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**Office of Electronic Communications (UKE)**
Attn: Mr Wiktor Sega,
Director of the Department of Frequency Resources Management
przetarg-aukcja@uke.gov.pl

**Date 30 April 2010**

Dear Mr Wiktor Sega

# GSMA input to award of 2.6 GHz licenses in Poland

The GSM Association (GSMA) represents over 850 operator members deploying GSM/GPRS/EDGE, UMTS/HSPA and lately LTE based networks. In addition, we have strong relationships with manufacturers (both device and infrastructure) with over 100 companies contributing to GSMA activities in building a comprehensive mobile ecosystem supporting mobile communication.

GSMA believe that we share a common interest with UKE to successfully developing the mobile sector to the benefit of the consumers of mobile broadband services in Poland. One of the key factors for successfully doing so is to ensure mobile operators have access to exclusive usage rights to spectrum in internationally harmonised mobile bands and to do so awarding spectrum usage rights according to best international practices in terms of designing and implementing award procedures which are open, transparent and administratively efficient is a key delivery by regulators.

As a result of GSMA being requested by members to participate in the public consultation meeting in Warsaw 13 April 2010 and as a result of discussions between the GSMA and the UKE and discussions between GSMA members and the GSMA we have decided to contribute to the Polish 2.6 GHz award preparations by providing an overview which shares information on 2.6 GHz awards in other countries in Europe. Please note that GSMA have not analysed the performance of the auctions accomplished or the auctions planned that we refer to below.

Most questions raised in the Polish consultation on tender documentation on the proposed award procedure are issues which potentially are commercially sensitive and where GSMA members potentially do not always have common interests. GSMA do not work on such issues and the mobile industry does, of course, not develop common policies on commercially sensitive subjects. Please note that GSMA do not have any preferences regarding the commercially sensitive components of various auction designs but limits ourselves to underline the importance of well designed and implemented award procedures to ensure they meet best international practise on key criteria such as transparency, anti-corruption and controlled participation cost.

GSMA puts forward a kind reminder of the significant contribution to society's welfare stemming from mobile communication and that this means an economic efficient allocation of the essential input spectrum between spectrum users and not maximizing government revenue is the key policy objective when designing and implementing an award procedure.

The auctions of 2.6 GHz spectrum which have been accomplished in Europe so far have all used the auction design to decide upon the number of licenses. All auctions have concluded with four or more winners of 2.6

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GHz spectrum. The fact that radio frequencies in economic terms are the essential input for a mobile operator simply means controlling their own spectrum portfolio seems to be considered essential for all infrastructure based mobile operators. Without controlling their own spectrum portfolio a market player basically ends up as a service provider on others networks (MVNO like operations). Being a mobile operator and being a pure MVNO seems to be considered as two rather different businesses. Even in Sweden, were the four major existing infrastructure based operators are involved in extensive infrastructure sharing agreements for rolling out UMTS/HSPA networks in the 2.1 GHz band, they showed up as independent bidders in the 2.6 GHz auction. The four Swedish operators are said to have competed hard for their licenses and they all ended up buying 2.6 GHz spectrum. It seems like the Swedish operators prefer to control their own spectrum portfolio even if they are heavily involved in infrastructure sharing agreements for rolling out and operating networks.

We understand UKE's initial proposal was to award four FDD licenses (three licenses of 2X20 MHz and one license of 2X10 MHz) but that the present proposal from UKE is to award only two FDD licenses (of 2X35 MHz). We assume UKE's policy is to promote competition to benefit consumers and that promoting competition is seen as a tool to encourage technology development and service innovations. To narrow down to two licenses in the 2.6 GHz band might lead to some challenges regarding ensuring spectrum availability that promotes a competitive market structure. One would normally expect an analysis of the pros and cons of such an approach (of limiting to two licences) being done to help decide if such an approach is a proportionate to the stated objectives of the award.

We do understand that there are other frequency bands available for deploying mobile technologies in Poland and this does, of course, mean that the availability of 2.6 GHz spectrum is not the only factor defining the future market structure. Competition in the Polish mobile market might be affected by which technologies different market players deploys if this affects which services they can offer or/and if this affects the cost of the various market players. Although current HSPA deployments are capable of delivering high quality mobile broadband the peak capacities that can be delivered on LTE is greater. LTE is also better suited to coping with internet type traffic (better delay and jitter responses etc), and will also be a member of the IMT advanced family of technologies. The 2.6 GHz band is expected to be the only globally available LTE suitable band, although UHF (700/800 MHz) will be available the bands are not identical globally.

Factors such as different timing of technology availability for various bands and differences in carrier sizes for different bands may affect which services can be delivered (and their quality) to what prices in the future. The first phase of commercial launch of LTE will be in the 700/800 MHz band and the 2.6 GHz band. It is expected that LTE will be commercially available for other bands at later stage but only those having access to 800 MHz and/or 2.6 GHz spectrum will have the opportunity of a first mover advantage strategy in European markets including Poland. And since aggregated bandwidth of the 800 MHz band is significantly less than the 2.6 GHz band it seems like deploying the exiting 20 MHz carrier will be easier to accommodate in the 2.6 GHz band than in the 800 MHz band.

Poland has yet to confirm decisions on allocation of and market release of the 800 MHz band for mobile. This means that currently the only confirmed decision on making spectrum suitable for first phase of LTE launch available is the release and award of the 2.6 GHz band.

We do also understand that arrangements for sharing spectrum can be implemented should only two 2.6 GHz licensees be awarded. Some countries, e.g. Sweden, Norway and Denmark, have fully flexible trading regimes. This means a 2.6 GHz licensee can rent parts of his spectrum to a third party, e.g. a mobile operator with no 2.6 GHz usage rights. Despite the fully tradability we saw the existing mobile operators securing spectrum in the Swedish and Norwegian auctions and the existing mobile operators are all registered as independent bidders for the Danish auction kicking off shortly. It seems like mobile operators prefer to control the initial buying of their own spectrum portfolio despite having the opportunities offered by a full tradability regime available. Poland has not implemented a regime of fully tradable spectrum usage rights. We assume this means market players cannot engage in secondary market transactions for renting or buying spectrum

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should they not be successful in securing 2.6 GHz spectrum in the UKE award. Based on the behaviour of mobile operators in Sweden it seems like operators consider it important to control their own spectrum portfolio even if they chose to be involved in extensive network sharing agreements for UMTS/HSPA and they have publicly stated there will be operators aiming at rolling out joint LTE networks too.

## Spectrum for LTE

First phase commercial launch of LTE network equipment and receivers (dongles, handsets etc) happens in the 800 band and the 2.6 GHz band in Europe.[1] Deploying LTE in the 800 band will perfectly complement deployment of LTE in the 2.6 GHz band. Making the 800 band available in a manner which promotes LTE deployment will make cost-efficient rural coverage and cost efficient initial city area roll-out with excellent indoor coverage for mobile broadband happen and the 2.6 GHz band will constitute the perfect complement making it possible to achieve the capacity needed for handling greater traffic volume in city areas.[2]

A harmonised bandplan for the 800 MHz band has been developed by the CEPT and the EU in Europe. For the 800 MHz band this harmonised band plan should be adopted to ensure best possible opportunities for economies of scale in equipment and handset production and to facilitate international roaming in countries using the same band and bandplan. Terms and conditions when licensing the 800 band should ensure opportunities for LTE deployment.

Mounting evidence suggests most existing mobile operators will favour LTE above other technologies for the 800 band, thanks to the huge installed base of networks in the mobile ecosystem and the value of maintaining operational compatibility across succeeding generations of networks.[3] The compatibility benefits customers and supports sustainable rates of investment in new facilities.

The Polish market is served by GSM/GPRS/EDGE and UMTS/HSPA based operators which mean the natural next step in developing their networks is to deploy LTE, which will ensure backwards compatibility and integrated future growth. As a consequence, the GSMA believe that Poland should put its maximum effort into making the 800 MHz band available for mobile and implement the harmonised CEPT bandplan for the band and release it to the market as soon as possible. Only the 800 band will ensure the most cost-efficient roll-out of LTE networks which can extend the broadband coverage to rural areas and make cost-efficient indoor coverage happen in city areas. And GSMA believe Poland should license the 2.6 GHz band in a manner which recognises this bands very important role in securing sufficient LTE network capacity to handle traffic in densely populated areas in the bigger city areas. Only by ensuring this perfect combination of spectrum availability for the mobile industry can we provide the most cost-efficient wireless broadband connections at lowest possible consumer prices with excellent coverage including rural coverage and sufficient capacity where most citizens live and work.

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[1] First commercial 2.6 GHz based LTE network were TeliaSonera in Norway and Sweden in 2009: http://www.teliasonera.com/4g/

[2] Extensive information on the digital dividend is available at the GSMA website: http://www.gsmworld.com/our-work/public-policy/spectrum/digital-dividend/digital_dividend.htm

Please see recent GSMA press release about this band **"**2.6 GHz Band Vital for the Growth of LTE According to GSMA Backed Research": http://www.gsmworld.com/newsroom/press-releases/2010/4551.htm

[3] According to the Global mobile Suppliers Association (GSA) by December 2009 there are around 51 LTE network commitments in 24 countries (see http://www.gsacom.com/news/gsa_288.php4). Even major non-GSM operators, notably Verizon Wireless, have also chosen LTE for their next generation system.

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# Overview of selected 2.6 GHz awards in Europe

GSMA will share information by presenting a table with a brief overview which sums up essential issues from the 2.6 GHz awards accomplished in Norway, Sweden and Finland, the ongoing 2.6 GHz award in Germany (the auction awards spectrum in the 800 band, 1.8 GHz band and the 2.0 GHz band too) and in the planned awards of the 2.6 GHz band in Denmark and Netherland.

| | **Award Method** | **Spectrum Cap** | **Fees Charges Guarantee Deposit** | **Coverage Roll-out** | **Duration** | **Terms and Conditions** | **Trade** |
|---|---|---|---|---|---|---|---|
| **Norway** | Auction, 2007<br><br>SMRA with switching format | Yes<br><br>Max 90 MHz per bidder | Guarantee<br><br>No deposit<br><br>No annual fees<br><br>Annual charges apply | No<br><br>No use-it-or-lose-it condition apply | 14 years | Tech neutral<br><br>Service neutral | Fully tradable |
| **Sweden** | Auction, 2008<br><br>SMRA with switching format | Yes<br><br>Max 140 MHz per bidder | Guarantee<br><br>No deposit<br><br>No annual fees<br><br>Annual charges apply | No<br><br>No use-it-or-lose-it condition apply | 15 years | Tech neutral<br><br>Service neutral | Fully tradable |
| **Finland** | Auction, 2009<br><br>SMRA format | Yes<br><br>Max 50 MHz per bidder | Non-refundable participation fee | | Max 20 years | Tech neutral<br><br>Service neutral | Tradable, conditions, hire allowed |
| **Germany** | Auction 2010<br><br>Open ascending multiple round format | No<br><br>(no cap in the 2.6 band, cap applies in the 800 band sold simultan-eously) | Deposit: EUR 1.25 mio per lot rating (the same as the reserve price) | No | 15 years | Tech neutral<br><br>Service neutral | Tradable, regulators approval required |
| **Denmark** | Auction 2010<br><br>Combinatorial clock format | Yes<br><br>65 MHz and specific cap of 40 | Guarantee or deposit<br><br>Bidders must recover NITA's cost | No | 20 years | Tech neutral<br><br>Service neutral | Fully tradable |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | MHz in FDD band | of planning and implementing the auction | | | | |
| **Netherlands** | Auction, 2010<br><br>Combinatorial clock format | Yes<br><br>Individual caps depending upon existing spectrum portfolio of bidder | Guarantee or deposit<br><br>Annual fees apply | Yes | 20 years | Tech neutral<br><br>Service neutral | Tradable two years after issued |

We will provide brief comments on those topics to sum up what seems to be more or less common in the awards in those selected European countries:

- Spectrum usage rights in the 2.6 GHz band is awarded by auctions. Auction formats used are variants of well known auction designs for selling spectrum and those formats seems to basically be developed by experts in the field including use of laboratory testing etc to ensure the formats used will work and deliver according to policy objectives defined.
- All auctions accomplished and planned are formats were the auction itself is used to decide upon the number of licenses in the 2.6 GHz band. Some of the auctions are designed with a spectrum cap ensuring a minimum number of licenses but none of those auctions were designed based on a predefined number of licenses to be sold.
- All of the auctions have used or will use specific software for implementation. The auctions are basically run with remotely located bidders and using any access to the internet as the connection tool. Only the German auction is implemented in a way that requires the bidders to stay in a specific location when participating.
- Use of coverage and roll-out obligations is very limited. Netherland impose (limited) coverage and roll-out conditions in the 2.6 GHz band. In Germany they have explicitly chosen to implement coverage and roll-out requirements in the 800 band and not in the 2.6 GHz band when those two bands are sold simultaneously. Implicitly we assume this means Germany is very much aware of the fact that the 800 band is the coverage band while the 2.6 GHz band is the capacity band for the first phase of LTE roll-outs.
- Guarantee and/or deposit requirements are used solely as an instrument to ensure bidders have the financial strength required to participate and pay according to the payment rules of the auction. Requirements of (bank) guarantees are commonly interpreted as constituting an entry barrier to an auction ensuring the bidders have a certain level of financial strength and have established a business case which financial institutions have assessed as acceptable before issuing the guarantee.
- Documents are made publicly available and can be downloaded by anyone for free in all those auctions. Most documentation is made available in English too.
- Seems like the trend have been moving in the direction of abolishing annual fees. Payment of annual administrative charges to recover regulators cost is still in place.
- Denmark has implemented a solution of annual instalments for paying the auction prices. A one-off payment of the auction price seems to be a more common solution.
- Duration of licenses moving more in the direction of 20 years seems to be a trend. Shortest duration of licenses sold seems to be 14 years.
- All licenses sold claims to be based on a technology and service neutral trend and technical/operational definition of the usage rights is based on the block edge mask concept.

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- The trend towards making licenses tradable is strong. Some countries have implemented a regime of full tradability which means the licensee can sell parts of or all of its spectrum and the licensee can hire out parts of or its entire spectrum. Some countries have a more restrictive trading regime.

The annex provides more information on the 2.6 GHz auctions in Norway, Sweden, Finland, Netherlands, Germany and Denmark.

GSMA would be delighted to contribute to successful awards of spectrum in the 2.6 GHz band in Poland by sharing the extensive information we collect when working across more than 180 markets globally. Please do not hesitate to contact us should you have questions or any other enquiries.

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# Annex

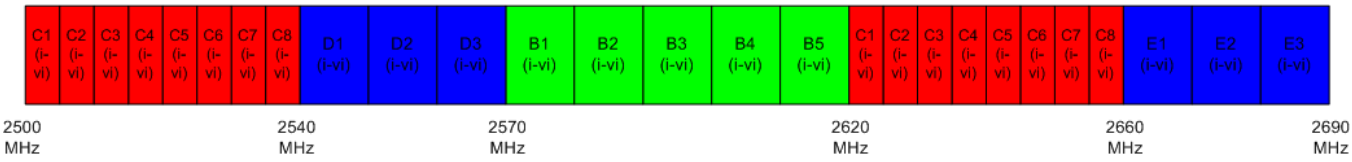
## About the Norwegian award of 2.6 GHz spectrum

The Norwegian regulator NPT awarded usage right for 2.6 GHz spectrum by auction accomplished in the autumn of 2007.[4]

### Auction format and lots plan

Auction format used was a simultaneous multiple round auction (SMRA) variant, the so-called Norwegian SMRA with switching.

The auction format was used to define licenses. This means spectrum was offered in eight lots of 2X5 MHz paired spectrum, three lots of spectrum which were flexi lots when sold (three lots of 2X10 MHz or six lots of unpaired 10 MHz) and five lots of 50 MHz unpaired spectrum. For the flexi lots (the blue ones in the figure below) it was left to bidders to decide upon FDD or TDD preferences and the technical conditions for usage of spectrum outlined in the auction rules were different depending upon FDD or TDD use.[5] In addition, it was left to bidders to decide upon aggregated bandwidth preferences when bidding for designing their own license. The lots plan for the auction[6]:




The red blocks are paired spectrum, regional licences.
The blue blocks are unparied spectrum, regional licences.
The green blocks are unpaired spectrum, regional licences.
The regions are numbered i-vi.

Please note that the lotsplan used for the purpose of selling spectrum and what we usually refer to as the bandplan are not necessarily the same. To identify what became the bandplan in Norway we have to look at the results of the bidding and what FDD-TDD preferences the winning bidders have expressed.[7]

Telenor, the in terms of market share biggest mobile operator, bought the four of the six flexi lots (D1/E1 and D2/E2 lots) and they have publicly stated that their plans for use of the spectrum is FDD based LTE. The D3 lot were bought by a couple of local bidders in the six different geographic regions and some of the E3 lot spectrum was not sold in this auction but in a later auction accomplished in February 2008.[8]

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[4] The 2.6 GHz auction website is available here:
http://www.npt.no/portal/page/portal/PG_NPT_NO_EN/PAG_NPT_EN_HOME/PAG_RESOURCE_TEXT?p_d_i=-121&p_d_c=&p_d_v=50655

[5] Info on technical/operational conditions are published here:
http://www.npt.no/ikbViewer/Content/103986/Summary%20of%20answers%20to%20public%20consultation%20and%20updated%20proposals%20on%20technical%20conditions%20-%2020070918.pdf

[6] http://www.npt.no/portal/page/web/PG_NPT_NO_NO/PAG_NPT_NO_HOME/PAG_RESSURSER_TEKST?p_d_i=-121&p_d_c=&p_d_v=50515

[7] Results of the auction are available here:
http://www.npt.no/portal/page/portal/PG_NPT_NO_NO/PAG_NPT_NO_HOME/PAG_RESSURSER_TEKST?p_d_i=-121&p_d_c=&p_d_v=104880 But some secondary trades etc have changed the situation slightly after the 2007 auction was concluded.

[8] The February 2008 auction was a sealed bid first price auction, info available here:
http://www.npt.no/portal/page/portal/PG_NPT_NO_EN/PAG_NPT_EN_HOME/PAG_RESOURCE_TEXT?p_d_i=-121&p_d_c=&p_d_v=106032

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The C lots, the paired spectrum, were bought by the two, in terms of market share, biggest mobile operators Telenor[9] and NetCom[10]. The third infrastructure based operator in the Norwegian market did not register as bidder and did not participate in the 2007 Norwegian 2.6 GHz auction. The B lots, the unpaired spectrum, were bought by Craig Wireless Systems Ltd. There have been some secondary market activities after the auction concluded but that strengthened the message on buyers preferring paired spectrum in the 2500-2570/2620-2690 MHz bands.

This leaves us with the following status as of today:

- NetCom controls 2X20 MHz which was sold as paired and launched LTE network in Norway in 2009.
- Telenor controls 2X20 MHz which was sold as paired plus 2X20 MHz which was sold as FDD/TDD flexible but Telenor have chosen FDD and consequently the technical conditions for FDD operation is to be applied. Telenor have not launched services but the Telenor Group is among the many mobile operators committed to LTE deployment.
- The 50 MHz of TDD spectrum is not used. The locally based bidders winning the D3/E3 lots have limited, if any, use of spectrum.

The lotsplan implemented for selling the spectrum deviated from what has become known as the CEPT bandplan; not in terms of the centre TDD block but in terms of implementing the FDD/TDD flexible lots in the 2540-2570/2660-2690 MHz bands whereas the CEPT bandplan have paired spectrum in the 2500-2570/2620-2690 MHz bands. The technical/operational conditions imposed by the NPT in Norway were different depending upon use of FDD or TDD was chosen by winning bidder. Deviating from internationally harmonised bandplans will potentially work, but adds cost, when looking at handling interference on the base station side. For handling interference for the handset part of operating a network deviating from internationally harmonised bandplans producing handsets based on a market specific specification means increasing cost tremendously and it will basically not happen for a small market.[11] The global handset makers producing specific handsets for the Norwegian market will not happen (Norwegian population is about 4.5 millions). And the auction results and what has happened after the auction concluded shows us that the main use of the band will be LTE and in accordance with the CEPT bandplan to ensure Norway benefitting from the economies of scale stemming from international harmonisation of use of frequencies.

The implementation of the FDD/TDD flexible lots (and dividing Norway into six geographic regions when selling the spectrum) complicated the auction design. We have not seen any cost benefit analysis which can explain the reasoning behind such complications of the auction design. What we have seen is reasoning based on what have been expressed in public consultations regarding demand and we're aware of NPT struggling with the unfinished international work on harmonised bandplan when they were designing and implementing the 2.6 GHz auction (as the first European regulator and as a result of the soft-law rule of applicants, not government/regulator initiating the award). But on behalf of the mobile industry we will question whether the cost of the more complicated auction design and uncertainty added was worth it for the Norwegian society. Below we will see that other European governments/regulators selling the 2.6 GHz spectrum have based their lotplans on the internationally harmonised bandplan regarding the FDD and TDD split.

**Spectrum cap**

Each bidder was allowed to bid for maximum 90 MHz of spectrum.[12]

[9] 2.6 GHz spectrum was bought by Telenor Group, formally Telenor ASA, but it is used by one of their fully owned Norwegian Telenor companies.
[10] NetCom AS is the Norwegian TeliaSonera owned operator.
[11] For more information on the importance of economies of scale in handset production please go to this document: http://www.gsmworld.com/documents/gsma_white_tech_note.pdf
[12] Item 4.3 of the auction rules: http://www.npt.no/portal/page/web/PG_NPT_NO_NO/PAG_NPT_NO_HOME/PAG_RESSURSER_TEKST?p_d_i=-121&p_d_c=&p_d_v=50515

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**Auction implementation**
The Norwegian auction was run online with bidders bidding from wherever they wanted to be located using ordinary internet access and specific passwords provided by NPT to log in. The auction was implemented by using specialised and encrypted software.

**Guarantee, deposit etc**
A guarantee issued by a financial institution was required and the amount of the guarantee was dependent on the amount of spectrum the bidder wanted to be qualified to bid for.[13]

No requirement of deposit. No annual fees imposed. Annual administrative charges are to be paid to the NPT.[14]

**Coverage and roll-out obligations**
NPT did not impose any coverage and/or roll-out obligations. And licenses issued does not contain any use-it-or-lose-it conditions meaning licensees are given full discretion on whether to use the spectrum or not and on timing for start using their spectrum etc.

**Terms and conditions, duration**
The licences are technology and service neutral and cover terrestrial services on Norwegian territory with the exception of Svalbard, Jan Mayen Island and Norwegian dependencies.

The licences are tradable, including sale, lease etc. Transfer of a licence must, however, be approved by and registered with the NPT.

Duration of the licences is 1 January 2008 until 31 December 2022.

[13] Details of the guarantee requirements and the template to be used etc are outlined in item 3.1 of the auction rules available here: http://www.npt.no/portal/page/web/PG_NPT_NO_NO/PAG_NPT_NO_HOME/PAG_RESSURSER_TEKST?p_d_i=-121&p_d_c=&p_d_v=50515

[14] Item 4.4 of the auction rules: http://www.npt.no/portal/page/web/PG_NPT_NO_NO/PAG_NPT_NO_HOME/PAG_RESSURSER_TEKST?p_d_i=-121&p_d_c=&p_d_v=50515 About administrative charges (Norway's level of charges are modest): http://www.npt.no/portal/page/portal/PG_NPT_NO_EN/PAG_NPT_EN_HOME/PAG_MAIN_TEXT?p_d_i=-121&p_d_c=&p_d_v=47782

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# About the Swedish award of 2.6 GHz spectrum

The Swedish regulator PTS awarded usage right for 2.6 GHz spectrum by auction accomplished in the spring of 2008.

**Auction format and lots plan**

Auction format used was a simultaneous multiple round auction (SMRA) variant, the so-called Norwegian SMRA with switching. The auction format was used to define licenses. This means spectrum was offered in lots of 2X5 MHz paired spectrum and one lot of 50 MHz unpaired spectrum and it was left to bidders to decide upon aggregated bandwidth preferences. The lots plan for the auction[15]:

| Frequency block | Terminal and repeater: uplink transmission (MHz) | Base station and repeater: downlink transmission (MHz) | Points |
|---|---|---|---|
| FDD1 | 2500–2505 | 2620–2625 | 1 |
| FDD2 | 2505–2510 | 2625–2630 | 1 |
| FDD3 | 2510–2515 | 2630–2635 | 1 |
| FDD4 | 2515–2520 | 2635–2640 | 1 |
| FDD5 | 2520–2525 | 2640–2645 | 1 |
| FDD6 | 2525–2530 | 2645–2650 | 1 |
| FDD7 | 2530–2535 | 2650–2655 | 1 |
| FDD8 | 2535–2540 | 2655–2660 | 1 |
| FDD9 | 2540–2545 | 2660–2665 | 1 |
| FDD10 | 2545–2550 | 2665–2670 | 1 |
| FDD11 | 2550–2555 | 2670–2675 | 1 |
| FDD12 | 2555–2560 | 2675–2680 | 1 |
| FDD13 | 2560–2565 | 2680–2685 | 1 |
| FDD14 | 2565–2570 | 2685–2690 | 1 |

| Frequency block | Terminal, base station, and repeater: uplink and downlink transmission (MHz) | Points |
|---|---|---|
| TDD1 | 2570–2620 | 5 |

When the auction concluded three bidders had successfully secured four contiguous FDD lots each constituting a 2X20 MHz spectrum license, one bidder had successfully secured two contiguous FDD lots constituting a 2X10 MHz spectrum license and one bidder had successfully secured the TDD lot constituting a 50 MHz spectrum license.

The lotsplan for the auction was based on the ITU option one bandplan, or in Europe better known as the CEPT bandplan regarding the FDD-TDD split of the band. But PTS have implemented a solution for licensees

[15] Source: section 6 of the auction regulation published here: http://www.pts.se/upload/Foreskrifter/Radio/2007-11-regulation-2500-2690-20071219.pdf

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applying for change of duplex directions although not an attractive solution due to the technical restrictions that must be imposed to handling the interference issues, cf. page 8 of the invitation to participate in the auction.[16]

**Spectrum cap**
The spectrum cap implemented by PTS was 140 MHz which means each bidder was allowed to bid for maximum 140 MHz of spectrum.[17]

**Auction implementation**
The Swedish auction was run online with bidders bidding from wherever they wanted to be located using ordinary internet access and specific passwords provided by PTS to log in. The auction was implemented by using specialised and encrypted software.

**Guarantee, deposit etc**
To ensure payment of auction fees and administrative charges PTS required all bidders to provide a bank guarantee.[18]

**Coverage and roll-out obligations**
PTS did not impose any coverage and/or roll-out obligations. And licenses issued does not contain any use-it-or-lose-it conditions meaning licensees are given full discretion on whether to use the spectrum or not and on timing for start using their spectrum etc.

**Terms and conditions, duration**
Licenses is service neutral and, with certain restrictions, technology neutral. Duration of licenses sold is 15 years.[19] Licenses are fully tradable.

[16] http://www.pts.se/upload/Ovrigt/Radio/2500_2690_Open_invitation_080117.pdf
[17] Section 5 of the auction regulation published here: http://www.pts.se/upload/Foreskrifter/Radio/2007-11-regulation-2500-2690-20071219.pdf
[18] Section 13 of the auction regulation published here: http://www.pts.se/upload/Foreskrifter/Radio/2007-11-regulation-2500-2690-20071219.pdf
[19] Page 6 of the invitation to participate in the auction published here: http://www.pts.se/upload/Ovrigt/Radio/2500_2690_Open_invitation_080117.pdf

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# About the Finnish award of 2.6 GHz spectrum

The Finnish regulator Ficora awarded usage right for 2.6 GHz spectrum by auction accomplished in the autumn of 2009.

### Auction format and lots plan

Auction format used was a simultaneous multiple round auction (SMRA) variant. The auction format was used to define licenses. This means spectrum was offered in lots of 2X5 MHz paired spectrum and one lot of 50 MHz unpaired spectrum and it was left to bidders to decide upon aggregated bandwidth preferences. The lots plan for the auction constituted of 14 lots of paired spectrum (2X5 MHz) in the 2500-2570/2620-2690 MHz bands and one lot of unpaired spectrum (2570-2620 MHz). The Finnish and the Swedish lotsplans were identical.

The lots plan for the auction[20]:

| Spectrum block | Lower band (MHz) | Upper band (MHz) |
|---|---|---|
| FDD1* | 2500-2505 | 2620-2625 |
| FDD2* | 2505-2510 | 2625-2630 |
| FDD3 | 2510-2515 | 2630-2635 |
| FDD4 | 2515-2520 | 2635-2640 |
| FDD5* | 2520-2525 | 2640-2645 |
| FDD6* | 2525-2530 | 2645-2650 |
| FDD7 | 2530-2535 | 2650-2655 |
| FDD8 | 2535-2540 | 2655-2660 |
| FDD9* | 2540-2545 | 2660-2665 |
| FDD10* | 2545-2550 | 2665-2670 |
| FDD11 | 2550-2555 | 2670-2675 |
| FDD12 | 2555-2560 | 2675-2680 |
| FDD13* | 2560-2565 | 2680-2685 |
| FDD14* | 2565-2570 | 2685-2690 |
| TDD* | 2570-2620 | |

### Spectrum cap

Each bidder was allowed to buy maximum 50 MHz bandwidth.[21]

[20] Annex 2 of the auction regulation: http://www.ficora.fi/attachments/englantiav/5jXIhRv0T/M60english.pdf
[21] Section 4 of the Auction Act.

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**Auction implementation**
The Finnish auction was run online with bidders bidding from wherever they wanted to be located using ordinary internet access and specific passwords provided by Ficora to log in. The auction was implemented by using specialised software.[22]

Collusion between bidders participating in a spectrum auction is regulated by the Finnish Act on Auctioning off Certain Frequencies and collusion between bidders in the auction is basically prohibited.[23]

The level of transparency at different stages of the auction was regulated by the Auction Act.[24]

**Guarantee, deposit etc**
A EUR 50 000 fee for participation was implemented. The participation fee was nun-refundable.[25]

**Coverage and roll-out obligations**
No confirmed information available.

**Terms and conditions, duration**
Licenses were issued on a technology and service neutral approach.

The technical/operational conditions imposed are based on the internationally harmonised conditions developed within the CEPT framework (CEPT report 19).[26] But certain usage restrictions imposed to protect existing use of the frequencies in certain geographical areas.[27]

Licenses are tradable according to certain rules and tradability include hiring of usage rights.[28]

Duration of maximum 20 years.[29]

A combination of one-off payment at end of auction and yearly instalments were implemented.[30]

[22] Section 5 of the auction regulation: http://www.ficora.fi/attachments/englantiav/5jXIhRv0T/M60english.pdf
Page 4 of the auction rules: http://www.ficora.fi/attachments/englantiav/5jXIir75t/MPS60english.pdf
Use of software for electronic bidding was mandatory and regulated by section 9 of the Auction Act.
[23] Section 8 of the Auction Act: http://www.finlex.fi/sv/laki/alkup/2009/20090462 (Swedish only - sorry about that).
[24] Section 11 of the Auction Act.
[25] Section 6 of the Auction Act.
[26] The FDD license conditions are published here: http://www.ficora.fi/attachments/englantiav/5jXIkYXFp/FDDmalliehdotenglish.pdf
The TDD license conditions are published here: http://www.ficora.fi/attachments/englantiav/5jXIm2mYb/TDDmalliehdotenglish.pdf
[27] Page 4-5 of the auction rules: http://www.ficora.fi/attachments/englantiav/5jXIir75t/MPS60english.pdf
[28] Section 16 and section 18 of the Auction Act: http://www.finlex.fi/sv/laki/alkup/2009/20090462 (Swedish only - sorry).
[29] Section 4 of the Auction Act.
[30] Section 14 of the Auction Act.

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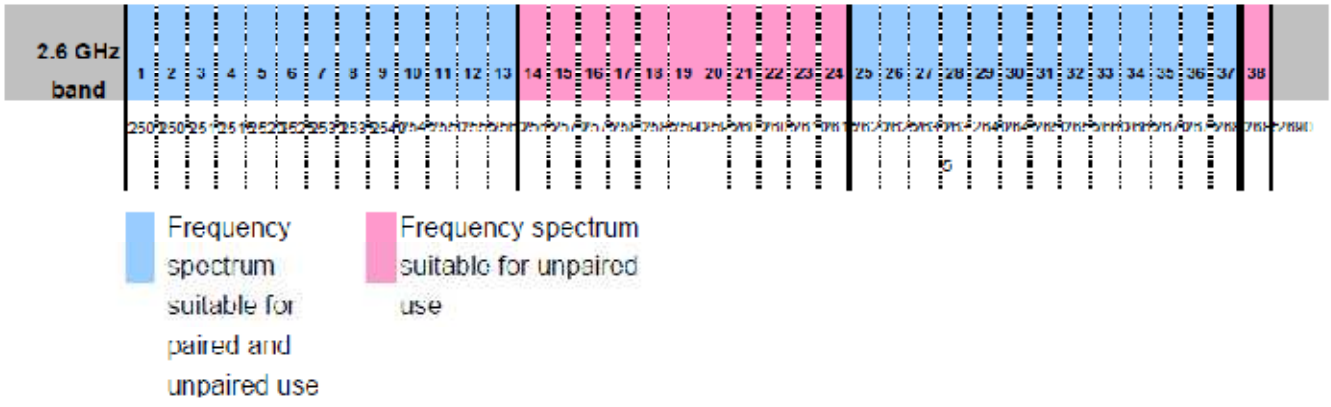
# About the Dutch award of 2.6 GHz spectrum

Agentschap Telecom (Radiocommunications Agency Netherlands), the dutch regulator, have just finalized the award of usage rights to the 2.6 GHz band by auction.

### Auction format and lots plan

The auction format used was a combinatorial clock auction, a multiple round ascending-bid auction. Principle stage of the auction was used for determining bandwidth per bidder. Assignment stage of the auction was used for placing winning bidders spectrally (with rules implemented to ensure contiguous spectrum for each bidder).[31]

The lotsplan used for selling the 2.6 GHz spectrum[32]:




The ratio between paired and unpaired spectrum was determined during the auction. The following two conditions did have to be fulfilled for the market parties to determine this ratio themselves: (1) the duplex distance of 120 MHz was guaranteed and, (2) if licences was awarded for paired frequency spectrum, the use of the 2615-2620 MHz frequency band would be limited in order to prevent interference between unpaired and paired frequency spectrum in the upper band.[33] A maximum of 39 licences could be issued for unpaired use. Within the available 190 MHz a maximum of 13 licences could be issued for paired frequency space. For paired frequency space it had to be lots of two times 5 MHz.[34]

This means that the lotsplan adopted for the purpose of selling the 2.6 GHz spectrum in the Netherlands did leave it to bidders to decide upon the bandplan (similar approach as the Norwegian auction accomplished back in 2007 when international harmonisation work had still not established the strong harmonisation trend as we see in 2010). And bidders did decide: no unpaired spectrum was sold. Five bidders bought paired spectrum.

A mechanism to ensure each bidder having contiguous spectrum was built into the auction rules.[35] And when the Dutch auction concluded two bidders had bought 2X20 MHz, two bidders had bought 2X10 MHz and one bidder had bought 2X5 MHz. The two 2X20 MHz licenses were bought by new entry bidders while the three other successful bidders where incumbent mobile operators securing the maximum bandwidth possible

[31] http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf See page 44.
[32] Page 33: http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf
[33] Page 40: http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf
[34] http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Pages/Licences.aspx
[35] Page 40-41: http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf

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according to the spectrum cap implemented. With the very modest prices (two licenses sold at reservation prices) it seems like fair to conclude this auction was not designed to maximize government's revenue but to achieve other policy objectives of the government. It seems like attracting new entry was an policy objective and the auction did attract new entry bidders but none of them did bid successfully for unpaired spectrum.

**Spectrum cap**
A spectrum cap of 40 MHz was imposed (but can be lifted after two years). The spectrum cap rule implemented was individual. When applying the rule of spectrum caps spectrum holdings in what was considered comparable bands were considered relevant. This meat current licensees in mobile bands (KPN/Telfort, T-Mobile and Vodafone) did face more restrictions on bandwidth they could bid for in the 2.6 GHz band than bidders not holding licenses in what was considered comparable frequency bands (other IMT bands, 900 band, 1800 band and 2100 band).[36]

**Auction implementation**
The Dutch auction was implemented as an online auction with bidders bidding from wherever they wanted to be located. Standard internet access and specific passwords provided by the auctioneer was used to log in. The auction was implemented using specialised and encrypted software.[37]

Specific rules on confidentiality and collusion were imposed by the auction rules.[38]

**Guarantee, deposit etc**
Bidders had to provide a bank guarantee *or* deposit money with Ministerie van Economische Zaken.[39] Amount of guarantee/deposit did depend upon the bandwidth the bidder wanted to be qualified to bid for (taking the restrictions from the cap implemented into consideration). Guarantees/deposits to be returned/refunded according to the rules set out in the Auction Regulation.[40]

Licensees are subject to annual fees.[41]

**Coverage and roll-out obligations**
Within two years the licence holder is obliged to offer a public electronic communication service within an area of 20 square kilometres, and within five years in an area of at least 200 square kilometres.[42] Obligations to use the spectrum have been implemented; (1) the licences stipulate that a licensee must start providing a public electronic communications service within two years after the award of the licence and, (2) the licences provide that the licensee must start providing a public electronic communications service within those two years in an area measuring at least 20 square kilometres, using in any case the awarded frequency spectrum in the 2.6 GHz band (for each 5 MHz licence) and, (3) the licensee is obliged to use at least 1600 square kilometres within five years to provide a public electronic communications service.[43]

[36] Page 33-38: http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf
[37] Page 44: http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf
[38] Section 11 of the Auction Regulation: http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf
[39] Section 10 of the Auction Regulation: http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf
[40] Section 39 of the Auction Regulation: http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf
Page 41: http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf
[41] http://www.agentschap-telecom.nl/ENGLISH/COMPANIES/AUCTION2.6GHZ/Pages/Fees.aspx
[42] http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Pages/Licences.aspx
[43] Page 69: http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf

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**Terms and conditions, duration**

Usage rights will be issued based on a technology and service neutral approach[44] and the regulator refer to the EU Decision (2008/477/EG) for the 2500 – 2690 MHz frequency band when stating so.

Technically/operationally the license is defined by a block edge mask.[45]

Duration of licenses is 20 years.[46]

[44] http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Pages/Licences.aspx
[45] http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Pages/Licences.aspx
[46] http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Pages/Licences.aspx
Page 41-42: http://www.agentschap-telecom.nl/english/companies/auction2.6GHz/Documents/Regulation%202,6%20GHz%2007-01-2010.pdf

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# About the German award of 2.6 GHz spectrum

The German Federal Network Agency, Bundesnetzagentur[47], the German regulator, kicked off the German spectrum auction selling usage rights for spectrum in the 800 band, the 1.8 GHz band, 2 GHz band and the 2.6 GHz band 12 April 2010. Altogether 360 MHz of bandwidth are offered in this auction. The Federal Network Agency (FNA) received six applications to participate in the auction[48], but ended up with four qualified bidders which are T-Mobile (Deutsche Telekom), Vodafone PLC, Royal KPN NV's E-Plus and Telefonica SA's O2[49].

**Auction format and lots plan**

Auction format implemented is a open ascending multiple round auction selling 41 lots and spectrum are offered partly as abstract lots (meaning usage rights within a particular band but not spectrally placed) and partly as concrete lots (meaning spectrally placed usage rights).

What is up for sale:

- 800 band: six lots of 2X5 MHz, five abstract lots, one spectrally placed
- 1.8 GHz band: five lots of 2X5 MHz, three abstract lots, two spectrally placed
- 2.0 GHz band: four spectrally placed lots of 2X5 MHz, one spectrally placed lot of 5 MHz and one spectrally placed lot of 14.2 MHz
- 2.6 GHz band: fourteen abstract lots of 2X5 MHz and ten abstract lots of 5 MHz.

Abstract lots sold will be spectrally placed using an allotment procedure following the auction. The allotment procedure aims at securing contiguous spectrum for each bidder buying more than one lot in a band.[50]

The lots plan for auctioning off the 2.6 GHz band is based on the ITU option one bandplan, or in Europe better known as the CEPT bandplan regarding the FDD-TDD split of the band.

**Spectrum cap**

A spectrum cap is implemented for the 800 band. The cap implemented varies for different bidders depending upon their current holdings in the 900 band. Bidders currently being defined as Dnetwork operators may bid for maximum two lots (2X10 MHz) and bidders currently being defined as Enetwork operators may bid for maximum three lots (2X15 MHz).[51]

**Auction implementation**

The auction takes place in Mainz where bidders have to be physically present. A local independent computer network appointed by the auctioneer must be used by all bidders. Specific software will be used. Bidders are located in separate rooms and bids are submitted without bidders discussing and/or disclosing information to each other.

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[47] http://www.bundesnetzagentur.de/cln_1912/DE/Home/home_node.html

[48] http://www2.bundesnetzagentur.de/frequenzversteigerung2010/images/pressemitteilungen/100121%20Press%20Bewerbung%20Mobilfunkfrequenzen%20[E].pdf

[49] http://www2.bundesnetzagentur.de/frequenzversteigerung2010/images/pressemitteilungen/100305%20Press%20Frequenzauktion%20212%20[E].pdf

[50] http://www2.bundesnetzagentur.de/frequenzversteigerung2010/images/pressemitteilungen/Sprechzettel%20Pressebriefing%2008.04.2010%20[E].pdf

[51] http://www2.bundesnetzagentur.de/frequenzversteigerung2010/images/pressemitteilungen/Sprechzettel%20Pressebriefing%2008.04.2010%20[E].pdf

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**Guarantee, deposit, reservation prices etc**
To participate in the auction the bidder must leave a deposit of EUR 1.25 million per lot rating (deposit for a lot is same as reserve price for a lot).

**Coverage and roll-out obligations**
For the 800 MHz band coverage and roll-out obligations is imposed. Licensees must achieve coverage of at least 90% of the population and this must be rolled-out no later than 1 January 2016.[52]

For the other bands sold in this auction no coverage and roll-out requirements are imposed.

**Terms and conditions, duration**
Spectrum is awarded based on a technology and service neutral approach.

Spectrum can be traded according to the regulatory framework on trading implemented and subject to the regulator's approval.

52
http://www2.bundesnetzagentur.de/frequenzversteigerung2010/images/pressemitteilungen/Sprechzettel%20Pressebriefing%2008.04.2010%20[E].pdf

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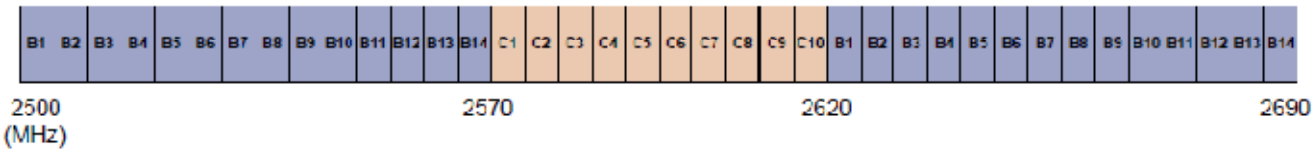
# About the Danish award of 2.6 GHz spectrum

The Danish regulator NITA will auction off the 2.6 GHz spectrum in the period between mid April to mid May 2010.[53]

### Auction format and lots plan

The auction format that will be used is a combinatorial clock auction, a multiple round ascending-bid auction. Principle stage of the auction is used for determining bandwidth per bidder. Assignment stage of the auction is used for placing winning bidders spectrally (with rules implemented to ensure contiguous spectrum for each bidder).[54]

The lots plan for the auction[55]:




The lotsplan for the auction is based on the ITU option one bandplan, or in Europe better known as the CEPT bandplan regarding the FDD-TDD split of the band. The auction rules states that: *"The spectrum available in the Auction is the 190MHz between 2500MHz and 2690MHz. The 2.5GHz Band will be awarded nationwide in accordance with the band plan proposed by CEPT in the ECC Decision (05) 05."*[56]

### Spectrum cap

A spectrum cap is implemented. It is expressed using eligibility points not in terms of maximum bandwidth that each bidder can buy. The practical interpretation is that a bidder can buy 65 MHz of spectrum measured in unpaired terms but the cap is implemented so that no bidder can buy more than 2X20 MHz of paired bandwidth.[57]

### Auction implementation

The Danish auction will be implemented as an online auction with bidders bidding from wherever they want to be located using ordinary internet access and specific passwords provided by NITA to log in. The auction will be implemented using specialised and encrypted software.[58]

### Guarantee, deposit etc

Bidders are required to submit a deposit in the form of a cash deposit *or* a bank guarantee. The amount of the initial deposit determines the bidder's initial eligibility in the bidding phase. Consequently, the amount of guarantee/deposit depends upon the bandwidth the bidder wants to be qualified to bid for.[59]

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[53] http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/expected-time-table

[54] A flow chart describing the auction is provided, page 3 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf

[55] Page 2 of the auction rules published here: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf

[56] Page 7 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf

[57] Page 49 and page 54 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf

[58] Page 52-53 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf
More info on software is available here: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/software-and-guide-for-determining-the-winner

[59] Page 49-51 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf

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Successful bidders must pay recovery cost for organising and implementing the auction. This is described in the auction rules and an estimate of aggregated cost will be around DKK 15 000 000 is published.[60]

Annual frequency charges apply. Information provided in the auction rules.[61]

**Coverage and roll-out obligations**
No coverage obligations apply.[62]

**Terms and conditions, duration**
Licenses are technology and service neutral.[63] Technical/operational conditions are based on a block edge mask based on the CEPT report 19.[64]

Duration of licenses is 20 years.[65]

Geographic scope of licenses are national covering land territory plus inner and outer territorial water.[66]

Site sharing and network sharing is regulated in Denmark. The auction rules provide information on this.[67]

Licences to use frequencies may be transferred or returned, wholly or partly, divided up either in frequency portions or geographically.[68]

[60] Page 81 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf
[61] Page 26 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf
[62] Page 23 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf
[63] Page 23 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf
[64] Page 14-20 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf
[65] Page 22 of auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf
[66] Page 22-23 of auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf
[67] Page 23-24 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf
[68] Page 24-25 of the auction rules: http://en.itst.dk/spectrum-equipment/Auctions-and-calls-for-tenders/2-5-ghz/information-memorandum/Final%202%205GHz%20IM%20v1-5%20%28updated%29.pdf