently from Turkey, Ofcom lifted the restrictions on the use of 2G bands for providing 3G and 4G services, although not all mobile operators have frequencies in 900 MHz band, without any refarming or redistribution process. Furthermore, following the request of EE on 21 August 2012 Ofcom allowed EE to provide LTE services from 11 September 2012. In Turkey, ICTA preferred to auction E-GSM band which was previously used for military purposes but cleared by the ICTA for allocation to mobile services in addition to the 1800 MHz band 2x60 MHz of which is already free. Auction process of ICTA has a mechanism including caps for the operators to ensure sustainable competition regarding IMT-2000/UMTS services at the 900

³³⁶ *Supra* n.318

MHz band and to provide opportunity to all MNOs for providing LTE services at 1800 MHz band.

Moreover, differently from the UK existence of the concession agreements for 2G and 3G services causes legal problems to implement spectrum trading in Turkey. Lengthy and difficult process of amending the concession agreements decreases the amount of benefits of trading.

Furthermore, one of the factors that differentiate Turkey from the UK is the tax policy. In Turkey, there has been a great amount of tax burden on communications services especially mobile operators which can decrease the incentive to trade spectrum. Turkey exhibits the highest tax rate on communications worldwide³³⁷. Mobile operators in Turkey pay more than 60% of the money they earn from their customers as taxes which nearly triples the EU average which is around 20%³³⁸. According to a study published by the GSMA in 2011, Turkey is the highest ranking country with tax as a proportion of consumer's Total Cost of Mobile Ownership (TCMO) of over 48%, while the average tax as a proportion of TCMO is 18.14%³³⁹. Situation of mobile virtual network operators (MVNO) in Turkey is a good indicator to reflect the adverse effects of high taxes. Although there are more than 40 MVNO operators, none of them has actively embarked on providing services due to tax policy in addition to the difficulties with the negotiations with MNOs. In this context, high tax burden on operators decrease the incentive to trade spectrum and the attraction of market despite the dynamic economy of Turkey.

5. CONCLUSION

In this chapter; within the context and information that has been provided through the previous chapters of the dissertation, a conclusion will be made on the key issues in spectrum trading including, its introduction, implementation, benefits and costs. Finally, it will be argued if spectrum trading is a universal solution for all cases or not.

³³⁷ Renda A, Guerin S, Arbak E., (2009), "EU-Turkey Accession Negotiations Impact Assessment of Chapter 10 on Information Society and Media" "<http://aei.pitt.edu/11266/1/1868.pdf> p.81

³³⁸ Ülgen S. (eds), 2007, "Second Generation Structural Reforms: De-Regulation And Competition In Infrastructure Industries, The evolution of the Turkish telecommunications, energy and transport sectors in light of EU harmonisation", EDAM, CEPS, p.21 <http://aei.pitt.edu/11749/1/1585.pdf>

³³⁹ Deloitte LLP, (2011) "Global Mobile Tax Review 2011", p.23

Scarcity of spectrum as a result of excess demand and inefficient management and use of spectrum require this resource to be managed more efficiently. Market oriented approach in which the market itself determines the value and best use of spectrum has gained attraction due to inflexible nature of traditional “command and control” approach and the low applicability of “license exemption” approach. Within the framework of market oriented approach, one of the regulatory mechanisms to ensure more effective spectrum management and easier access to market is spectrum trading which allows the transfer of part or all of the rights and obligations of a spectrum usage right to a third party. Spectrum trading also comprises the liberalisation of spectrum by which its benefits are considered to be increased through the removal of restrictions on services and technologies associated to the authorisations.

Spectrum trading is a regulatory tool which has some costs beside its benefits. One of the most important arguments to suppose spectrum trading is efficiency. Proponents of spectrum trading argue that it provides efficient assignment and use of the spectrum. It is considered as a solution; to get rid of the artificial scarcity of spectrum which occurred as a result of a likely inefficient primary allocation of spectrum and to keep pace with the technological developments and market conditions. Furthermore, spectrum trading is evaluated to provide greater benefits in case it is combined with flexible use of spectrum, i.e. liberalisation. Transparency is also a likely gain that can be achieved through spectrum trading since it will provide opportunity to the transferor and the transferee of the spectrum to be aware of the current value of the spectrum. Additionally, spectrum trading is expected to improve the technology and boost innovation by allowing an easier access to spectrum. As the market has a greater knowledge about new technologies compared to a regulator, spectrum trading is considered to promote new technologies, products and services.

Taking into account the necessity to use spectrum efficiently and the considerations that the market would manage the spectrum better than anyone, spectrum trading has caused great expectations regarding its benefits. In the EU, spectrum trading is allowed and regulated under Article 9/b of the Framework Directive as amended by the Better Regulation Directive 2009/140/EC. However, in the Member States where spectrum trading has been implemented, the results of the spectrum trading does not coincide with the expectations.

With regard to competition, spectrum trading not only has benefits but also has some risks. While it facilitates competition through removing barriers for new operators to entry into the market, it can also disrupt competition by encouraging anticompetitive behaviours. Incumbent operators may try to prevent entry into market through spectrum hoarding and try to acquire market power to limit the competition. Therefore, competition is a sensitive issue that needs to be considered while implementing spectrum trading.

In addition, one of the most important costs related to the trading of spectrum is harmful interference which causes inefficient use of spectrum and restricts the users of spectrum. It has greater importance especially in the bands requiring high degree of coordination. Dealing with harmful interference requires the clear definition of rights and obligations and the adoption of appropriate measures. Therefore, leaving the decision to market to decide on the assignment and use of spectrum through spectrum trading is not always an easy issue and can require government intervention at some point. Otherwise, it can have adverse effects not only on spectrum users but also on consumers, vendors, investors etc. In practice, it is difficult for governments to leave the decision to settle the problems related to interference to the market as argued by some economists in theory and it is considered as the most difficult issue to be solved. Additionally, one of the points to take into consideration is the possible high transaction costs which can decrease the number of transactions related to spectrum trading.

Another concern arising from spectrum trading is achieving public policy goals such as emergency services, security, defence, etc. Due to public concerns in general, countries which implemented spectrum trading, excluded frequency bands that are dedicated to certain public services, from spectrum trading.

Furthermore, while on the one side harmonisation of bands facilitates the wireless broadband services and allows providers to take advantage of economies of scale in equipment manufacture through standardisation and facilitates the cross border movement of wireless services and provision of roaming, on the other side it restricts the flexible use of spectrum and thus limits the applicability of spectrum trading.

On the other hand it is not always easy to implement spectrum trading. Transition to introduce spectrum trading should be managed carefully in order not to cause interruption of services, delay in the introduction of new services, service quality problems, interference problems etc.

It is crucial to handle the rights and obligations of existing spectrum holders carefully within the transition period. Impacts of spectrum trading vary according to different existing rights of use in different countries.

Other than existing spectrum holders, timing of spectrum trading is also an important issue to be taken into account by the regulators in the transition process. In general a phased method is applied to introduce spectrum trading. In order to introduce spectrum trading with existing holders there are basically two approaches one of which is band clearance and the other approach is conversion of existing rights of use into tradable rights of use. Both approaches have advantages and disadvantages.

Although band clearance is a straightforward approach, from a legal and political perspective its implementation is more difficult in practice due to the existing spectrum authorisations. In this approach; lengthy notice periods to be given to the operators to clean the bands, compensating existing operators whose authorisations are early terminated and providing alternative bands for existing operators to migrate are the factors that make this approach too lengthy, expensive and time-consuming for regulators. In addition, necessary measures are needed to be put in place in the reassignment process of a cleaned band, in order to compensate any negative impacts of spectrum trading and/or liberalisation.

The approach of conversion of existing rights of use into tradable rights of use, comprises changing existing conditions of an authorisation to include the right to trade and/or liberalisation. Although this approach is more attractive for incumbent operators since it gives the decision to operators to vacate a band and facilitates the introduction of spectrum trading, it has specific difficulties. Managing interference problems, obligations of existing authorisations such as roll-out, coverage etc. are need to be addressed by the regulators and become complicated when spectrum trading is allowed with liberalisation. Therefore, this approach is also not easy to implement in practice due to complexity to amend the conditions of existing authorisations into a trading framework. Mishandling this process can; provide loopholes for existing operators to escape from their obligations, cause interference problems, decrease the value of spectrum and adversely affect spectrum trading. Furthermore, conversion of existing authorisations into tradable ones to implement spectrum trading can cause windfall gains or losses which can be a barrier for regulatory reforms since windfalls can cause concerns in the public and delays to implement spectrum trading in practice.

Implementations of these approaches and the difficulties encountered are different from country to country. When practices of the UK and Turkey are considered, the difficulties arising from conditions of existing authorisations, reactions of incumbent operators, power of regulators and competition concerns reflect the issues within the introduction of spectrum trading with existing authorisations. Since it is not possible to satisfy all existing operators, regulators are threatened with legal actions by the operators. In liberalisation process of 900 MHz and 1800 MHz bands, operators (including Vodafone which operates in both countries) holding different amount of spectrum have reflected different reactions in the UK and Turkey. Regulators of the two countries adopted different rules in the liberalisation process. For instance while Ofcom preferred not to redistribute 900 MHz bands although not all operators have this band, in Turkey ICTA preferred to ensure equal opportunities for the operators for provision of services via assignment of additional 1800 MHz and E-GSM bands using caps.

Furthermore, attempts of Ofcom for the auction of 800 MHz and 2.6 GHz are the examples reflecting the power of incumbent operators. Ofcom has been forced to delay the auction due to the pressure of operators, especially by Vodafone and O2, arising from the rules of the auction process including caps for the operators holding 900 MHz. Therefore, start of LTE services was delayed in the UK. At the end, on 21 August 2012 Ofcom published the revised auction rules which do not guarantee either EE or Three to achieve sub-1 GHz spectrum.

Merger of T-Mobile and Orange to form EE is an important example since not only it has a great impact on spectrum trading but also it reflects the importance of having valuable spectrum for new technologies and the effects of the EC decision in the UK. On 21 August 2012 Ofcom allowed EE to provide LTE services from 11 September 2012 taking into account the EC decision related to the merger. The EC decision has a great effect on Ofcom in taking such a decision despite the objections of other operators especially Vodafone and O2. In line with the EC decision, on 21 August 2012 EE announced an agreement to sell 2x15 MHz at 1800 MHz to Three, where a valuable public asset is to be sold by a private company following the consent of Ofcom and the EC. Hence, beside the advantage of providing LTE services first in the UK, EE also has become the biggest beneficiary of trading of mobile spectrum in the UK since any amount made from the sale of the 1800 MHz spectrum will be its profit.

Reactions of different MNOs in both countries indicate the importance attached to spectrum by incumbent operators. Therefore, it is difficult to expect high motivations from these operators to transfer their frequencies through spectrum trading. Rather than trading, incumbent operators may prefer to retain the unused spectrum to prevent entry into market. In both countries MNOs would like to trade their spectrum in case the assignment of more valuable bands through mechanisms including caps etc. in order to achieve the more valuable ones. Without the requirement of the EC, EE could choose not to sell any of its spectrum at 1800 MHz. Therefore, in high value frequencies establishment of a functioning secondary market seem complex as in practice and in a secondary market without the trading of high value spectrum, it is difficult to achieve the expected benefits with the trade.

Although the specific conditions of each country, experiences of the UK which faithfully adopted the EU legislation on spectrum trading are important for Turkey as a candidate country. Although detailed legislation and experience since 2004, a functioning secondary market has not formed in the UK yet. Most of the transactions related to spectrum trading are at PMR bands which do not have value like 2G and 3G bands. Legislation in Turkey on spectrum trading is insufficient when compared with the UK. In addition to being slow in the development of legislation regarding spectrum trading, existence of concession agreements in authorisation regime differentiates Turkey from the UK. Concession agreements in Turkey cause specific difficulties for allowing spectrum trading in mobile spectrum and transfer of frequencies allocated under the concession agreements are only allowed with transfer of concession agreements currently.

Furthermore, tax burden on operators especially on mobile sector in Turkey is one of the important factors different from the UK which decrease the incentive to trade spectrum despite the dynamic economy of Turkey. Due to tax policy, more than forty authorised MVNO operators has not embarked on providing services different from the UK where several MVNO operators are providing service.

As a result, since every country has different specific conditions, asserting that spectrum trading is a universal solution and a magic wand to dispel the scarcity of the spectrum in order to meet the increasing demand for spectrum dependent services and ensure efficient use of spectrum is not always true. A successful secondary market depends on several factors including power of regulators and operators, existing authorisations, rights and obligations

associated to the existing authorisations, market conditions, competition, legal regimes and other issues such as tax policy which vary from country to country and affect the implementation of spectrum trading in practice. The same rules related to spectrum trading do not always provide the same results in different countries. Moreover, achieving a functioning secondary market at high value bands seems specifically difficult in near future.

BIBLIOGRAPHY

I. Books

Cave M., Doyle C., Webb W., (2007) "Essentials of modern spectrum management", Cambridge University Press, p.3, 5, 6, 85, 97, 101

Farr & Oakley, (2006), "EU Communication Law", 2nd edition, Thomson Sweet & Maxwell, p. 77

Gaughan P.A., (2011), "Mergers, Acquisitions and Corporate Restructurings", 5th edition, John Wiley & Sons, Inc., p.8

Gentzoglanis A. and Henten A., (2010), "Regulation and Evolution of Global Telecommunications Industry", Feijoo C., Ramos S. and Gomez-Barroso J., "Next generation mobile networks deployment and regulation in the European Union", Edward Elgar Publishing Limited UK, USA, p.306, 307,

Koenig C., Bartosch A., Braun J.D., (2002), "EC Competition and Telecommunications Law", Kluwer Law International, International Competition Law Series, p.519, 520

Nihoul O., Rodford P., (2011), "EU Electronic Communications Law, Competition and Regulation in the European Telecommunications Market", 2nd edition, Oxford University Press, p.153

Walden I. (edt.), (2009), "Telecommunications Law and Regulation", Walden I., "International Telecommunications Law", Chapter 15, 4th edition, Oxford University Press, fourth edition, p.319, 320, 728

II. Articles and Reports

Akalu R., Arias, A. D., (2012) "Assessing the policy of spectrum trading in the UK", info, Vol. 14 Iss: 1, pp.36 – 54, p.45

Akalu, R., (2010) "Why there have been so few spectrum trades in the UK: lessons for Europe", info, Vol. 12 Iss: 1, pp.10 - 17, p.10

Analysys, DotEcon, Hogan & Hartson, (2004), "Study on Conditions and Options in Introducing Secondary Trading of Radio Spectrum in the European Community", p.3, 4, 12, 13, 26, 36, 37, 40, 68, 91, 92, 119, 121, 123, 124, 125, 127, 130, 131, 132, 222

Analysys, DotEcon, Hogan & Hartson, (2009), "Exploiting the digital dividend-a European Approach", p.20 (accessed 10 September 2012)

http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/document_storage/studies/digital_dividend_2009/dd_finalreport_executivesummary.pdf

Atiyas İ, Doğan P. (2007), "When good intentions are not enough: Sequential entry and competition in the Turkish mobile industry", Telecommunications Policy 31 (2007) 502–523, p.505, 519

Bykowsky M., (2003), "A secondary market for the trading of spectrum: promoting market liquidity", Telecommunications Policy, Volume 27, Issue 7, August 2003, Pages 533–541, p.533, 534

Caicedo, C.E., Weiss M.B.H, (2007), "Spectrum Trading: An Analysis of Implementation Issues", Proceedings of the IEEE Symposium on Dynamic Spectrum Access Networks, p.579

Caicedo, C.E., Weiss M.B.H, (2010), "The Viability of Spectrum Trading Markets", IEEE, p.1

Cave, M. (2002) "Review of Radio Spectrum Management: An Independent Review for the UK Department of Trade and Industry and HM Treasury", Ofcom, London, p.9, 12, 71, 106, 107, 109, 110, 115

Cave, M. and Webb, W., (2003), "Designing property rights for the operation of spectrum markets", Papers in Spectrum Trading No.1, Warwick Business School, p.2

Cave M., Foster A., Jones R. W., (2006), “Radio Spectrum Management: Overview and Trends”, p.8

Cave, M., (2006) “New spectrum-using technologies and the future of spectrum management: a European policy perspective”, p.222 (accessed 11 September 2012)
http://www.cullen-international.com/cullen/cipublic/presentations/martin_cave_communications_next_decade.pdf

Cave M., Foster A., Jones R. W., (2007), “Radio Spectrum Management”, ITU, ICT Regulation Toolkit, Executive Summary, p.35

Cave, M., (2010), “Anti-competitive behaviour in spectrum markets: analysis and response”, Telecommunications Policy, Vol.34 (No.5-6). pp. 251-261, p.251

Chochliouros I., Spiliopoulou A., Chochliouros S., Doukoglou T., (2007), “European Challenges towards Forming and Promoting an Innovative Radio-Spectrum Policy in a Fully Converged Electronic Communications Market”, The Journal of The Communications Network, Volume 6, Part 2, p.1

Coase, R. (1959), “The Federal Communications Commission”, Journal of Law and Economics, Vol.2, pp.1-40 (accessed 10 September 2012)
<http://old.ccer.edu.cn/download/7874-1.pdf>

Crocioni, P., (2009), “Is allowing trading enough? Making secondary markets in spectrum work”, Telecommunications Policy, Vol.33 (No.8). pp. 451-468, p.454, 463

Cullen International, (2011), “Supply of services in monitoring regulatory and market developments for electronic communications and information society services in Enlargement Countries, 2011-2013”, p.39

Deloitte LLP, (2011) “Global Mobile Tax Review 2011”, p.23

Falch, M., Tadayoni, R., (2004), “Economic versus technical approaches to frequency management”. Telecommunications Policy, 28 (2), 197–211, p.203

Forge, S., Blackman C., Bohlin E., (2006), “Benchmarking Impacts of EU Policy: Options for Economically Efficient Management of Radio Spectrum”, Final Report, SCF Associates Ltd., UK, p.7

Hale A., (2007), “The Future of EU Spectrum Policy”, TelcomFinance, Issue 153, p.1, 5

Hazlett T. (2004) “Property Rights and Wireless License Values”, AEIBrookings Joint Center for Regulatory Studies, Working Paper 04-08, p.3, 34

Hazlett T.W., (2001), “The Wireless Craze, The Unlimited Bandwidth Myth, The Auction Faux Pas, and the Punchline to Ronald Coase’s ‘Big Joke’”, An Essay on Airwave Allocation Policy, AEI-Brookings Joint Center for Regulatory Studies, p.32

Hwang, J.S and Yoon, H.Y., “Analysis of Future Spectrum Management Alternatives Considering Technology Innovation”, p.5

ITU, (2004), “Radio Spectrum Management for a Converging World”, Background Paper, p.12, 24

ITU, (2008), “GSR 2008 Discussion Paper”, 8th Global Symposium for Regulators, p.20 (accessed 10 September 2012)

http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR08/discussion_papers/Spectrum_Sharing_web.pdf

Kelly T. & Rossotto C.M. (edt), (2012), “Broadband Strategies Handbook”, The World Bank, p. 98, 100, 103

Leese, R., Levine P., Rickman N., (2002), “The Economic Effects of Spectrum Trading”, Royal Economic Society Annual Conference 2002 123, Royal Economic Society, p.32

Lichtenberger, E., (2003), “Spectrum Trading in Germany, Austria and the UK: The Influence of Regulatory Regimes and Evaluation of Criteria on Competition in the European Mobile Telecommunication Sector”, p.1, 2, 5

London economics, (2008) ‘Economic Impacts of Increased Flexibility and Liberalisation in European Spectrum Management’, p.3, 16, 47

Marcus J.S., Nett L., Scanlan M., Stumpf, U, Cave M., Pogorel G., (2005), “Towards More Flexible Spectrum Regulation”, Wik Consult, Study for the Federal Network Agency, p.78

Oberst G., (2010) “Impact of the amended EU regulatory framework on spectrum and mobile issue”, Communications Law Newsletter, May 2010, p.16 (accessed 10 September 2012)

<http://www.hoganlovells.com/files/Publication/06bb4b14-4b69-4309-bfde-6c0cd6053c9d/Presentation/PublicationAttachment/6b887a6e-3287-426a-bbfc-16321391484c/CommunicationsLawCommitteeNewsletterMay2010.pdf>

OECD, (2005), “Secondary Markets For Spectrum: Policy Issues”, p.4, 12, 23, 29, 30, 31, 34

Oxera Consulting Ltd, (2012), “Spectrum Trading Issues – A framework for competition assessments”, Report prepared for Commission for Communications Regulations, p.ii, 1, 41, 47 (accessed 10 September 2012)

http://www.comreg.ie/_fileupload/publications/ComReg1276b.pdf

Radiocommunications Agency, (2002), Implementing Spectrum Trading, A Consultation Document, UK, p.10

Renda A, Guerin S, Arbak E., (2009), “EU-Turkey Accession Negotiations Impact Assessment of Chapter 10 on Informaion Society and Media”, p.81 (accessed 10 September 2012) <http://aei.pitt.edu/11266/1/1868.pdf>

Stumpf U., Nett L., (2003), “The Economics of Frequency Trading”, Wik Consult Conference Paper, p. 9, 11

Stumpf U., Nett L., (2003), "Institutional arrangements for spectrum trading", COMMUNICATIONS & STRATEGIES, no. 50, 2nd quarter 2003, p. 193, 197

Thanki R., (2009), "The economic value generated by current and future allocations of unlicensed spectrum", Perspective Associates, p.17

Ülgen S. (edt), 2007, Second Generation Structural Reforms: De-Regulation And Competition In Infrastructure Industries, The evolution of the Turkish telecommunications, energy and transport sectors in light of EU harmonisation, EDAM, CEPS, p.21 (accessed 10 September 2012) <http://aei.pitt.edu/11749/1/1585.pdf>

Xavier, P., Ypsilanti, D., (2006) "Policy issues in spectrum trading", info, Vol. 8 Iss: 2, pp.34 – 61, p.34, 49, 51, 52, 54

Valletti T.M., (2001) "Spectrum property rights", info, Vol. 3 Iss: 5, pp.375 – 380, p. 378

Valletti T.M., (2001), "Spectrum Trading", Telecommunications Policy, Volume 25, Number 10, October 2001, pp. 655-670, p.656

Van Caspel, M. (2002), "Spectrum trading: increasing the efficiency of spectrum usage", p.2

Weiss M., (2006) "Secondary use of spectrum: a survey of the issues", info, Vol. 8 Iss: 2, pp.74 – 82, p.74

Weiss M.B.H and Lehr W.H., (2009), "Market Based Approaches for Dynamic Spectrum Assignment", p.3 (accessed 10 September 2012)
http://d-scholarship.pitt.edu/2824/1/JSAC_Weiss_and_Lehr.pdf

Wellenius B., Neto I., (2006), "The radio spectrum: opportunities and challenges for the developing world", info, Vol.8, Iss:2, pp.18-33, p.19, 21, 109

Wellenius B., Neto I., (2007), "Managing the Radio Spectrum: Framework for Reform in Developing Countries", The World Bank Global Information and Communication

Technologies Department Policy Division, Policy Research Working Paper No: 4549, p.16, 22, 23, 33

III. Official Documents

Communication from the Commission to the Council, the European Parliament and the European Economic and Social Committee and the Committee of the Regions, a market-based approach to spectrum management in the European Union, COM(2005) 400 final, 14.9.2005, p.4, 6 (accessed 10 September 2012)

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0400:FIN:EN:PDF>

Communication from the Commission to the Council and European Parliament, a forward-looking radio spectrum policy for The European union: second annual report, COM(2005) 411 final, Brussels, 6..2005, p.6 (accessed 10 September 2012)

http://eur-lex.europa.eu/LexUriServ/site/en/com/2005/com2005_0411en01.pdf

Commission Staff Working Document, (2007), Impact Assessment, Accompanying document to COM(2007)697, COM(2007)698, COM(2007)699, SEC(2007)1473, p.48, 54

Commission Staff Working Document, (2010), Impact Assessment, Accompanying document to the Proposal for a Decision of the European Parliament and of the Council Establishing the First Radio Spectrum Policy Programme, SEC (2010) 1034 final, Brussels, 20.09.2010, p.9, 11, 18, 37

The RSPG Opinion on Secondary Trading of Rights to Use Radio Spectrum, 19 November 2004, RSPG04-54 Rev. (final), p.8

Radio Spectrum Committee Working Document, “EC Paper on a Decision amending Commission Decision 2009/766/EC on the harmonisation of the 900 MHz and 1800 MHz bands”, 9.12.2010 (accessed 10 September 2012)

http://ec.europa.eu/information_society/policy/comm/radio_spectrum/_document_storage/rsc/rsc34_public_docs/rscom10_60.pdf

ECC Report, (2011), “Description of Practices Relative to Trading of Spectrum Rights of Use”, p.17 (accessed 10 September 2012)

<http://www.erodocdb.dk/docs/doc98/official/pdf/ECCRep169.pdf>

ECC Report, (2002), “Refarming and trading in a changing radiocommunication world”, p.8 (accessed 10 September 2012)

<http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP016.PDF>

EC, Information Society, (accessed 10 September 2012)

http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/topics/ecs/wapecs/index_en.htm

“Introduction to Spectrum Management Overview”, InfoDev (Information for Development) & ITU Joint Project, ICT Regulation Toolkit, (accessed 10 September 2012)

<http://www.ictregulationtoolkit.org/en/Section.2656.html>

“Spectrum as a Technical Resource”, InfoDev (Information for Development) & ITU Joint Project, ICT Regulation Toolkit (accessed 10 September 2012)

<http://www.ictregulationtoolkit.org/en/Section.2658.html>

“Spectrum Trading”, InfoDev (Information for Development) & ITU Joint Project, ICT Regulation Toolkit, (accessed 10 September 2012)

<http://www.ictregulationtoolkit.org/en/Section.2836.html>

Ofcom, (2012), “Ofcom’s decision to make Wireless Telegraphy Trading and Register Regulations”, p. 3, 4 12, 13, 17 (accessed 10 September 2012)

http://stakeholders.ofcom.org.uk/binaries/consultations/wireless-telegraphy-trading/statement/TradingRegister_statement.pdf

Ofcom, (2012), “Notice of proposals to make Wireless Telegraphy Trading and Register Regulations”, p.1, 2, 3, 4, 11, 17, 18 (accessed 10 September 2012)

<http://stakeholders.ofcom.org.uk/binaries/consultations/wireless-telegraphy-trading/summary/main.pdf>

Ofcom, (2012), “Second consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues”, Consultation Document, p.12 (accessed 10 September 2012)

<http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/summary/combined-award-2.pdf>

Ofcom, (2012), “Decision to vary Everything Everywhere’s 1800 MHz spectrum licences to allow use of LTE and WiMax technologies” p.15, 45 (accessed 10 September 2012)

<http://stakeholders.ofcom.org.uk/binaries/consultations/variation-900-1800mhz-lte-wimax/statement/statement.pdf>

Ofcom, (2012), “Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences to allow use of LTE and WiMAX Technologies”, p.1, 6, 7, 17 (accessed 10 September 2012)

<http://stakeholders.ofcom.org.uk/binaries/consultations/variation-900-1800mhz-lte-wimax/summary/condoc.pdf>

Ofcom, (2012), “The award of 800 MHz and 2.6 GHz spectrum”, Information Memorandum, p.5 (accessed 10 September 2012)

<http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/statement/IM.pdf>

Ofcom, (2012), “Statement of Ofcom regarding assessment of future mobile competition and award of 800 MHz and 2.6 GHz”, p.8 (accessed 10 September 2012)

<http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/statement/Statement-summary.pdf>

Ofcom, (2012), “Assessment of future mobile competition and award of 800 MHz and 2.6 GHz”, p.3 (accessed 10 September 2012)

<http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/statement/Statement-summary.pdf>

Ofcom, (2011), “Simplifying Spectrum Trading-Spectrum leasing and other market enhancements”, Final statement, p.1, 4 (accessed 10 September 2012)

<http://stakeholders.ofcom.org.uk/binaries/consultations/simplify/statement/statement-spectrum-leasing.pdf>

Ofcom, (2011), “Statement on proposal to make 900 MHz, 1800 MHz and 2100 MHz public wireless network licences tradable”, Statement, p.5, 6 (accessed 10 September 2012)

<http://stakeholders.ofcom.org.uk/binaries/consultations/trading-900-1800-2100/statement/900-1800-2100-statement.pdf>

Ofcom, (2010), “Simplifying spectrum trading- reforming the spectrum trading process and introducing spectrum leasing”, Interim Statement, p.6, 7, 8, 10 (accessed 10 September 2012)

<http://stakeholders.ofcom.org.uk/binaries/consultations/simplify/statement/statement.pdf>

Ofcom, (2009), “Simplifying spectrum trading-Regulatory reform of the spectrum trading process and introduction of spectrum leasing”, Consultation Document (accessed 10 September 2012)

<http://stakeholders.ofcom.org.uk/binaries/consultations/simplify/summary/simplify.pdf>

Ofcom, “A Statement on spectrum trading: Implementation in 2004 and beyond”, p.3, 14 (accessed 10 September 2012)

http://stakeholders.ofcom.org.uk/binaries/consultations/spec_trad/statement/sts.pdf

Ofcom Spectrum Information System, (accessed 10 September 2012)

<http://spectruminfo.ofcom.org.uk/spectrumInfo/>

UK Parliament website, 3.11.2011 (accessed 10 September 2012)

<http://www.publications.parliament.uk/pa/cm201012/cmselect/cmcomeds/1258/125806.htm#a3>

UK Parliament website, 3.11.2011 (accessed 10 September 2012)

<http://www.publications.parliament.uk/pa/cm201012/cmselect/cmcomeds/1258/125807.htm>

UK Parliament website, 23.08.2012 (accessed 10 September 2012)

<http://www.publications.parliament.uk/pa/cm201012/cmselect/cmcomeds/1258/125806.htm#a4>

IV. Legislation

Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive) OJ L 108/33, 24.4.2002

Directive 2002/20/EC of the European Parliament and of the Council of 7 March 2002 on the authorisation of electronic communications networks and services (Authorisation Directive), OJ L 108/21, 24.4.2002

Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community, OJ L 108/1, 24.4.2002

Directive 2009/140/EC of the European Parliament and of the Council of 25 November 2009 amending Directives 2002/21/EC on a common regulatory framework for electronic communications networks and services, 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities, and 2002/20/EC on the authorization of electronic communications networks and services (Better Regulation Directive), OJ L 337/37, 18.12.2009

Council Directive 87/372/EEC of 25 June 1987 on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community (GSM Directive), OJ L 196, 17.7.1987, p. 85–86

Directive 2009/114/EC of the European Parliament and of the Council of 16 September 2009 amending Council Directive 87/372/EEC on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community, OJ L 274/25, 20.10.2009

Commission Decision of 16 October 2009 on the harmonisation of the 900 MHz and 1 800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community, (2009/766/EC), OJ L 274/32, 20.10.2009

Commission Implementing Decision of 18 April 2011 amending Decision 2009/766/EC on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community, (2011/251/EU), OJ L 106/9, 27.04.2009

Commission Decision of 6 May 2010 on harmonised technical conditions of use of the 790 to 862 MHz band for terrestrial systems capable of providing electronic communications services in the European Union (2010/267/EC), OJ L 117/95, 11.5.2010
(accessed 10 September 2012) <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:117:0095:0101:EN:PDF>

Communications Act of the UK, section 168 (accessed 10 September 2012)
<http://www.legislation.gov.uk/ukpga/2003/21/section/168>

Wireless Telegraphy Act 2006 of the UK, section 30 (accessed 10 September 2012)
<http://www.legislation.gov.uk/ukpga/2006/36/section/30>

The Electronic Communications and Wireless Telegraphy Regulations 2011 of the UK, S.I. 2011 No. 1210 (accessed 10 September 2012)
<http://www.legislation.gov.uk/uksi/2011/1210/made>

Wireless Telegraphy (Spectrum Trading) Regulations 2004 of the UK (2004 Trading Regulations) (accessed 10 September 2012)
<http://www.legislation.gov.uk/uksi/2004/3154/contents/made>

Wireless Telegraphy (Register) Regulations 2004 of the UK (2004 Register Regulations) (accessed 10 September 2012)
<http://www.legislation.gov.uk/uksi/2004/3155/contents/made>

The Wireless Telegraphy (Mobile Spectrum Trading) Regulations 2011 of the UK, S.I. 2011 No. 1507 (accessed 10 September 2012)
<http://www.legislation.gov.uk/uksi/2011/1507/made>

Wireless Telegraphy (Spectrum Trading) Regulations 2012 of the UK (2012 Trading Regulations), S.I. 2012 No. 2187 (accessed 10 September 2012)

<http://www.legislation.gov.uk/uksi/2012/2187/made>

Wireless Telegraphy (Register) Regulations 2012 of the UK, S.I. 2012/2186 (accessed 10 September 2012) <http://www.legislation.gov.uk/uksi/2012/2186/contents/made>

Electronic Communications Law of Turkey numbered 5809, Articles 5, 6, 9/6, 40/6

By-Law on Authorisation in the Electronic Communications Sector of Turkey (By-Law on Authorisation), Articles 7, 20/3 and Temporary Article 4

Telegraph and Telephone Law of Turkey numbered 406, Temporary Article 7

By-Law on the Procedures and Principles regarding the Implementation of Temporary Article 7 of the Telegraph and Telephone Law numbered 406

Law on Council of State of Turkey, Article 48

V. Online Sources

Vodafone, Press Release, (accessed 10 September 2012)

http://www.vodafone.com/content/index/media/group_press_releases/2006/press_release13_12.html

Berwin SJ, “CAT rules against O2 in appeal”, 9.11.2010 (accessed 10 September 2012)

<http://www.inhouselawyer.co.uk/index.php/it-telecommunications-outsourcing/8216-cat-rules-against-o2-in-appeal>

Bratby R., “UK 4G spectrum auctions put back again” (accessed 10 September 2012)

<http://www.telecomstechnews.com/blog-hub/2012/feb/08/uk-updates-rules-for-800-mhz-and-26-ghz-auctions/>

BBC News, "Date set for 4G airwaves auction", 17.11.2010 (accessed 10 September 2012)
<http://www.bbc.co.uk/news/technology-11776901>

BBC News, "Mobile firms attack 'early 4G' on Everything Everywhere", 9.5.2012 (accessed 10 September 2012) <http://www.bbc.co.uk/news/technology-18008666>

BBC News, "Mobile firms can trade spectrum", 21.6.2011 (accessed 10 September 2012)
<http://www.bbc.co.uk/news/uk-13855655>

White G., "4G mobile may arrive this year following Ofcom ruling", 13.3.2012 (accessed 10 September 2012)
<http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/9141669/4G-mobile-may-arrive-this-year-following-Ofcom-ruling.html#>

Curtis S., "Ofcom puts the brakes on Everything Everywhere's 4G plans", 27.3.2012 (accessed 10 September 2012) <http://news.techworld.com/networking/3347216/ofcom-puts-the-brakes-on-everything-everywheres-4g-plans/>

BBC News, "Everything Everywhere gets 4G go-ahead from Ofcom", 21.8.2012 (accessed 10 September 2012) <http://www.bbc.co.uk/news/business-19328653>

Burns E., "UK's Ofcom To Hold 4G Auction Of", 24.7.2012 Airwaves (accessed 10 September 2012) <http://www.redorbit.com/news/technology/1112662769/uks-ofcom-to-hold-4g-auction-of-airwaves>

Oberst G., "UK Spectrum Trading", 1.7.2011 (accessed 10 September 2012)
<http://www.hlspectrumreview.com/2011/07/articles/spectrum-management/uk-spectrum-trading/>

Sahota D., "3UK to buy 1800MHz spectrum from Everything Everywhere", 21.8.2012 (accessed 10 September 2012)
<http://www.telecoms.com/48383/3uk-acquires-ees-1800mhz-spectrum-but-faces-wait-to-use-it/>

Rushton K., “Everything Everywhere agrees spectrum sale to Three”, 21.8.2012 (accessed 10 September 2012)

<http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/9490513/Everything-Everywhere-agrees-spectrum-sale-to-Three.html>

Har-even, B., “Regulator approves UK mobile spectrum trading”, 20.6.2011(accessed 10 September 2012) <http://www.telecoms.com/29488/regulator-approves-uk-mobile-spectrum-trading-2/>

VI. Cases

Turkcell v ICTA, 13th Chamber of the Council of State, E.2007/4817, K.2009/5991

Telefonica O2 UK Ltd v Office of Communications & Anor, Court of Appeal - United Kingdom Competition Appeals Tribunal, October 07, 2010, [2010] CAT 25

European Commission, (2010), “Regulation (EC) No 139/2004 Merger Procedure – Case No COMP/M.5650, T-Mobile/Orange”

http://ec.europa.eu/competition/mergers/cases/decisions/M5650_20100301_20212_247214_EN.pdf