

# A comparison of UMTS spectrum allocation rules in Germany, The Netherlands, Sweden and United Kingdom

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## Assignment description

The assignment was to collect information of some representative UMTS auctions in Europe and compare them by the auction rules. Additionally, results from beauty-contest-based allocation could also be used to bring reference to alternative forms of frequency licensing.

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## Description of the related files

<code>Analysis.py</code>	Python3 script creating figures of the auction results.
<code>UK3GAuction.py</code>	Python3 script to extract the UK auction data from The National Archives (UK).
<code>Auction_*.csv</code>	Auction data from a specific country in .csv format.
<code>Sweden_*.pdf</code>	Documents describing the Swedish allocation process in .pdf format.
<code>*.png</code>	Figures created by Analysis.py which are present in this document.
<code>FX_31121999.txt</code>	Exchange rates used in this document.

## Exchange rates

Currencies in this document are converted to USD to allow comparison between the auction bids. The exchange rates references to The Federal Reserve weekly rates from 31<sup>st</sup> December 1999 [5].

Currency	USD	Date
1 DEM	0.51487	31.12.1999
1 GBP	1.6150	31.12.1999
1 NLG	0.45696	31.12.1999

## 1 Introduction

The third generation of mobile communication networks became standardized and ready for development in the late 1990s, which required the new allocation of spectrum used by the technology. The two different approaches to allocate the spectrum for the companies was either through an auction or a beauty contest, where the licenses were given based on a evaluation how well certain companies can fulfil the criteria set by the regulator[7]. Auction as a main method to distribute spectrum licenses was already widely used in the USA and by the emergence of UMTS, it became popular in Europe as well.

The purpose of this article is to compare the different approaches to the UMTS spectrum distribution process in the United Kingdom, the Netherlands, Germany and Sweden. Of these four countries only Sweden used a beauty contest for license distribution, while the three other auctioned their licenses. Telecommunication regulators in these countries provided the network operators similar kinds of UMTS licenses, mainly dual bands of 2 x 15 MHz or 2 x 10 MHz and with an additional non-paired band of 5 MHz. The allocation of the UMTS bands in these countries took place during the years 1999 and 2000 [14].

## 2 Spectrum auctions

A spectrum auction is a way for the government to ensure the operators commitment to their networks, and is aimed to ensure a good efficiency in the spectrum use[7][4]. The goal of the efficiency in mobile communication spectrum is to ensure that the scarce resources are well allocated for use[7]. In addition, the efficiency of the spectrum use is a consequence of the goal for operators to maximize the return on investment. In addition to promoting fair competition and spectrum efficiency, the governments' goal of the spectrum auctions is to collect cash, which can then be used for general welfare.

The revenue accumulation of the three different auctions discussed in this paper is shown in Figure 1. As we can see, the 60% of the sum in the Netherlands was gained in the last 50 rounds of the auction and the whole auction took roughly twice as long as in the UK and Germany.

### Germany

The German auction on the UMTS licenses was held as a simultaneous ascending auction, where each bidder had to bid on at least two but at most on 3 spectrum blocks. In total there were 12 blocks, which made it possible to share it between four, five or six licenses. In the case of a bidder bidding for three blocks of spectrum, it was possible to exclude an another bidders from the auction[12]. As the license lots were similar to each other by bandwidth, the price differences between them were minimal as shown in Figure 2.

The German auction managed to gain a revenue of 50,8 billion euros, which was almost 20 billion more than the auction in UK. It has been argued that the auction rules used in the

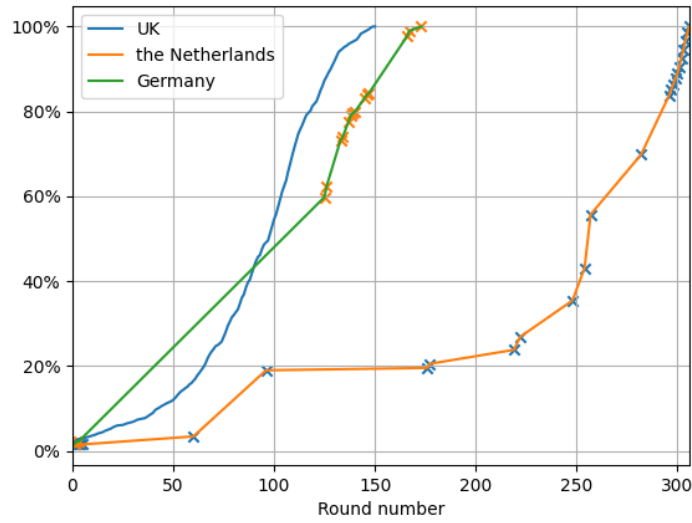


Figure 1: Auction revenue accumulation [1][4][12].

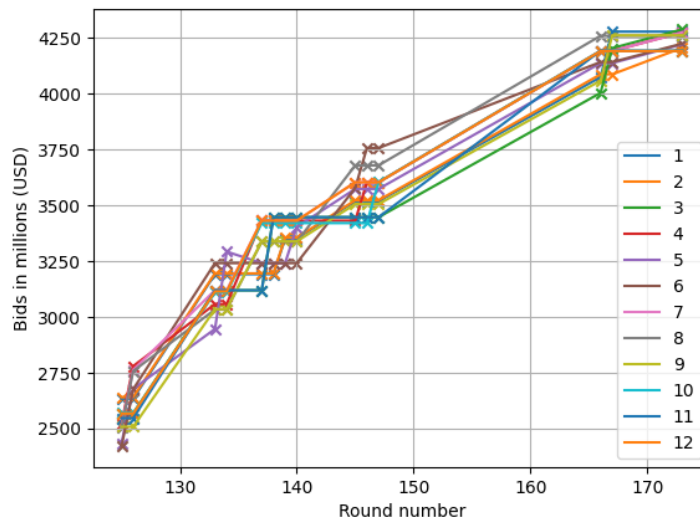


Figure 2: Development of the license bids in Germany [12]<sup>1</sup>.

German auction made it more competitive compared with the auction in the UK [12]. The more competitive auction were achieved by making it possible to bid for three licences and in they way play out one bidder from the auction who was left only with one license.

The German auction had been criticized before the auction of is the lack of licences reserved for new entrants compared to the model used in the UK [12]. Even if the auction was successful both by revenue and making a way for new entrants to the market, an alternative

<sup>1</sup> Figure does not show the results from the early rounds of the auction.

end for the auction could have been that the existing operators would have bought out the new entrants by limiting the number of licenses to 4. However, this was not a problem as the operators did not see it worth it to bid for a third lot in order to get an extra 5 MHz to their licenses.

## The Netherlands

The Dutch UMTS auction was identified as an unsuccessful auction compared to Germany and United Kingdom as it did not reach similar results on certain measures. According to van Damme [4] the auction managed only to raise ca. 25% of the revenue per capita compared to Germany and United Kingdom, see Table 1. From Figure 3 we can identify the different valuation of the licences. There are two groups, the higher valued one with the 2 x 15 MHz bands and the lower with 2 x 10 MHz bands.

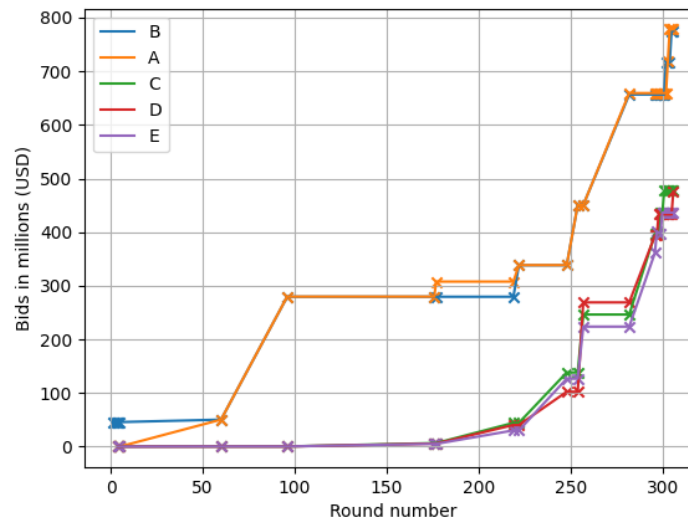


Figure 3: Development of the license bids in the Netherlands [4].

The amount of participants were unfavorable for the auction outcome as for 5 licences there were 6 bidders of which one was a newcomer that had not a real possibility to win a license. The only newcomer, Versatel took part in the auction as they had a motivation to get a license from another operator and operate as a MVNO<sup>1</sup> but at the same time they did not want anyone to get a free license from the auction [4]. If the Versatel wouldn't have taken a part to the auction there wouldn't have been any competition sharing 5 licenses between 5 operators. In addition, the possibility of free licences lowered the competitiveness in the beginning rounds of the auction, which is also visible in the first rounds in Figure 3.

<sup>1</sup>Mobile Virtual Network Operator

Country	Revenue per capita (€)
Germany	620
The Netherlands	170
United Kingdom	650

Table 1: Revenue of the auctions [4].

## United Kingdom

In the British auction for the UMTS licenses the license prices resulted in a total of about 22.5 billion pounds which was significantly higher than the estimates before the auction (2-5 billion pounds)[2]. In addition, the auction managed to reach the highest revenue per capita in the Europe, as shown in Table 1.

Remarkable in the UK auction was that they were only one of the three countries discussed in this paper to reserve a license for a new entrant from the auction. Additionally, the licence that was reserved for the entrant was the one with most spectrum. The license with most spectrum was not auctioned with the highest price as the bidder was only competing with the other new entrants.

Figure 4 presents the prices of the licensed auctioned in the UK, from which we can clearly identify three different prices categories for the licences. The highest price was paid from the 2 x 15 MHz license (B) and the second highest from the license A that had an additional 1 x 5 MHz band, and which was reserved for a new entrant. The lowest price group was the licenses C, D, and E (2 x 10 MHz), which were similar with each other and therefore was evaluated similarly.

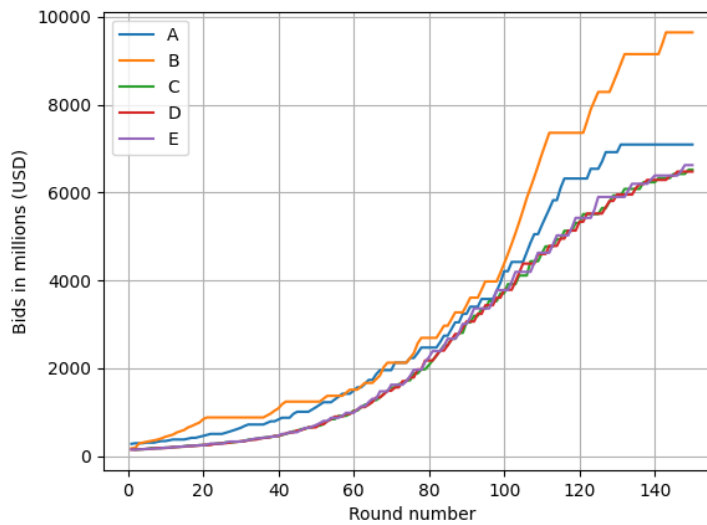


Figure 4: Development of the license bids in United Kingdom [1].

### **3 About spectrum allocation through beauty contests**

A beauty contest is an alternative way to the telecommunication regulators to allocate spectrum for the operators. In a beauty contest the spectrum licenses are distributed to the operators chosen by a jury that evaluates the participants based on certain, previously agreed and published criteria[7]. The criteria can set requirements for the company applying for a spectrum license itself or it can be relating to the quality of the features of the network. The major reason for regulators to choose the beauty contest for the license allocation has been the fear of high auction prices reflecting to the end users' subscription prices[2].

The UMTS licenses were allocated by using the beauty contest model for instance in Finland, Norway, and Sweden. As these countries are Nordic neighbours, we may assume that their regulation and spectrum allocation resemble each other. The most significant difference between the beauty contests and auctions are the price paid of a single band. While the prices of the beauty contest allocated bands were priced to tens of thousands of USD per a lot, with the auctions the sums were often counted in billions USD [14].

In Finland one of the operators, Suomen 3G that had claimed a license did not build a network according to the criteria of the contest. Without complying with the rules the government had to give a note to the operator in 2004, and finally terminate the license in 2005[13][11]. Additionally, in Sweden, Telia did not have a possibility to get a license as it could not manage to prove sufficient evidence to be able to build a technically feasible network [9]. Meanwhile another operator, Orange, did left the market only after two years.

An operator losing the a spectrum license is not limited only to beauty contest allocations, even though it is more likely to happen as the motivation to build a network is not as high as with auctioned licenses. An example of an operator losing its license is Sonera in Germany, where Group 3G, with Telefonica and Sonera as owners, lost its license. The spectrum auctions in Germany and Italy had consumed Sonera's assets which had led to the situation where they were not able to fund the network rollout, which caused the license expiration. Advice from American investment banks and unprofessional management decisions led to the situation, where the investments had become too large when comparing to the company's resources [6]. As a result, Sonera had acquired a license with 4000 million USD, which had become worthless and to be paid by the company's shareholders.

### **4 Conclusion**

With the results from the German auction we can state that the upgrade for one operator from a 2 x 10 MHz license to a 2 x 15 MHz were not so beneficial that it would have bid extra to buy out one of the other bidders. In addition, as we compare the results from the all three auctions together we and see the effect of the different amounts of spectrum in the licenses. In the Dutch and UK auctions (Figures 3 and 4) there were more variation between the license prices than in the German auction (Figure 2), where the licenses were identical.

The beauty contest offers a alternative way of spectrum allocation. Compared to the auctions, the prices of a license are not high for the operators, which makes it attracting to gain a license. However, to get a license it requires sufficient proof of being able to build and operate a network. By this, cases like Suomen 3G, which was discussed in the previous chapter, are tried to exclude. Additionally, beauty contest in Sweden was unsuccessful regarding the evaluation of the capabilities of the selected operators.



## A Auction rules

Country	Germany	The Netherlands	United Kingdom
Auction type	Simultaneous ascending auction		
Licenses	12 licences, each 2 x 5 MHz.	5 licences. A and B: 2x15 MHz + 1x5 MHz; C, D and E: 2x10 MHz + 1x5 MHz.	5 licences. A: 2x15 MHz + 1x5 MHz; B: 2x15 MHz; C, D and E: 2x10 MHz + 5 MHz.
# of licences for a new entrant	0	0	1
Publicity of the bids	Highest bid	Highest bid on each lot	All bids
Limitations on the licenses	Min 2 and max 3 licenses per bidder	Max 1 license per bidder. Highest bidder on a lot ca not bid on another license	Max 1 license per bidder
Minimum increment	10%, but the regulator reduced the minimum increment towards the end of the auction%	10% or 200 000 NLG at minimum	1.5-5% depending on the round
Minimum bid	100 million DM	100 million NLG on lots A and B, 90 million NLG on C, D and E. If no bids given, the price of the license is reduced first by 10 million NLG, then in half and last to 0.	A: 125 million GBP; B: 107.1 million GBP; C, D and E: 89.3 million GBP
Waivers	-	3	3
License duration (years)	20	15	20

Table 2: Rules of the spectrum auction by country [4][2][12][3].

## B Details of the beauty contest in Sweden

### Measures for license holders of the beauty contest in Sweden

The Swedish regulator, Post- och Telestyrelsen (PTS), evaluated the operators that had left an application for UMTS licenses. The evaluation was based on certain measures, that indicated the operators ability to be able to fulfil the network requirements. Based on the evaluation criteria, the operators were asked to write an application so that areas related to the criteria could be covered. There were four measures for the evaluation [8]:

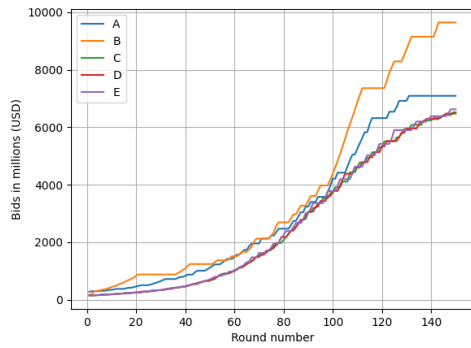
- Financial capabilities to operate a network with a sufficient capacity.
- Technical feasibility of the network.
- Capabilities to operate a business required for operating a network.
- Feasible capabilities and experience of mobile communication industry or similar.

### License terms of beauty contest allocated bands in Sweden

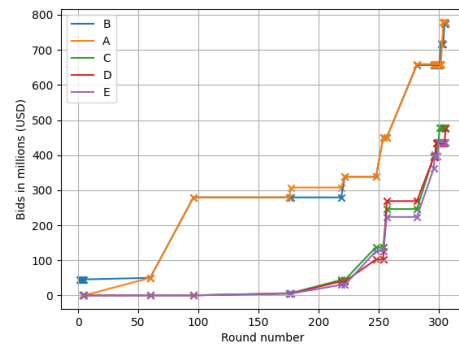
Category	Requirement
Frequency and bandwidth	2x15Mhz paired spectrum from bands 1920-1980 MHz and 2110-2170 MHz. Additionally, non-paired 5 MHz from band 1900-1920 MHz.
Requirement for the service	The four license holders should deploy a service that covers at least a population of 8 860 000 persons by the end of 2003. Based on the signal strength, an area could be defined as covered when the signal exceeded $58 \text{ dB}\mu\text{V}/\text{m}/5\text{MHz}$ , with a probability of 0.95.
Infrastructure sharing	The Operators should share the base station towers together in order to decrease environmental impact and reduce costs.
Requirement of RAN ownership	At least 30 % of the coverage over population should be done using operators own infrastructure.
Licenses, operators and duration.	4 licenses until 2015 for Europolitan, HI3G, Orange and Tele2.

Table 3: License terms of the UMTS licenses in Sweden [10].

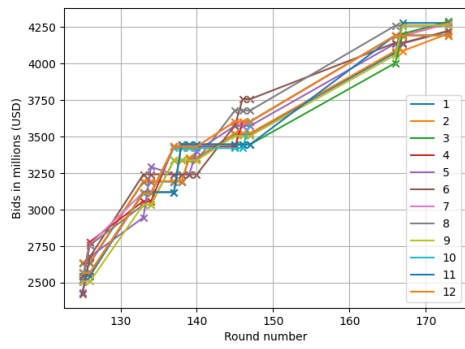
## C Figures



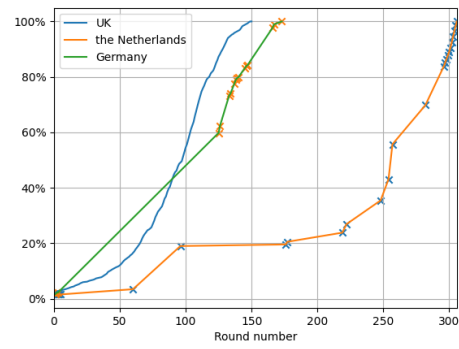
United Kingdom



The Netherlands



Germany



Cumulative

## D Final results of the auctions

Country	License	Highest bid (USD)	Operator
the United Kingdom	A	7 081 290 500	TIW
	B	9 631 860 000	Vodafone
	C	6 508 611 500	British Telecom 3G
	D	6 465 814 000	One2One
	E	6 613 425 000	Orange
the Netherlands	A	778 202 880	Libertel
	B	775 461 120	KPN
	C	477 523 200	Dutchtone
	D	476 152 320	Telfort
	E	436 396 800	Ben
Germany	1	4 278 775 648	Viag Intercom
	2	4 206 487 900	Mobilcom
	3	4 288 867 100	Mannesmann-Vodafone
	4	4 275 634 941	Group 3G
	5	4 221 934 000	Mobilcom
	6	4 225 332 142	Viag Intercom
	7	4 275 634 941	T-Mobil
	8	4 260 188 841	E-Plus
	9	4 262 042 373	T-Mobil
	10	4 193 049 793	E-Plus
	11	4 192 998 306	Mannesmann-Vodafone
	12	4 191 762 618	Group 3G

Table 4: Final result of the auctions [1][4][12].

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