

## *Lecture 9*

# Regulation by Licensing

Mobile Business II (SS 2011)

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Goethe University Frankfurt a. M.



- General Information
- UMTS Auction in Germany (2000)
  - Process
  - Admittance to the Auction
  - Licence
    - Liabilities
    - Validity
  - Result of the Auction
  - Auction of the Auction's Clock
  - International UMTS Licensing
- Frequency auction for wireless access (2010)
- Conclusions and Outlook

CNN.com - German mobile auction sets record - August 15, 2000 - Microsoft Internet Explorer

Adresse: <http://www.cnn.com/2000/WORLD/europe/08/15/germany.mobile/>

Google: cnn umts auction

**CNN.com** world > europe

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**German mobile auction sets record**

August 15, 2000  
Web posted at: 8:16 AM EDT (1216 GMT)

BERLIN, Germany (CNN) -- A massive \$37 billion windfall created from auctioning Germany's mobile telephone licences, the biggest in Europe, is sparking calls for money to be spent on social needs.

The Green Party leader from Western Berlin, Renate Kuenast, wants some of the cash raised to be spent on hospitals and kindergartens.

"I would like to see the money used for social spending," she said.

But a spokesman for the government, Une-Karsten Heye, is reported as saying no final decision on the precise use of the money will be made until the auction is over. The government wants to use the money to ease its debt of DM 1,531 billion (\$715.42 million).

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News: UK 3G operators 'destined for bankruptcy' - Microsoft Internet Explorer

Adresse <http://zdnet.com.com/2100-1105-530774.html>

ZDNet News  
technology News Now

Page One Applications **Networking** Hardware Commentary

## Networking

### UK 3G operators 'destined for bankruptcy'

By Graeme Wearden  
ZDNet (UK)  
September 25, 2001, 5:00 PM PT

**The mobile industry was warned on Tuesday that two of the UK's 3G licence holders could go bust by 2004 because of the slow growth of m-commerce.**

The grim prediction was made by the keynote speaker at London's Mobile Commerce World Europe, Ken Blakeslee--senior executive at Wireless Works, a venture capitalist group. Blakeslee fears that the slow growth in the popularity of m-commerce revenues will be fatal for some operators, some of whom have spent tens of billions of pounds winning licences to roll out next-generation mobile services.

"Some network operators paid dearly for their 3G licences. I think as many as two of them could be bankrupt by 2004, just in time for the other 3G operators to buy up their licences," said Blakeslee.

Blakeslee would not say which of the UK's five operators he thought were most likely to fail, but hinted that Hutchison 3G, which owns a British 3G licence but does not already operate

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- Securing cyberspace: The national plan
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**More networking analysis...**

News in Brief

- Site makes room for unknown musicians 04:46PM
- Barksdale sells \$1 million in ADL stock 03:02PM
- U.K. mobile firms eye "electronic Post-Its" 01:35PM
- Xerox makes management changes 12:03PM
- Corel CFO departs; new COO named 10:50AM

**More...**

Commentary

RASH

(Noch 1 Element) Bild [http://zdnet.com.com/1/zdnn/nav/4\\_off.gif](http://zdnet.com.com/1/zdnn/nav/4_off.gif) wird geladen

Start W M. 1. P. C. M. D. a. L. v. G. S. A. R. m. P. C. N. 3. DE 12:21

# UMTS Emotion Curve



Almost all information accessible at:



Bundesnetzagentur

[www.bundesnetzagentur.de](http://www.bundesnetzagentur.de)

Caution: Many pages! 😊

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- 31.07.-18.08.2000
  - Office building of the RegTP [now Bundesnetzagentur], Canisiusstraße 21, 55122 Mainz
  - on weekdays, 8-18 o'clock, 1 h lunchtime between 12 and 14 o'clock [without leaving the bidder rooms]
  - Every bidding party is represented by two authorized persons
- Every bidding party is provided with a separate room with an auction PC, telephone and fax (just connection to the company)

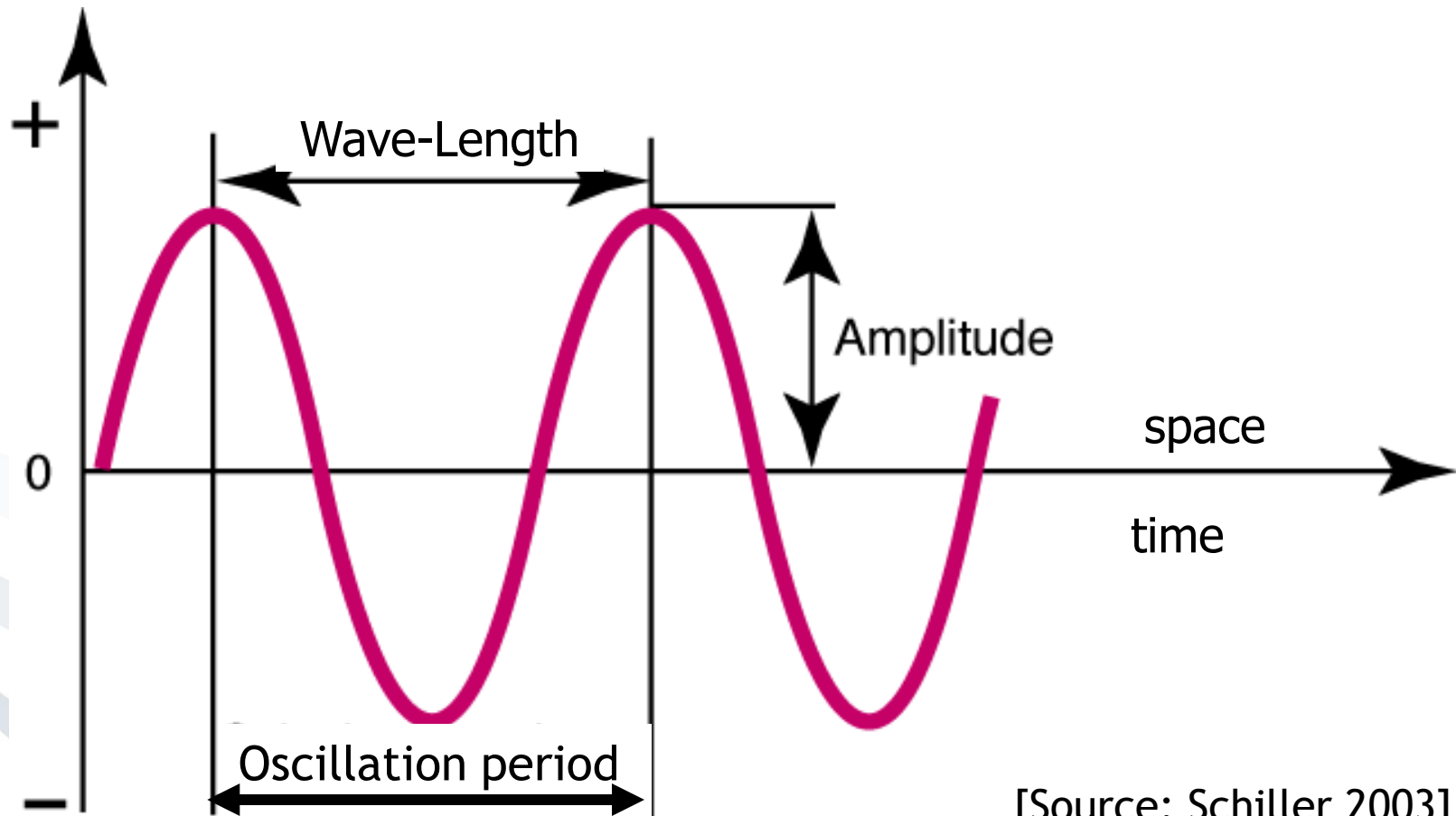


- Bidder tutorial
  - Separated for every bidder
    - Instruction to the process
    - Prerequisite for auction!
    - [The telephone and fax numbers have to be brought to the bidder tutorial.]
  
- Mobile telephones not admitted!
- All the time an employee of the RegTP is present in the rooms.



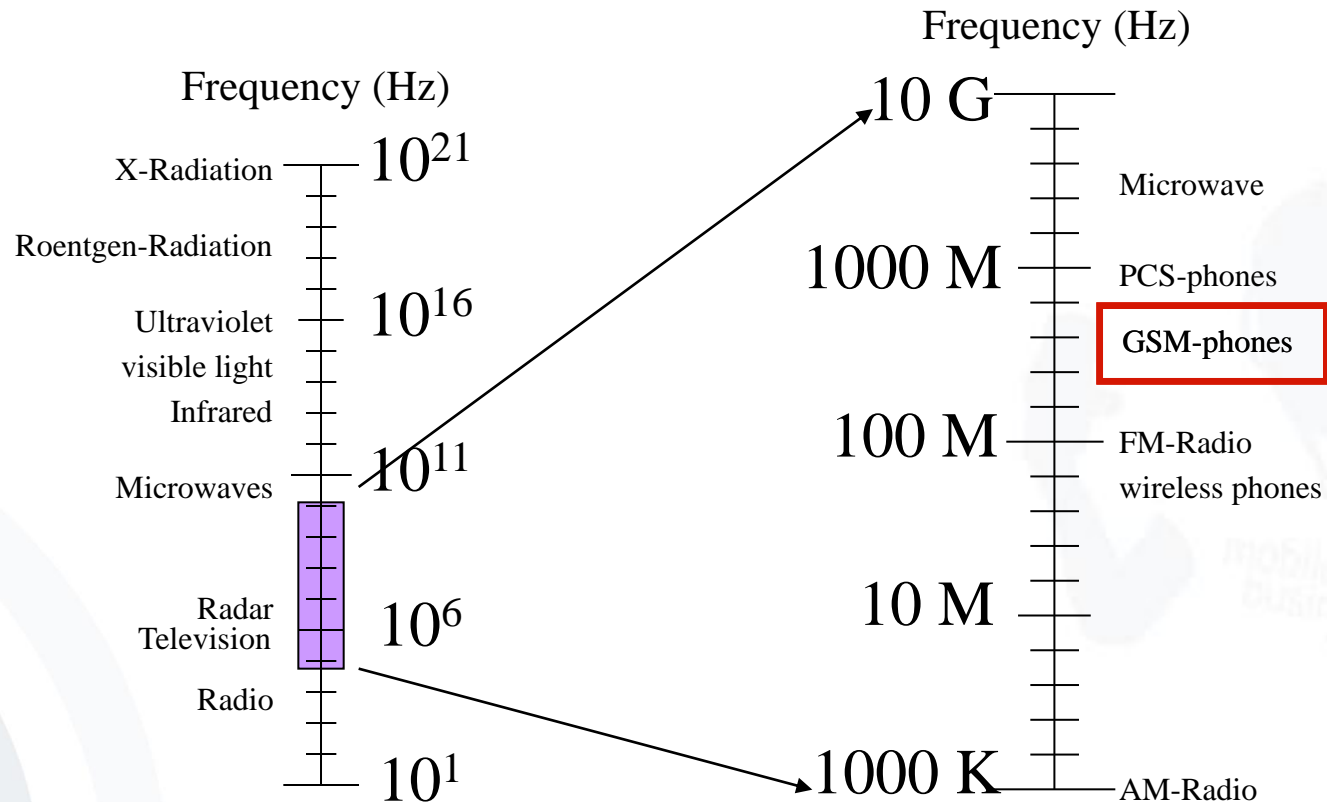
- Simultaneous multiple round auction in two stages
- No communication among the bidders
- At the start of each round, each bidder will only be notified of the numerical value of the current highest bids and the identity of the current highest bidders. This ensures utmost transparency.

- Electromagnetic Waves and Frequencies



[Source: Schiller 2003]

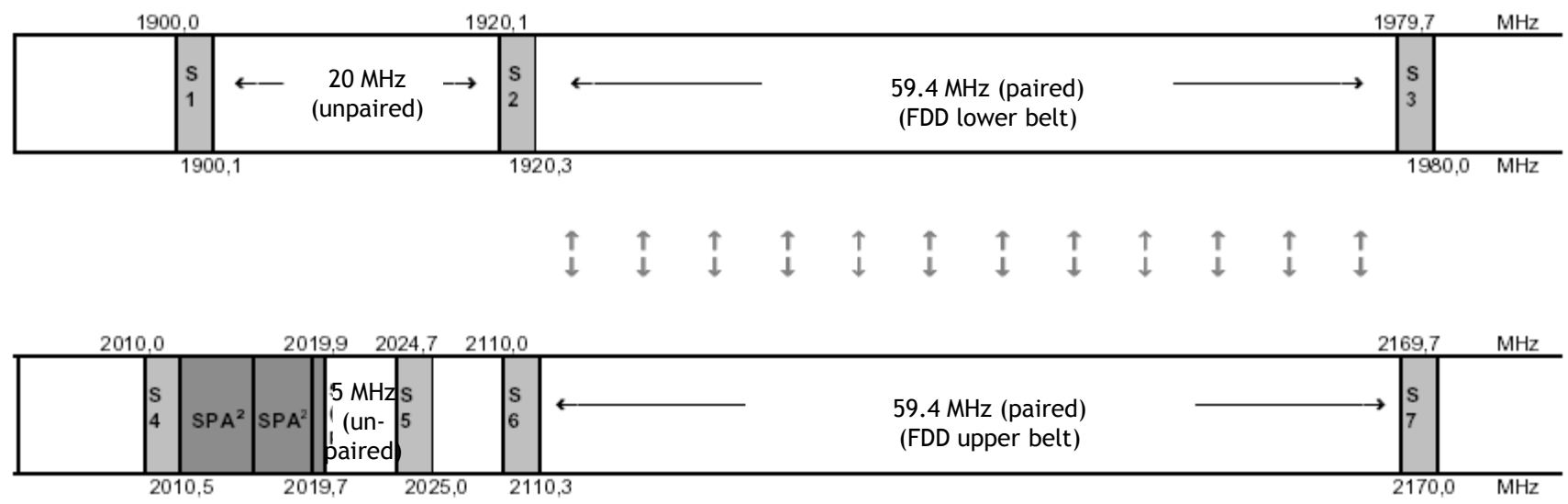
- Frequency range of entertainment and communication electronics



# Excursion: Frequencies & Co | 3

UMTS/IMT-2000 channel plan for the frequency areas 1920 - 1980 MHz, 2010 - 2025 MHz and 2110 - 2170 MHz (in accordance to ERC/DEC(99)25)

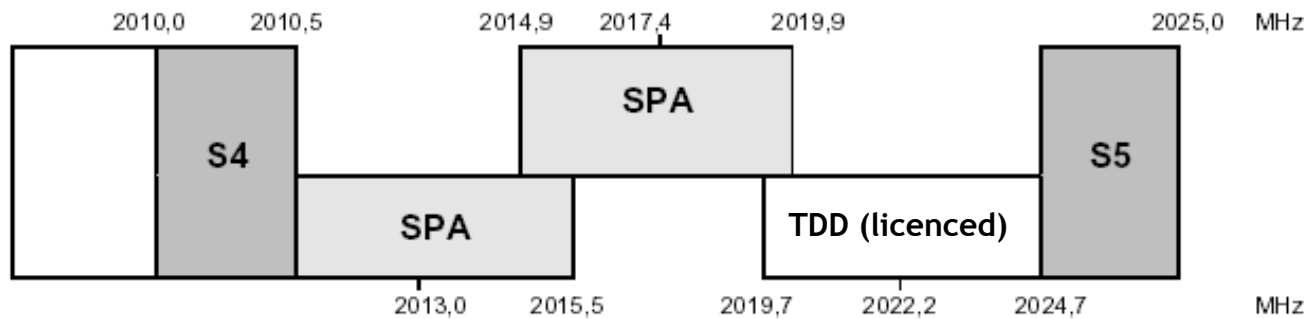
- **FDD Spectrum:** Sending frequencies for mobile stations in FDD mode (1920 - 1980 MHz), Sending frequencies for basis stations in FDD mode (2110 - 2170 MHz),
- **TDD Spectrum:** Sending frequencies for mobile and basis stations in TDD mode (1900 - 1920 MHz, 2010 - 2025 MHz), the lowest two TDD frequency blocks of the area 2010 - 2025 MHz are reserved for public domain applications (SPA)<sup>1</sup> according to ERC/DEC(99)25



<sup>1</sup> Public domain applications (SPA = Self provided applications operating in a self coordinated environment).

<sup>2</sup> Reserved for public domain applications (SPA) according to ERC/DEC(99)25.

detailed fragmentation of the frequency range between 2010 MHz and 2025 MHz



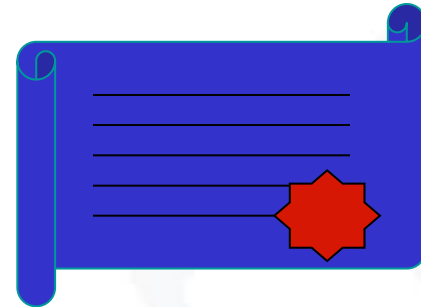
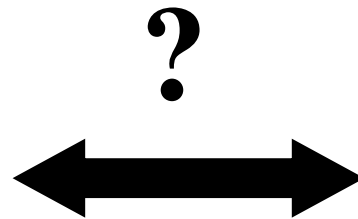
- 2 \* 60 MHz (paired) and 1 \* 25 MHz (unpaired) available.
- Two auction stages
- 1st Stage:
  - Licenses are offered whose frequency equipment amounts at least 2 x 10 MHz (paired) and at most 2 x 15 MHz (paired).
  - Hence the **amount of the licences** which are up for auction in the first stage amounts **between four and six** depending on the demand of frequency blocks and the actual bidding behaviour of the candidates.
  - The spectrum of 2 x 60 MHz (paired) is offered in 12 abstract blocks, each per 2 x 5 MHz (paired).

- 2nd Stage:
  - **Five blocks** of 1 x 5 MHz unpaired spectrum and any blocks of 2 x 5 MHz paired spectrum not bought in the first stage shall be auctioned.
    - Block one to four: 1 x 5 MHz unpaired spectrum shall be offered as abstract frequency blocks, i.e. with no defined spectral position.
    - Fifth block shall be offered with a defined spectral position.
  - If, at the close of the bidding proceedings, there is no valid bid for a frequency block or if a bidder is the highest bidder for one frequency block only, the block shall not be awarded in the first stage. The unbought spectrum shall be auctioned in the second stage in blocks of 2 x 5 MHz among the successful bidders from the first stage, together with the other auctionable (unpaired) spectrum.
  - Only those bidders are admitted to the participation in the second stage who have purchased licences by auction in the first stage.

- The bidding rights in the first stage are limited to at least 2 \* 10 MHz (paired) and at most 2 \* 15 MHz (paired).
- Unpaired frequencies can be purchased by auction (in the second stage) without limitation.
- **Minimum bidding in the 1st stage**
  - For one licence with a basis equipment of 2 x 10 MHz (paired) 200 million DM/102,258 million EUR,
  - For one licence with an equipment of 2 x 15 MHz (paired) 300 million DM/153,387 million EUR.
- **Minimum bidding in the 2nd stage**
  - 50 million DM/25,565 million EUR per 1 x 5 MHz frequency block unpaired
  - As far as a paired frequency spectrum is auctioned in the second stage the minimum bidding per 2 x 5 MHz frequency block (paired) amounts 100 million DM/51,129 million EUR.

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- Would Kai Rannenberghave been able to purchase a licence by auction?



- Four requirements have to be fulfilled:

Proposition

Notification of the RegTP

Deposit

Bank guarantee



- Requirement 1: Proposition
  - In German language
  - Original proposition and 15 copies
  - Till 28th April 2000
  - Legal prerequisites for the admittance to the auction process have to be fulfilled (Section 8(3) sentence 2 subparas 1 to 3 of the Telecommunications Act).

## ■ Requirement 1: Proposition

- a) Statements to the requestor
- b) Statements to reliability
- c) Statements to efficiency
- d) Statements to competence
- e) Participation structure of the requestor /  
innocuousness certificate of the Federal  
Cartel Office

## TKG §8, Abs. 3 (Nr. 1-3)

- “ An ordered licence is to deny if:
1. the regulation office does not possess useful frequencies which can be allocated to the requester who wants to conduct radio connections or
  2. facts justify the supposition that
    - a) the requester does not possess the reliability, efficiency and competence which are required for the exertion of the requested licence rights and it is to expect that these licence rights will not be executed enduring or
    - b) the public safety or order would be endangered through the issue of the licence.
- ”

- Requirement 2: Notification of the RegTP
  - Approval of the statements to reliability, productivity, competence, ...
- Requirement 3: Deposit
  - 14 days before the auction
  - 20 Million DM (10,226 Million EUR)

- Requirement 4: Bank guarantee (1)
  - Indefinite, unconditional, irrevocable, directly enforceable
  - Amounting to 400 million DM (204,517 million EUR) for the purchase by auction of a licence with a frequency equipment of 2 x 10 MHz (paired) in the first stage of the auction
  - Amounting to 600 million DM (306,775 million EUR) for the purchase by auction of a licence with a frequency equipment of 2 x 15 MHz (paired) in the first stage of the auction

- Requirement 4: Bank guarantee (2)
  - amounting to 100 million DM (51,129 million EUR) per occupied bidding right for unpaired frequencies in the second stage of the auction
  - amounting to 200 million DM (102,258 million EUR) for one bidding right for paired frequencies in the second stage of the auction

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## Licence Template

### Licence for operating of transmission paths

For the supply of mobile radio services of the third generation  
(UMTS/IMT-2000) for the public in the area of the Federal Republic of Germany

(UMTS/IMT-2000 licence)

Hereby the regulation authority for telecommunication and post (LICENSER) issues a licence for  
operating of transfer routes for the supply of mobile radio services of the third generation  
(UMTS/IMT-2000) for the publicity (licence class 1; mobile radio licence)

to ..... (LICENSEE)

based on the auction from ..... and on the application for admission of the LICENSEE to the  
auction process from ..... according to § 6 paragraph 1 No. 1, paragraph 2 No. 1 letter a) in  
connection with §§ 11 paragraph 4, 8 paragraph 1 sentence 1 as well as paragraph 4 and 5 and  
50 paragraph 2 of the telecommunication law.

[Bundesnetzagentur 2000]

1. Part A
2. Part B
3. Part C
4. Part D

## Index of contents

- Part A
  - 1 Scope of Licence
  - 2 Right to Operate Transmission Paths
  - 3 Usage of Mobile Radio Frequencies
  - 4 Use of Public Ways
  - 5 Numbering
  - 6 Fees and Contributions

- Part B
  - 1 Licence Term
  - 2 Revocation of Licence and Accompanying Rights
  - 3 Attachment of Collateral Clauses after Licence Award
  - 4 Roll-Out and Coverage Obligations
  - 5 Frequency Usage Conditions
  - 6 Open Network Provision and Interconnection
  - 7 Extract from the Commercial Register
  - 8 Technical Protection Measures

- Part C
  - 1 Market Dominance
  - 2 Competitive Independence of Licensee
  - 3 Connection of Terminal Equipment
  - 4 Telecommunications Secrecy and Telecommunications Systems Security
  - 5 Restriction of Telecommunications Secrecy
  - 6 Data Protection and Information Requests from Security Authorities
  - 7 Civil Protection
  - 8 Influence on Other Legal Relationships

- 9 Transfer of Licence and Accompanying Rights, Change in Ownership of Licensee, and Merger Prohibition
- 10 Fixed Link Frequencies
- 11 Notification and Reporting Requirements
- 12 Separation of Corporate Structures and Separate Accounting
- 13 Submission of General Terms and Conditions
- 14 Customer Protection
- 15 Offerings for Service Providers
- 16 Choice of Operator
- 17 Information Requirements

- 1 Scope of Licence

This licence applies to the operation of transmission paths for the offer of publicly available 3G mobile radio (UMTS/IMT-2000) services on the territory of the Federal Republic of Germany by the LICENSEE or by other parties.

The LICENSEE shall be free to apply any standard from the IMT-2000 concept.

The system used by the LICENSEE shall fulfil the following minimum requirements according to Decision No 128/1999/EC of the European Parliament and of the Council of 14 December 1998 on the coordinated introduction of a third-generation mobile and wireless communications system (UMTS) in the Community (EC Official Journal of 22 January 1999):

- Multimedia capability, full mobility and low mobility applications in different geographical environments beyond the capability of the second generation systems such as GSM;
- Efficient access to the Internet, Intranets and other Internet Protocol (IP) based services.
- High quality speech transmission commensurate with that of fixed networks.
- Service portability across distinct UMTS/IMT-2000 environments, where appropriate (e.g. public/private/business; fixed/mobile).

- Operation in one seamless environment, including full roaming with GSM and between the terrestrial and satellite components of UMTS/IMT-2000 networks.
- New terrestrial air interface for access to all services (including packet data based services, supporting asymmetric traffic and allowing for bandwidth/data rate on demand in harmonised frequency bands).
- Call handling, service control, and location and mobility management, including full roaming functionality based on an evolution of existing core network systems, for example on an evolved GSM core network, taking the convergence between mobile/fixed networks into account.

## 2 Right To Operate Transmission Paths

- This licence authorises the LICENSEE to operate transmission paths for public 3G mobile radio (UMTS/IMT-2000) service offerings on the territory of the Federal Republic of Germany.

## Part B

### 1 Licence Term

The licence and accompanying rights shall expire on 31 December 2020.

- That means 20 years runtime
- GSM licences for originally 20 years, too
  - Licences D-Networks until 2009
  - Licence E1 until 2012
  - Licence E2 until 2016
- Meanwhile all GSM licence agreements are extended until 2016 [Bundesnetzagentur 2006]

## 4 Roll-Out and Coverage Obligations

- 4.1 The LICENSEE shall ensure the offer of UMTS/IMT-2000 mobile radio services to at least 25% of the population by no later than 31 December 2003 and to at least 50% of the population by no later than 31 December 2005.

- After 31 December 2005, the LICENSER may increase the coverage obligation in connection with the award of additional spectrum, where necessary for regulatory reasons in order to ensure the regulatory aims as set out in Section 2(2) of the Act (Section 8(2) of the Act).

- 4.3 The coverage obligation according to Paragraph 4.1 shall apply on condition that the relevant specifications of the UMTS/IMT-2000 standard chosen by the LICENSEE are available in sufficiently stable form in good time before startup of service and that the relevant technical systems are on the market.

## 6 Data Protection and Information Requests from Security Authorities

6.1 The LICENSEE shall be subject to the provisions on personal data protection of the Telecommunications Act, the Telecommunications Carriers Data Protection Ordinance, and the Federal Data Protection Act.

6.2 Attention is drawn to the obligation to furnish information in accordance with Sections 89(6) and 90 of the Act.

## Shared use of infrastructure

- To what extent and under which technical conditions is a shared use of infrastructure in line with the UMTS licensing conditions [decision of the presidents chamber from 18.02.2000 on the determinations and rules for the licensing for UMTS/IMT-2000; RegTP official gazette from 23.02.2000, Vfg 13/2000]
- Thesis paper of the RegTP [available from [www.bundesnetzagentur.de](http://www.bundesnetzagentur.de) in German and in English]

## Infrastructure Sharing

### Interpretation of the UMTS Award Conditions in Light of More Recent Technological Advance

- Shared use of sites, masts, antennas, cables and combiners is permitted under the Award Conditions.
- Shared use of Site Support Cabinets, or SSCs (= more than one Node B in a single SSC) has no further implications for functions control (full legal control of the operator's network) and the independence of the licence holders as competitors and is thus compatible with the Award Conditions.

- Use of logically distinct Node Bs in one and the same unit instead of physically distinct Node Bs at the same site is covered by the Award Conditions if the individual cooperation agreements guarantee that each licence holder will retain functions control and competitive independence. The preconditions are:
  1. each licence holder has independent control of his own logical Node Bs so that he can operate his assigned frequencies only (no spectrum pool);
  2. no exchange of any data relating to competition beyond that required for technical operations takes place (eg customer data);
  3. separation of the Operation and Maintenance Centres;
  4. operation of additional own Node Bs (to guarantee the operator's planning autonomy);
  5. no regional splitting up of coverage areas that rules out network and coverage area overlap.

- Use of logically distinct RNCs in one and the same unit instead of physically distinct RNCs is covered by the Award Conditions if the individual cooperation agreements guarantee that each licence holder will retain functions control and competitive independence. The preconditions are:
  1. each licence holder has independent control of his own logical RNC, particularly of the usage-sensitive cell load and power;
  2. no exchange of any data relating to competition beyond that required for technical operations takes place (eg customer data);
  3. separation of the Operation and Maintenance Centres;
  4. possibility of operating additional own RNCs (to guarantee the operator's planning independence);
  5. connection of the operator's own Node Bs, operated solely by himself, to his own logical RNC.

- Shared use of the core network, i.e. of the MSC, would lead to a spectrum pool and is thus incompatible with the requirement of functions control as set out in the Telecommunications Act and the UMTS Award Conditions.
- Transitional arrangements on the shared use of MSCs are ruled out in light of principle 5.

- 9 Transfer of Licence and Accompanying Rights, Change in Ownership of LICENSEE, and Merger Prohibition**
  - 9.1** Transfer of licence shall be in written form and shall require prior written approval by the LICENSER (Section 9(1) sentence 1 of the Act).
  - 9.2** The LICENSER shall be given notice without undue delay of any other transfer of licence to a new holder, change in ownership of the LICENSEE, or permission for another party to use the licence (Section 9(2) of the Act).
  - 9.3** If the LICENSEE holds a dominant position according to Section 19 of the Restraints of Competition Act in the relevant market, he may be required by the LICENSER as a condition of his licence to refrain from any linkage with another company within the meaning of Section 37 of the Restraints of Competition Act if there is a limitation of the number of licences in accordance with Section 10 of the Telecommunications Act and if the other company is or will be operating in a telecommunications market deemed to be the same product and geographical market as the LICENSEE's sphere of activity (Section 32 of the Telecommunications Act).

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## Agenda of the allocation of the UMTS/IMT-2000 frequency blocks

### FDD frequency blocks

(MHz)	1920,3	1930,2	1940,1	1950,0	1959,9	1969,8	1979,7
	FDD 1: Mannesmann Mobilfunk (9,9 MHz)	FDD 2: Group 3G (9,9 MHz)	FDD 3: E-Plus 3G Lux (9,9 MHz)	FDD 4: MobilCom Multimedia (9,9 MHz)	FDD 5: VIAG (9,9 MHz)	FDD 6: T-Mobil (9,9 MHz)	

(MHz)	2110,3	2120,2	2130,1	2140,0	2149,9	2159,8	2169,7
	FDD 1: Mannesmann Mobilfunk (9,9 MHz)	FDD 2: Group 3G (9,9 MHz)	FDD 3: E-Plus 3G Lux (9,9 MHz)	FDD 4: MobilCom Multimedia (9,9 MHz)	FDD 5: VIAG (9,9 MHz)	FDD 6: T-Mobil (9,9 MHz)	

### TDD frequency blocks

(MHz)	1900,1	1905,1	1910,1	1915,1	1920,1	2019,7	2024,7
	TDD Block 1: Group 3G (5 MHz)	TDD Block 2: MobilCom Multimedia (5 MHz)	TDD Block 3: T-Mobil (5 MHz)	TDD Block 4: Mannesmann Mobilfunk (5 MHz)			E-Plus 3G Lux (5 MHz)

## Final result of the UMTS licence auction

Licensee	acquired frequency spectrum	DM
E-Plus Hutchison	2 x 5 MHz paired 1 x 5 MHz unpaired	16.491.800.000
Group 3G	2 x 5 MHz paired 1 x 5 MHz unpaired	16.568.700.000
Mannesmann Mobilfunk	2 x 5 MHz paired 1 x 5 MHz unpaired	16.594.800.000
MobilCom Multimedia	2 x 5 MHz paired 1 x 5 MHz unpaired	16.491.000.000
T-Mobil	2 x 5 MHz paired 1 x 5 MHz unpaired	16.704.900.000
VIAG Interkom	2 x 5 MHz paired	16.517.000.000
	<b>Total amount:</b>	<b>99.368.200.000</b>

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## Auction of the Auction's Clock

- From 28.08.2000 till 15.09.2000, 15 o'clock the auction's clock (costs: about 200 DM) was offered for a start bidding of 250 DM.
- The Pfleiderer AG in Neumarkt/Oberpfalz issued a bid of 30.000 DM.
- The money benefited charitable institutions.



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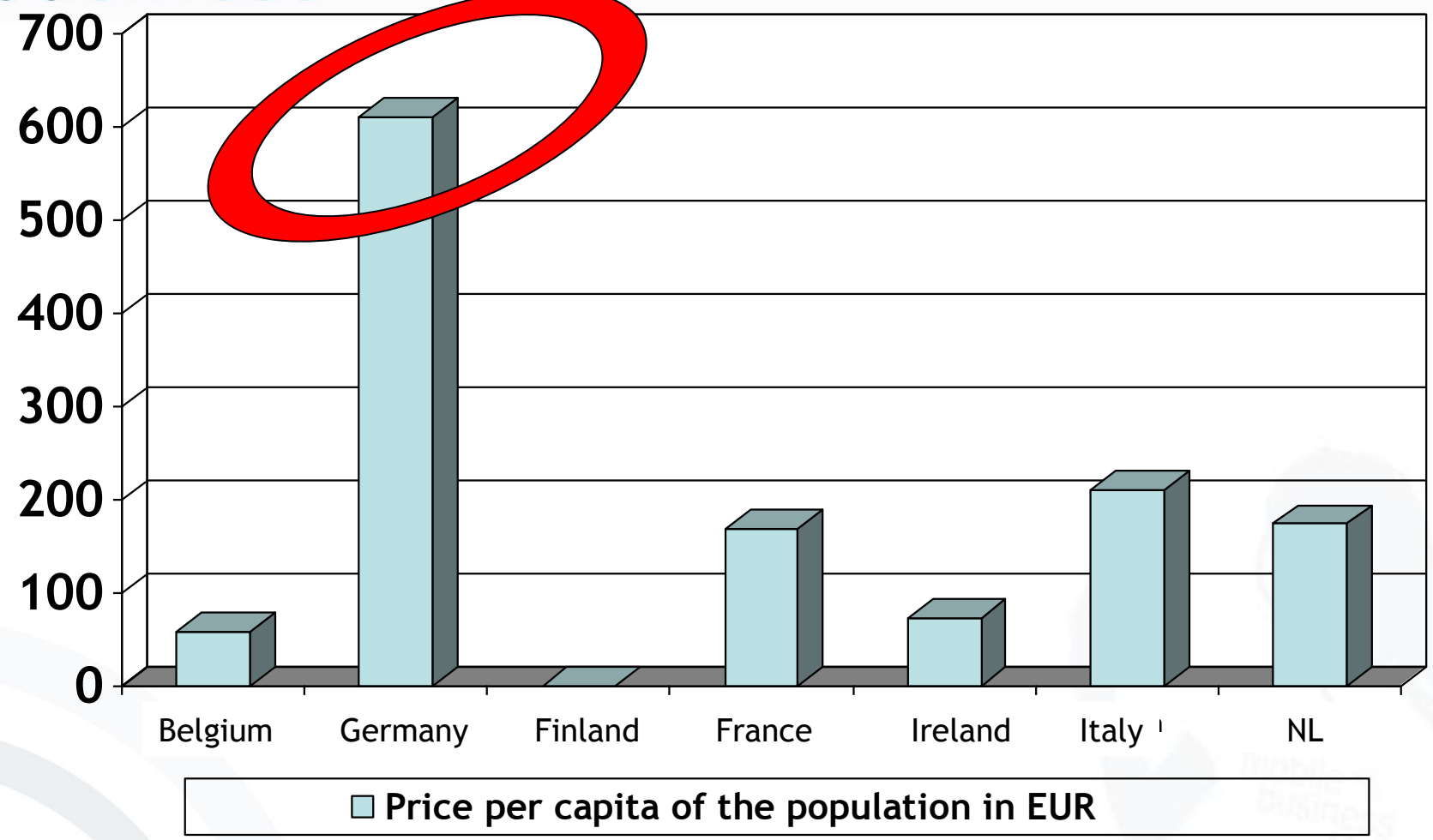
# International UMTS Licensing

- Australia (A)
- Austria (A)
- Belgium (A)
- Czech Republic (A)
- Denmark (A)
- Estonia (Sealed bid)
- Finland (BC)
- France (BC + fee)
- Germany (A)
- Greece (A)
- Hong Kong (Revenue Share)
- Ireland (BC)
- Isle of Man (Award)
- Israel (A)
- Italy (A)
- Japan (BC)
- Latvia (A)
- Liechtenstein (Award)
- Luxembourg (BC)
- Malaysia (BC)
- Monaco (Award)
- Netherlands (A)
- New Zealand (A)
- Norway (BC)
- Poland (BC)
- Portugal (BC)
- Singapore (Award)
- Slovakia (BC)
- Slovenia (A)
- South Korea (BC)
- Spain (BC)
- Sweden (combination A & BC)
- Switzerland (A)
- Taiwan (A)
- UK (A)

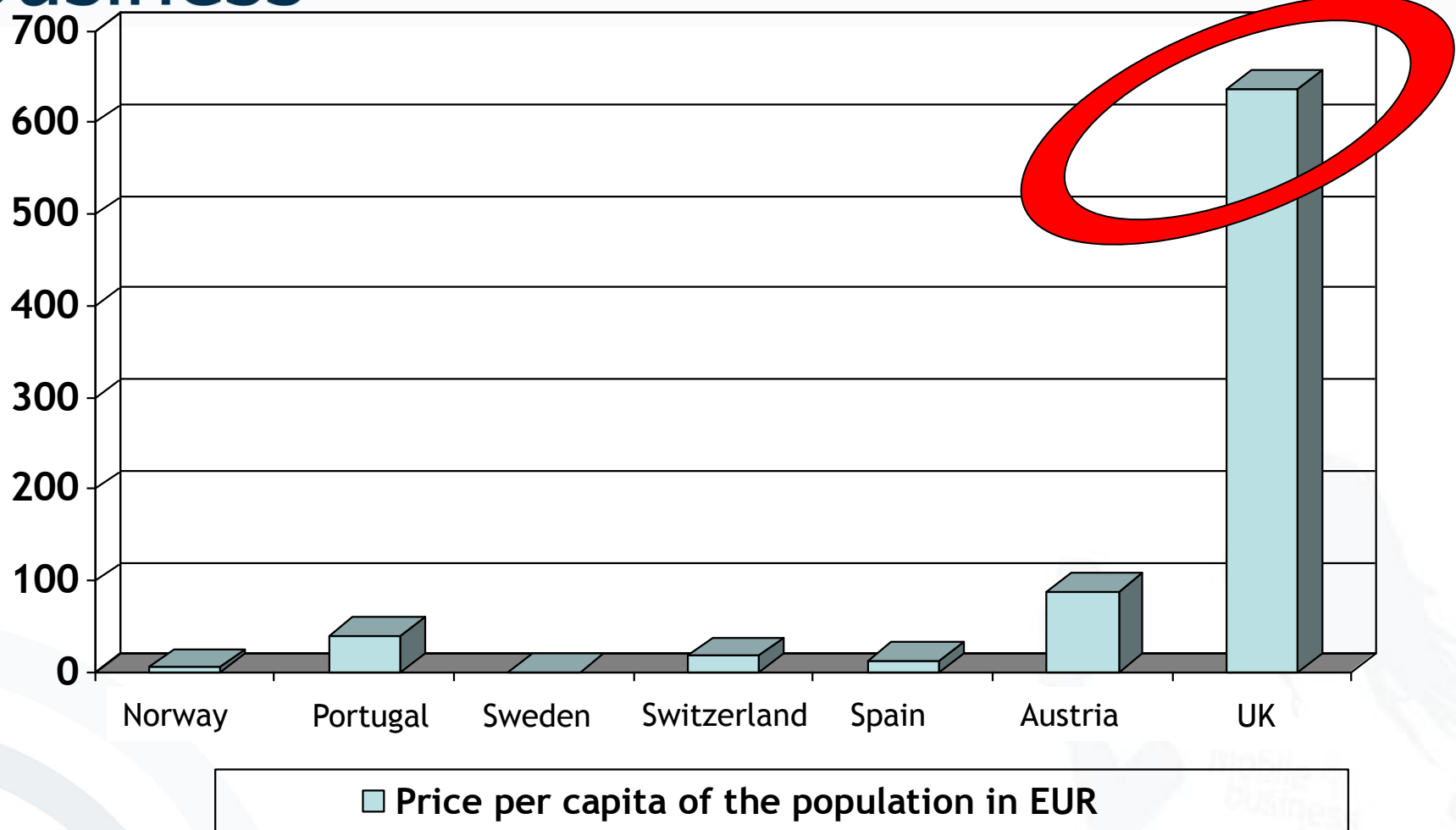
A = Auction, BC = Beauty Contest

[[www.gsmworld.com/gsm europe/faq/3g.shtml](http://www.gsmworld.com/gsm europe/faq/3g.shtml);  
[www.umtsworld.com/industry/licenses.htm](http://www.umtsworld.com/industry/licenses.htm)]

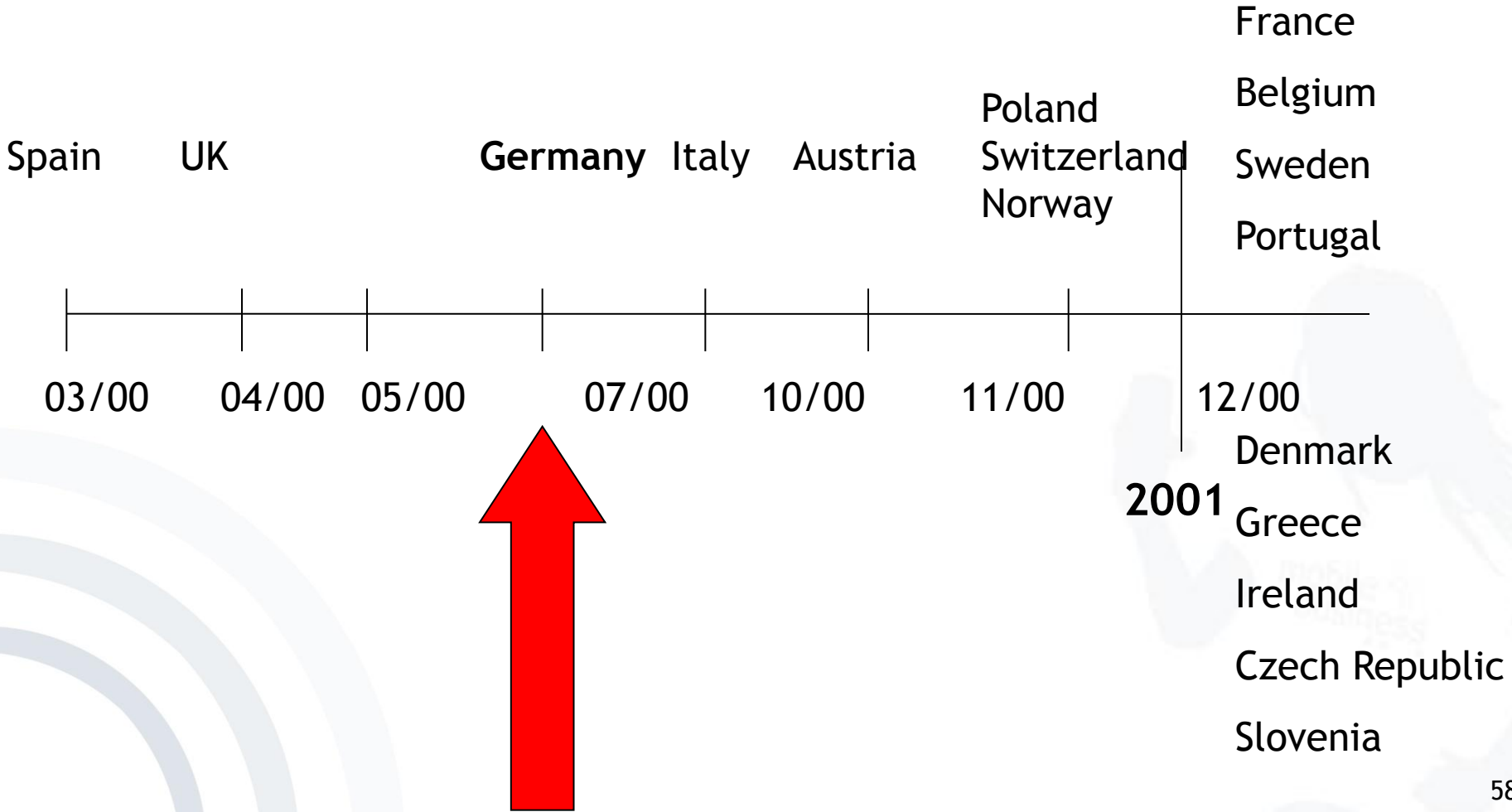
# International UMTS Licensing



# International UMTS Licensing



# International UMTS Licensing



- Actually it does not matter which frequency blocks one gets.
- **BUT:** If one operates several UMTS networks (beyond the frontiers) it can be interesting to get frequency blocks in the same “range”.

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Based on Broadband strategy within the German economic stimulus package (Konjunkturpaket II)

- Usage of digital dividend as soon as possible
- Provisioning of innovative mobile telephony and broadband internet in rural environments

The expression „digital dividend" refers to the **increase in transmission capacity** that is achieved by changing over to digital technology.

In the course of digitizing TV and radio broadcasts (DVB-T), signals will be transmitted in future over one frequency or one channel. This will **free up valuable frequency bands** (frequency range 790-862 MHz) - used to date solely for the transmission of analog signals - for the broadband Internet service.

- frequency auctions for wireless network access for the provision of telecommunication services in the ranges:
  - **800 MHz**
    - bound to network expansion obligations in rural environments (90% of the population of all states from 2016)
  - **1.8 GHz** (expansion of present networks)
  - **2.0 GHz** (expansion of present networks)
  - **2.6 GHz** (4G networks)
- Almost similar auction process as UMTS auction 2000 (Simultaneous multiple round auction)

# Result of the Auction 2010

Licensee	acquired frequency spectrum	Euro
Vodafone D2 GmbH	2 x 0,8 GHz paired 1 x 2,0 GHz paired 4 x 2,6 GHz paired 5 x 2,6 GHz unpaired	1,422,503,000
Telefónica O2 Germany GmbH & Co. OHG	2 x 0,8 GHz paired 1 x 2,0 GHz paired 2 x 2,0 GHz unpaired 4 x 2,6 GHz paired 2 x 2,6 GHz unpaired	1,378,605,000
Telekom Deutschland GmbH	2 x 0,8 GHz paired 3 x 1,8 GHz paired 4 x 2,6 GHz paired 1 x 2,6 GHz unpaired	1,299,893,000
Erste MVV Mobilfunk Vermögensverwaltungsgesellschaft mbH (E-Plus)	2 x 1,8 GHz paired 2 x 2,0 GHz paired 2 x 2,6 GHz paired 2 x 2,6 GHz unpaired	283,645,000
	<b>Total amount:</b>	<b>4,384,646,000</b>

## Comparison of auctions

### UMTS (2000)

- Participants 6
- Altogether 145 MHz
- Duration 19 days
- 173 rounds
- Time per round 40 Min.

→ 50bn €

### Wireless Access (2010)

- Participants 4
- Altogether 360 MHz
- Duration 27 days
- 224 rounds
- Time per round 90 Min.

→ 4.4bn €

- General Information
- UMTS Auction in Germany (2000)
  - Process
  - Admittance to the Auction
  - Licence
    - Liabilities
    - Validity
  - Result of the Auction
  - Auction of the Auction's Clock
  - International UMTS Licensing
- Frequency auction for wireless access (2010)
- Conclusions and Outlook

- Historic event  
... and you were around!
- UMTS licence payments were overdrawn
- Network expansion obligations of 800 MHz auctions in 2010 will accelerate the process of increased network coverage in rural areas
- Discussion on
  - Shared use of infrastructure
  - Licence transfer
  - Licence returncontinues.

- [Bundesnetzagentur 2000]: Licence Template; Schedule 1 to “Ruling of 18 February 2000 by the President's Chamber on the Determinations and Rules for the Award of Licences for the Universal Mobile Telecommunications System (UMTS) / International Mobile Telecommunications-2000 (IMT-2000); Third Generation Mobile Communications“;  
[www.bundesnetzagentur.de/media/archive/2163.pdf](http://www.bundesnetzagentur.de/media/archive/2163.pdf)
- [Bundesnetzagentur 2006]: Konzept zur Vergabe weiteren Spektrums für den digitalen öffentlichen zellularen Mobilfunk unterhalb von 1,9 GHz (GSM-Konzept); Umsetzung des Handlungskomplexes II (Angleichung der Restlaufzeiten),  
[http://www.bundesnetzagentur.de/enid/Oeffentlicher\\_Mobilfunk/GSM-Konzept\\_-\\_Angleichung\\_der\\_Restlaufzeiten\\_4bu.html](http://www.bundesnetzagentur.de/enid/Oeffentlicher_Mobilfunk/GSM-Konzept_-_Angleichung_der_Restlaufzeiten_4bu.html)

- [Bundesnetzagentur 2010]: Frequenzversteigerung 2010;  
<http://www2.bundesnetzagentur.de/frequenzversteigerung2010/images/pressemitteilungen/Sprechzettel%20Pressebriefing%2008.04.2010.pdf>