2025-05-28

Appendix 2 to the decision to issue open invitation to apply for licences to use radio transmitters in parts of the 1800 MHz band, Ref. no. 24-487

Open Invitation Part 2 to apply for licences to use radio transmitters in parts of the 1800 MHz band

Final date to confirm application:	18 June 2025
Planned auction start:	18 November 2025

PTS

This document is a non-binding translation to English of the Swedish Open Invitation Part 2 and its appendices published 28 May 2025.

Open Invitation Part 2 to apply for licences to use radio transmitters in parts of the 1800 MHz band

Reference number
24-487

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Table of Contents

1. Introduction

1.1 Open invitation in two parts

On 5 June 2024, the Swedish Post and Telecom Authority (PTS) decided to limit the number of licences and to issue Open Invitation Part 1 to apply for licences to use radio transmitters in the frequency ranges:

- 1710–1720/1755–1780 MHz and 1805–1815/1850–1875 MHz (parts of the 1800 MHz band)

The decision to issue an open invitation to apply states that the invitation is issued in two parts: Open Invitation Part 1 (OI Part 1) and Open Invitation Part 2 (OI Part 2).

OI Part 1 (published[1]): includes information regarding the process and application, the protection of the national security of Sweden when using radio transmitters and PTS's consultation of applications with the Swedish Security Service and the Swedish Armed Forces.

OI Part 2 (this document): includes rules for the auction procedure, the conditions to which licences to use radio transmitters will be subject as well as conditions regarding the payment of auction proceeds and processing fees following the auction.

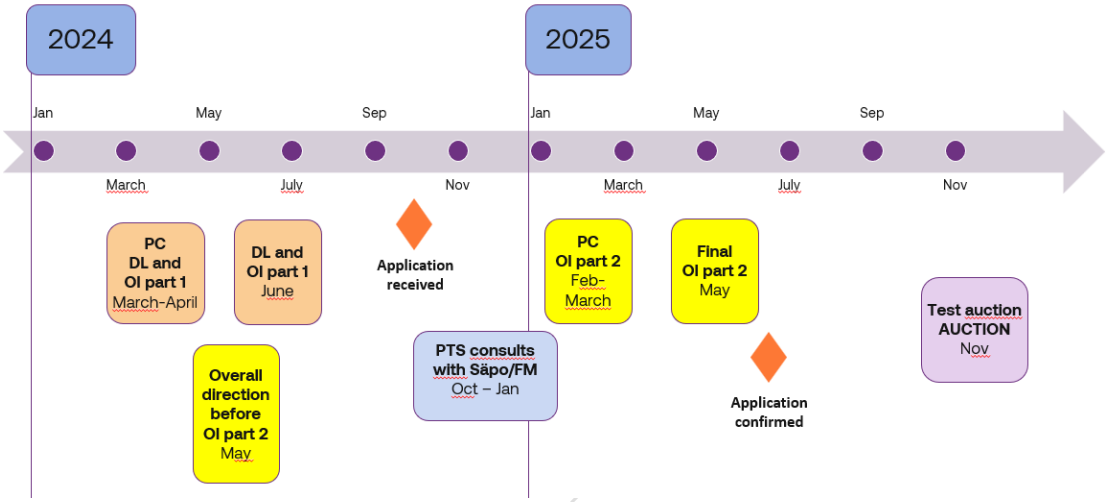
The licensing process shall take place in a tendering procedure where the price that the applicant is willing to pay for the licence shall be the deciding factor (auction), in accordance with the rules set out in OI Part 1 and OI Part 2.

[1] Open Invitation Part 1 to apply for licences to use radio transmitters in parts of the 1800 MHz band (ref. no. 24-487 file appendix 36).

1.2 Process leading to auction

The illustration below (Figure 1) clarifies the process and the preliminary timetable leading to the auction.

Figure 1 Preliminary process and timetable leading to the auction



Please note the following set times:

18 June 2025	Applicants confirm their applications
11 Nov 2025	Test auction
18 Nov 2025	Auction start

The process for confirmation of application is described in Section 2.

PTS estimates the auction to last up to five working days but applicants should be prepared for it to take longer.

PTS intends to hold trial auctions and recommends all applicants that have been approved to participate. All approved applicants will receive an invitation.

PTS does not intend to publicly disclose approved bidders before the auction has ended, as such information is likely to affect the outcome or otherwise defeat the purpose of the auction procedure itself.

2. Conditions for confirmation of application and participation in the auction

2.1 Confirmation of application

Applicants (i.e., those who have submitted an application for licence to use radio transmitters in parts of the 1800 MHz band in accordance with OI Part 1) whose radio usage is not assumed to cause harm to the national security of Sweden will, after the final version of the OI Part 2 has been published, have to confirm their participation.

Confirmation shall be submitted in a sealed envelope labelled
”Bekräftelse av ansökan 1800 MHz-auktionen”.
The confirmation can be handed in at the reception desk at PTS, Hälsingegatan 38, 113 43 Stockholm, Monday to Friday, 8 a.m. to 5 p.m., or sent by post to the following address:
Post- och telestyrelsen
Box 6101
102 32 Stockholm

Other requirements for the confirmation are found in the Sections 2.2 and 2.3.

Only applicants who confirm their application will be finally approved as bidders in the auction. Applications not confirmed by the deadline may be rejected. Once the confirmation has been received, PTS will evaluate whether it is complete (in accordance with the requirements set out in Section 2). PTS tentatively intends to notify qualified bidders during the month of June.

2.2 Conditions for confirmation and participation in the auction

2.2.1 Conditions for confirmation of application

- Confirmation shall be made using the form provided by PTS (see Appendix B) and shall be submitted in original.
- Confirmation must be received by PTS no later than 18 June 2025
- The confirmation may not contain false information
- The confirmation must be signed by an authorised signatory or holder of power attorney (see Sections 2.3.1 and 2.3.2).

2.2.2 Rules for participation in the auction

- Bids placed in the auction must originate from the bidder
- At the time of the auction, the bidder must be in compliance with the applicable provisions of OI Part 1 and OI Part 2
- Two or more bidders may not coordinate their bidding or in any other way collaborate during the auction procedure
    - Collaboration between bidders during the auctions could affect the outcome. Bidders are therefore prohibited from coordinating their bidding or collaborating in some other way during the auction procedure. An agreement on collaboration that is entered into before the auction procedure is initiated is also covered by this prohibition. Discussion between bidders about the auction could also be interpreted as collaboration. If PTS becomes aware that two or more bidders are collaborating, PTS may exclude them from the auction.
- Approved applicants may refrain from bidding in the auction

2.3 Appendices to the application confirmation

2.3.1 Extract from the registry of the Swedish Companies Registration Office

If any information about the applicant, such as the authorised signatory, has changed compared to what was provided at the time of application (application pursuant to OI Part 1), a new extract from the registry of the Swedish Companies Registration Office (or equivalent for foreign applicants) certifying the new information must be attached to the application confirmation. Rules for the extract are set out below.

If the registry extract or equivalent is not in Swedish or English, a Swedish or English translation shall be attached to the application confirmation. If it is not clearly apparent from the extract that the person who has signed the confirmation (or power of attorney pursuant to Section 2.3.2) is an authorised signatory for the applicant, the authorisation of the signatory must be certified by other means, with references to relevant legislation.

2.3.2 Original power of attorney

If the person who has signed the confirmation is not an authorised signatory, an original power of attorney shall be submitted with the confirmation form. The power of attorney shall be signed by an authorised signatory for the applicant.

3. Licence to use radio transmitters

3.1 General information on licences and licence conditions

The award refers to national licences to use radio transmitters, for terrestrial systems capable of providing electronic communications services, in the following frequency ranges:

- 1710–1720/1805–1815 MHz and 1755–1780/1850–1875 MHz (parts of the 1800 MHz band)

The licences and licence conditions are described briefly below. Detailed licence conditions are set out in Appendix A (Licence conditions for the 1800 MHz band).

Following the auction, each licence will be subject to conditions pursuant to the decision on licences to use radio transmitters. Minor adjustments to licence conditions may occur in connection with the final decision on licences.

Decision regarding the licences and the associated conditions will be made close to the conclusion of the auction.

3.2 Licence duration

Licences and licence conditions are valid from 1 January 2028 through 31 December 2054, with the exception of the conditions regarding placement.

3.2.1 Special conditions regarding placement

Licence conditions regarding placement are valid from 1 January 2028 through 31 December 2037. PTS will make a new assessment on conditions regarding placement before the expiration of these conditions.

The current division of the 1800 MHz band could result in licence holders not being able to obtain contiguous spectrum in coming awards. One measure to enable contiguous spectrum in the long term is to determine that conditions regarding placement are valid for a duration of 10 years. PTS will then decide on new conditions regarding placement. If a rearrangement is necessary to achieve contiguous spectrum in connection with the award of the frequency range containing licences that expire 2037, PTS's orientation is to take the least intrusive measure to achieve the purpose of the rearrangement.

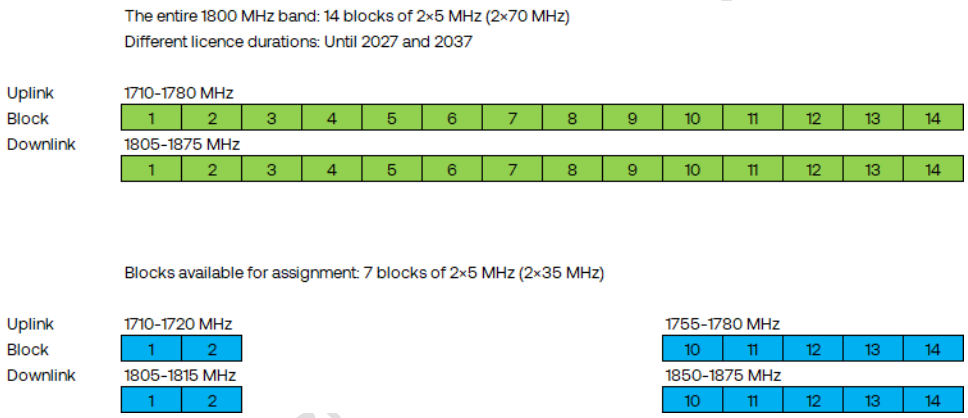
3.3 Licences and conditions in the 1800 MHz band

3.3.1 Number of licences to award

PTS has decided to limit the number of licences to use radio transmitters in parts of the 1800 MHz band (1710–1720 MHz/1805–1815 MHz and 1755–1780 MHz/1850–1875 MHz) to a maximum of seven licences.[2]

A licence can consist of several frequency blocks. The division of the available frequency range into frequency blocks comprises seven blocks of 2×5 MHz (FDD[3]) according to Figure 2.

Figure 2 The figure shows the block division in the 1800 MHz band.



3.3.2 Technical conditions

To enable coexistence between licence holders in the 1800 MHz band and to protect usages in adjacent frequency bands technical conditions are set out. All technical conditions for the 1800 MHz band are set out in Appendix A.

3.3.2.1 Regulation and use

The licences in the 1800 MHz band are subject to conditions in accordance with Commission Implementing Decision (EU) 2022/173[4], and in addition with as few limiting conditions as possible to enable efficient use of the frequency range over time, with flexibility for technological development.

[2] Decision to limit the amount of licences in parts of the 1800 band (ref. no. 24-487 file appendix 34).
[3] FDD – Frequency Division Duplex.
[4] Commission Implementing Decision (EU) 2022/173 of 7 February 2022 on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing electronic communications services in the Union and repealing Decision 2009/766/EC.

3.3.2.2 Radiated power of base stations within their own frequency block

PTS does not impose a limit on the maximum power of base station transmitters within their own assigned block.

3.3.2.3 Radiated power of terminals within their own frequency block

The limit for the maximum average power of terminals, in accordance with EU Implementing Decision 2022/173 (see Section 3.3.2.1), is regulated by the Post and Telecom Authority's regulations on exemptions from licence requirement for the use of certain radio transmitters (the exemption regulations). The licences therefore do not include any specific conditions to this effect.

3.3.3 Conditions for the protection of other use

3.3.3.1 Meteorological-Satellite, wireless transfer and DECT

The conditions for the protection of services in adjacent bands resulting from Commission Implementing Decision (EU) 2022/173 are considered sufficient for the protection of meteorological-satellite below 1710 MHz, for wireless transfer in the duplex-gap and for the protection of DECT above 1880 MHz.

3.3.3.2 Future system for railway communication

CEPT Report 74 addresses coexistence between electronic communications services (ECS) and future railway mobile communication system (FRMCS). The report concludes that both cab radio receivers and base station receivers for FRMCS in the frequency band 1900–1910 MHz shall be robust against transmissions in adjacent frequency bands, including from ECS base stations below 1880 MHz. The assessment of PTS is therefore that no specific conditions are required for coexistence with FRMCS in the frequency band 1900–1910 MHz.

3.3.3.3 Radio Astronomy

In the frequency range 1718.8–1722.2 MHz (part of the frequency blocks 1715–1720 MHz and 1720–1725 MHz), radio astronomy has a secondary allocation for observations of spectral lines through footnote 5.385 in Article 5 of the International Telecommunication Union's Radio Regulations. However, PTS assesses that it is not relevant to introduce conditions for the protection of radio astronomy at the Onsala Space Observatory within the aforementioned frequency range in connection with this award. Information is provided in Appendix A.

3.3.4 Sharing conditions

The use of the 1800 MHz band shall be prioritised and protected from harmful interference. The licence holder shall contribute in making information on the use and any current and planned deployment available in a suitable way to enable sharing of frequency range. Parties involved and PTS may need to collaborate on the forms of how information about the use can be shared. Conditions are set out in Appendix A.

3.3.5 Conditions on coordination

3.3.5.1 Coordination with the Swedish Armed Forces

The licence holders shall obtain the consent from the Swedish Armed Forces for all new installations of radio transmitters and changes to existing installations of radio transmitters according to the conditions set out in Appendix A.[5]

3.3.5.2 Coordination with other countries

Conditions are set out in Appendix A.

Information on existing coordination agreements for block licences can be found on PTS's website https://pts.se/radio/spektrumforvaltning/koordineringsavtal/.

3.3.6 Conditions regarding requirements that are of importance to the national security of Sweden

3.3.6.1 Legal prerequisites and background

A prerequisite for an application for a licence to use radio transmitters to be approved is that, pursuant to Chapter 3, Section 6, point 7 of the Act (2022:482) on Electronic Communication (LEK), it can be assumed that the radio usage will not cause harm to the national security of Sweden. According to Chapter 3, Section 12, point 9 of LEK, a licence to use radio transmitters can be subject to conditions regarding requirements that are of importance to the national security of Sweden. Pursuant to Chapter 11, Section 7 of LEK, it is furthermore possible to revoke a licence and to amend the licence conditions immediately if the radio usage has caused harm to the national security of Sweden or if it can be assumed that the radio usage will cause such harm. According to chapter 3, Section 13, Regulation (2022:511) on Electronic Communication (FEK), PTS must consult with the Swedish Armed Forces and the Swedish Security Service in matters of licences to use radio transmitters according to Chapter 3 of LEK. The aim of the consultation is to clarify

[5] There is currently a review of this process which may affect the wording and scope of this condition.

1. whether the radio usage according to the application for a licence or for permission to transfer of lease a licence can be assumed to cause harm to the national security of Sweden, and
2. the need to make such licence subject to conditions regarding requirements that are of importance to the national security of Sweden and, if so, which conditions.

By decision of 20 January 2021, ref. no. 18-8496, PTS granted licences for the use of radio transmitters in the 3,5 GHz and 2,3 GHz bands and established conditions for the use of radio transmitters in these frequency bands. Two of the conditions that applied to the protection of the national security of Sweden were appealed by Huawei Technologies Sweden AB. The Court of Appeal rejected the appeal by judgement on 22 June 2022 in cases no. 5222-21 and 5223-21. PTS' decision has thereby become legally binding.

In the consultation with the Swedish Security Service and the Swedish Armed Forces (the consultation authorities) regarding the assignment of licences to use radio transmitters in parts of the 1800 MHz band it has been made clear that there is a need to make the licences in the current assignment subject to conditions regarding requirements that are of importance to the national security of Sweden as well.

The licence conditions that PTS will set out are based on both general threats to the national security of Sweden that the consultations authorities have pointed to, and to security risks identified in the documents submitted by the applicants. The consultation authorities have also referred to the conditions for the protection of the national security of Sweden that were set out in assignment of licences to use radio transmitters in the 900 MHz, 2,1 GHz and 2,6 GHz bands, which correspond to the conditions set out in the assignment of licences to use radio transmitters in the 3,5 GHz and 2,3 GHz bands.

The following describes the conditions for protection of the national security of Sweden set by PTS in this assignment. The detailed conditions are set out in Appendix A.

3.3.6.2 General conditions for protection of the national security of Sweden

PTS has formulated a general condition for protection of the national security of Sweden, which states that the licence holder must take the technical and organisational measures required to ensure that the radio usage does not cause harm to the national security of Sweden.

The assessment of potential security risks, and of their management, is based, among other things, on the documentation provided by the applicants in their

application. The documentation submitted by the applicants (responses to Appendices B1 and B2) in accordance with OI Part 1 includes, among other things, descriptions of network deployment in the 1800 MHz frequency band and security measures relating to these networks based on the consultation authorities' policy document on the national security of Sweden.[6] It is assumed that licence holders will observe the principles and the criteria set out in this guidance document throughout the period of validity of their licence.

3.3.6.3 Requirement to exclude equipment from certain suppliers

Based on the consultation authorities' opinions, PTS acknowledges that there is a need for licence conditions that prohibit the use of products from certain suppliers in the current assignment of licences to use radio transmitters as well. PTS assesses that the requirement for protection of the national security of Sweden in Chapter 3 of LEK[7] entails that such conditions still are proportionate with regard to the purpose of the provision.

The suppliers listed in the licence conditions are those that might be considered today when supplying products for use in core network functions. With regard to the long period of validity of the licences, conditions may of course change.

As stated above, Chapter 11, Section 7, paragraph 3, point 3 of LEK grants PTS the right to revoke a licence and to amend the licence conditions without further notice if the radio usage has caused harm to the national security of Sweden or if it can be assumed that the radio usage will cause such harm. If the Swedish Armed Forces or the Security Service so request, PTS shall, according to Chapter 10, Section 3 of FEK, examine whether there are grounds to revoke the licence or change the licence conditions.

The principles of the consultation authorities[8] require operators to provide information concerning, among other things, measures taken in the communications networks which may affect confidentiality, resilience, accessibility, oversight or control.

The condition concerning suppliers who may not be used for central functions in the networks may thus be adjusted during the licence period.

[6] Samrådsmyndigheternas inriktningsdokument (ref. no. 24-487 file appendix 23).
[7] Chapter 3, Section 6, point 7 of LEK.
[8] Samrådsmyndigheternas inriktningsdokument (ref. no. 24-487 file appendix 23).

3.3.6.4 Redundant national source for common time reference

Synchronisation through Global Navigation Satellite Systems (GNSS) implies a dependence on functions controlled from abroad. For the purposes of protecting the national security of Sweden, PTS assesses that a redundant national solution for time synchronisation is required. The licences to use radio transmitters are therefore subject to the condition of a redundant national time synchronisation solution.

3.3.6.5 Dependence of central functions on functions and staff abroad

When central functions are dependent on functions or staff located abroad, situations where connections between Sweden and abroad are cut off can cause serious damage to network functionality. This could endanger the national security of Sweden.

Licence conditions are therefore required, that ensure that, where necessary, functions or staff located abroad on which central functions are dependent, are phased out and replaced by functions or staff located in Sweden. Such a condition does not exclude the possibility of temporary network interconnections to foreign countries, where applicants have indicated that this is part of their solution to ensure redundant operation, provided that such interconnections are initiated and monitored from Sweden.

3.3.6.6 Relationship to other applicable provisions

The presentation in Section 3.3.6 of the proposed conditions concerning the national security of Sweden begins with a general condition requiring that the technical and organisational measures, necessary to ensure that the radio use according to the licence does not cause harm to the national security of Sweden, must be taken. In this context, PTS would like to point out the importance of licence holders also being subject to other provisions aimed at increasing the security of their operations.

The Protective Security Act (2018:585) and other protective security legislation contain provisions that apply to anyone conducting security-sensitive activities. Pursuant to Chapter 8, Section 1 of the Protective Security Ordinance (2021:955), PTS is the supervisory authority under the Protective Security Act in the area of electronic communications. PTS has also issued regulations on protective security, PTSFS 2021:2.

Chapters 8 and 9 of LEK contain provisions on security, processing of traffic data and protection of privacy. These provisions aim to maintain a sufficient level of security for the networks and services covered by the rules.

In accordance with LEK, PTS has also issued regulations and general recommendations (PTSFS 2022:11) on security in networks and services (the Security Regulations). In this context, PTS would particularly like to point out that licence holders have an obligation to monitor external events that may affect the security of networks and services. The Security Regulations require providers to carry out risk analyses, inter alia, before acquiring assets, information processing assets or connections, before hiring contractors and before planned changes. A new risk analysis for assets, information processing assets and connections shall also be carried out after previously unknown threats relevant to the risk analysis have been identified.

3.3.7 Conditions regarding coordination between licence holders

Licence holders may agree on how to comply with the technical conditions in a coordinated manner. This coordination means that, if there are several licence holders may deviate from certain technical requirements in the licence conditions. The coordination must not entail deviations that affect a third party.

4. Auction procedure

4.1 General

4.1.1 Electronic online auction system

The award for assigning licences in parts of the 1800 MHz band will follow after an auction. PTS will organize the auction over the internet via an electronic auction system with an English user interface in collaboration with an external supplier. The auction system will be tested in a trial auction, which PTS will organise. The entire auction procedure will be carried out through the electronic online auction system over the internet.

4.1.2 Login information and internet connection

The electronic online auction system is provided by PTS.

The contact person nominated by the bidder will, well ahead of the auction, receive the following information about the auction system: login details, a bidder´s manual in English and a telephone number for support. Support via the telephone number will be in Swedish.

Bidders are responsible for their own participation, for example, that their computers and internet connections and other equipment are in order, that the right personnel participate and that the login details are kept secure.

4.1.3 Prior to the auction

PTS will contact the applicants that are approved to participate as bidders in the auction for additional information.

The auction is scheduled to start November 18th, 2025. If the starting date needs to be postponed, PTS will inform about the change on the authority's website https://www.pts.se/1800MHz and also directly inform each bidder's contact person of the change.

PTS plans to test the auction system through a trial auction on November 11th, 2025. PTS recommends that all bidders participate in the trial auction so as to assure themselves that their equipment functions correctly and that they understand the auction procedure.

The bidders will, before the auction, be provided with an auction schedule as well as a plan for how and when PTS intends to communicate the result of the auction on the authority's website.

4.2 Prerequisites and auction format

Below, blocks and eligibility in the auction are introduced. This is followed by a general description of the auction procedure, which consists of up to three stages.

4.2.1 Block, eligibility and reserve price

The frequency band is divided into 7 frequency blocks belonging to the same category according to Table 1. A bidder's initial eligibility is 7 in the Clock Stage, which corresponds to the entire supply.

Table 1 Block, eligibility and reserve price

Frequency band	Clarification	Block size	Number of blocks	Eligibility per block	Reserve price per block
1800 MHz FDD	Frequency generic block[9]	2×5 MHz	7	1	70 MSEK

4.2.2 Auction procedure in up to three stages

The auction procedure consists of up to three stages:

- a first part in the form of a Clock Stage
- followed by a Secondary Stage in case of one (1) unsold block
- and finally, a Frequency Assignment Stage if necessary.

In the Clock Stage and the possible Secondary Stage, it is determined how many blocks each bidder wins, and in the Frequency Assignment Stage it is decided where in the frequency band the blocks are placed.

4.3 Auction rules

4.3.1 General

In addition to the information in this section, the prerequisites stated above (see section 4.2) should also be seen as part of the rules for the auction.

At the beginning of the auction, bidders will see information in the auction system about their initial eligibility and the frequency blocks awarded in the auction.

[9] A frequency block that does not refer to any specific placement in the frequency band.

4.3.2 Clock Stage

4.3.2.1 Overview

The Clock Stage determines the number of generic blocks that each bidder wins in the 1800 MHz band and the associated price for these blocks. Specific frequencies are determined in the Frequency Assignment Stage (see section 4.3.4).

The Clock Stage consists of a number of clock rounds[10]. In the first clock round, each bidder specifies the number of blocks they are willing to buy at the reserve price announced by PTS (see section 4.2.1). In the Clock Stage, all prices are specified on a per-block basis.

In each of the following rounds, PTS defines a range of prices for the blocks by announcing an opening price (previous round's clock price) and a clock price (current round's clock price[11]). The opening price is the lowest price in the range and the clock price is the highest price in the range. In the Clock Stage, bidders specify how their demand[12] changes over the range of prices.

After each clock round, each bidder is committed to pay a certain price per block (the posted price) for a license including a certain quantity of blocks (the bidder's posted demand). The posted price is the same for every bidder (see *Bid processing* in section 4.3.2.4).

The aggregate demand after a given round is the sum of each bidder's posted demand. The excess demand is the aggregate demand minus the total supply. The excess demand can be positive, zero or negative.

The Clock Stage ends after the earliest round after which the excess demand is zero or negative.

4.3.2.2 Extension rights

Each bidder has three (3) extension to use during the Clock Stage. Bidders may use only one (1) extension, lasting a maximum of 30 minutes, per round of the Clock Stage.

An extension is activated automatically if the bidder has extensions remaining, is still eligible to bid in the clock round, but has not yet confirmed a bid when the regular clock round ends. An extension applies only to the bidder(s) who have received the

[10] A clock round is a period of time determined by PTS that can potentially be extended by a bidder, in the first part of the auction, with the option to place a clock bid.
[11] The clock price in clock round 1 consists of a predetermined reserve price.
[12] The number of frequency blocks that a bidder wishes to buy.

extension. A clock round that has been extended ends when all bidder(s) using the extension confirm that they are done bidding or when the extension period has expired.

4.3.2.3 Clock round 1

i. Information available before clock round 1

Before the Clock Stage starts, PTS announces to bidders:

- The start and end time of clock round 1,
- The tentative schedule of subsequent clock rounds,
- The reserve price per block in the 1800 MHz band.

ii. Bidding in clock round 1

The price in clock round 1 of the Clock Stage is the reserve price set by PTS. In clock round 1, each bidder can specify the number of blocks, up to the total supply of seven (7) blocks (initial eligibility), that they are willing to buy at this price.

iii. Failure to bid in clock round 1

A bidder who fails to bid in clock round 1, including the extension period (see section 4.3.2.2), will be deemed to have requested 0 blocks at the reserve price and will not be able to participate further in the Clock Stage.

iv. Minimum spectrum requirement (MSR)

A bidder not desiring to be awarded one single block in the auction may optionally specify in clock round 1 that it has a minimum spectrum requirement (MSR) of 2 blocks. A bidder selecting the MSR is guaranteed not to win exactly one block and is not allowed to request exactly one block in clock round 1 and for the remainder of the auction.

This selection to have an MSR cannot be changed after clock round 1.

v. Results of clock round 1

In clock round 1, the posted price is the reserve price, and each bidder's posted demand is the number of blocks requested in its bid.

If the aggregate demand in clock round 1 exceeds the total supply, the Clock Stage continues to the second round. Otherwise, the Clock Stage ends after the Round 1 and each bidder wins its posted demand at the posted price. The auction continues with the Frequency Assignment Stage, if required.

4.3.2.4 Clock round 2 and following clock rounds

i. Bidding eligibility

In the second and all following clock rounds of the Clock Stage, a bidder can only maintain or reduce their demand relative to their posted demand from the previous clock round.

A bidder that had a posted demand of 0 blocks in a clock round is not eligible to bid in any subsequent clock round and is not informed about the results of any subsequent clock round.

ii. Clock round prices

Before the start of the second and following clock rounds, PTS will determine the clock round's clock price resulting in a range of prices (expressed in whole thousands of Swedish Kronor) between and including the opening price and the clock price:

- The opening price is the lowest price per block in the range. It is equal to the previous clock round's clock price.
- The clock price is the highest price per block in the range. It is the maximum price in the current clock round.

Bidders will be informed of the opening and clock price before the round starts.

iii. Intra-round bids in clock round 2 and in following clock rounds

A bidder's start demand is equal to their posted demand from the previous clock round. Each bidder that is eligible to bid can submit one of the following types of bids, relative to their start demand:

- A bid to maintain demand, or
- A bid to reduce demand at a specified bid price[13]

A bid to maintain demand is a commitment to pay any price from the opening price up to and including the round's clock price for the number of blocks equal to the bidder's start demand in the round.

[13] Bid price is the price per block for which a bidder wishes to reduce its demand, where the bid price is within the closed interval from opening price to clock price.

In a bid to reduce demand the bidder specifies:

1. The number of blocks by which the bidder wishes to reduce its demand relative to its start demand (the previous clock round's posted demand) to its reduced demand[14].
2. The price in whole thousands of Swedish Kronor at which the bidder wishes this reduction to take effect. This price must be no less than the opening price and no more than the clock price.

A bid to reduce demand from X blocks to Y blocks at a bid price is interpreted as a bidder's willingness to buy:

a. Their start demand X at any price equal to or above the opening price and below the bid price.
b. Their start demand X, their reduced demand Y, or any quantity of blocks in between X and Y at the bid price.[15]
c. Their reduced demand Y at any price above the bid price and up to and including the clock price.

iv. Bid processing

Once a clock round has ended, PTS collects all the bids and processes them to determine the clock round results. As outlined above, each bidder will end the clock round committed to pay a certain price per block (the "posted price") for a license including a certain quantity of blocks (its "posted demand"). The posted price for the clock round is the same for every bidder and determined by PTS according to the process described below. The posted demand varies from bidder to bidder and may be zero.

During the bid processing, PTS determines which bids to reduce demand are "accepted", and to what extent they can be accepted. That is, PTS determines by how much each bidder's demand is reduced during the clock round, according to the process below.

While bids to maintain demand are always accepted in full, a bid to reduce demand is accepted only to the extent that it does not lead to unsold blocks.[16] A bid to reduce demand may be accepted fully, partially or not at all.

[14] A bidder who selected MSR cannot enter a bid to reduce demand down to 1.

[15] If the bidder has specified an MSR in clock round 1, and Y=0 (i.e., their reduced demand is zero), the bid does not express willingness to buy exactly 1 block.

[16] There is an exception in the case of a bidder that has specified MSR reducing its demand to zero. See Example 2 – Using MSR.

To determine the posted price and posted demand for each bidder, the following bid processing is executed:

- All bids to maintain demand are accepted without further processing.
- If every bid was to maintain demand, bid processing ends, excess demand stays unchanged and the posted price for the round is the clock price.
- Otherwise, all bids to reduce demand are processed in order of their bid price, lowest to highest. Bids with equal bid prices are processed in random order.
- When processing bids:
    - The initial value of the current excess demand (CED) is the excess demand after the previous round. The CED is updated after each bid is processed, i.e., the CED may change more than once during bid processing after a clock round.
    - A bid to reduce demand is accepted in full if the reduction is smaller than or equal to the CED. In this case, the bidder's posted demand is their reduced demand and the CED is decreased by the reduction.
    - A bid to reduce demand is partially accepted if the reduction is greater than the CED. In this case, the bidder's posted demand is equal to their start demand minus the value of the CED. Then, the CED is reduced to 0.
    - If the bidder has specified an MSR and this calculation would leave the bidder with a posted demand of 1, the bidder's posted demand is updated to 0 and the CED is reduced by one. Note that this leads to a CED of -1. The corresponding unsold block will be offered in the Secondary Stage.
- The bid processing ends when the CED is zero or negative.

After bid processing has ended, the posted price for the clock round is determined as follows:

- If the CED is still positive then the posted price is the clock price of the clock round. The Clock Stage will continue to the next clock round. The excess demand is equal to the value of CED after bid processing.
- Otherwise, the posted price is the bid price of the last bid to be accepted, fully or partially. In this case the Clock Stage ends.

v. Failure to bid

If a bidder does not submit a bid in a clock round, including a potential extension period (see section 4.3.2.2), PTS will treat the bidder as having submitted a bid to reduce its demand to zero at the opening price of the clock round.[17]

vi. Information for bidders after a clock round has ended

After a round has ended, each bidder that was eligible to bid in this clock round is informed of:

- the posted price,
- their posted demand, and
- whether there is excess demand.

No information about bids submitted by other bidders is released.

If the Clock Stage continues to the next clock round, bidders eligible to bid in the next clock round also are informed of the opening price and clock price for the next clock round.

4.3.2.5 Conclusion of the Clock Stage

The Clock Stage ends in the earliest clock round after which the excess demand is zero or negative. Each bidder will receive their posted demand at the posted price per block of the final clock round of the Clock Stage.

If the Clock Stage did not end in Round 1 and there is a single unsold block after the final clock round, PTS will hold a Secondary Stage (see section 4.3.3) before the Frequency Assignment Stage.

PTS will inform bidders after the conclusion of the Clock Stage (or, if applicable, the Secondary Stage), whether bidding in the Frequency Assignment Stage will be necessary (see section 4.3.4).

4.3.3 Secondary Stage

4.3.3.1 Overview

If at least one bidder has specified MSR in the Clock Stage, there is a small risk that one block of spectrum remains unsold after the Clock Stage, even if there was

[17] A reduction to zero does not guarantee an exit from the Clock Stage, since the reduction may be partially accepted or not accepted.

excess demand after clock round 1 (see section 4.4.3). Should this scenario occur, PTS will use a secondary auction stage to allocate the unsold block.

The Secondary Stage will be held as a single-round, sealed-bid, second price auction. There will be a single block of 1800 MHz spectrum available for sale. The minimum bid will be equal to the reserve price in clock round 1 of the Clock Stage.

Once the Secondary Stage has concluded, the auction will proceed to the Frequency Assignment Stage, taking the results of the Clock Stage and the Secondary Stage into account.

4.3.3.2 Participation in the Secondary Stage

Participation in the Secondary Stage is optional.

Any bidder that has specified an MSR in clock round 1 of the Clock Stage and has won no blocks in the Clock Stage is not permitted to participate in the Secondary Stage.

4.3.3.3 Information Available before the Secondary Stage

Before the Secondary Stage starts, PTS announces to bidders:

- The start and end time of the bidding round,
- The minimum bid, which is equal to the reserve price per block in the 1800 MHz band from clock round 1 of the Clock Stage.

4.3.3.4 Bidding in the Secondary Stage

Any bidder permitted to participate in the Secondary Stage can submit a single binding bid for the block on sale. A bid for the block on sale consists of a price, in whole thousands of Swedish Kronor, of at least the reserve price.

4.3.3.5 Conclusion of the Secondary Stage

The Secondary Stage concludes when the bidding round is over.

i. Determining the winning bid

Once the Secondary Stage has concluded, PTS will determine the winning bid, as follows.

The highest bid will become the winning bid. If there are multiple highest bids at the same price the winning bid will be determined by random selection. If no bids have been submitted, there is no winning bid and the block remains unsold.

ii. Determining the winning price

The price to be paid by the bidder that has submitted the winning bid (the winning price) is equal to the bid price of the highest bid that is not the winning bid. If only a single bid has been submitted the winning price for the block will be equal to the reserve price, i.e. 70 MSEK.

iii. Information once the Secondary Stage has concluded

After the Secondary Stage has concluded, all bidders are informed whether they have become the winning bidder. Only the winning bidder is informed of the winning price it has to pay.

All bidders from the Clock Stage are informed if the block remains unsold. Furthermore, all winners of blocks from the Clock Stage and the Secondary Stage will be informed whether bidding in the Frequency Assignment Stage will be necessary.

4.3.4 Frequency Assignment Stage

4.3.4.1 Overview

The Frequency Assignment Stage determines which specific frequencies each winning bidder receives for the generic blocks the bidder was allocated in the Clock Stage and the potential Secondary Stage.

If there is more than one permissible assignment of specific frequency blocks, bidders will have the possibility to bid for each assignment they could receive, in a single-round, sealed-bid auction with an opportunity cost based second price rule for payments. Only bidders who were allocated at least one block (the winners) take part in the Frequency Assignment Stage.

4.3.4.2 Permissible Frequency Assignments

i. Main rules

Based on the winners' allocations, PTS determines the set of permissible assignments of specific frequency blocks.

If it is possible to assign specific frequencies to the winners of generic blocks in a way that leaves all winners with contiguous spectrum, taking into account the existing holdings in the band until 2037 of Telia (blocks 3–7) and Net4Mobility (blocks 8–9), then all such assignments are permissible. There may be zero, one or several such assignments.

If no such assignment exists, an assignment is permissible if

- at most one of the winners' spectrum (including their existing holdings in the band until 2037) comprises two contiguous but not adjacent sets, and
- at least one of these sets contains 2 blocks or more.

That is, at most one of the two sets may contain an isolated block: a block that is not adjacent to any of the bidder's other blocks. This rule prevents a bidder who wins two generic blocks from being assigned two isolated blocks. Once again, this is taking into account the existing holdings in the band until 2037.

If there is exactly one permissible assignment then it becomes the winning assignment of frequencies and no bidding in the Frequency Assignment Stage is required. Otherwise, there is more than one permissible assignment and bidding takes place.

PTS will inform bidders at the end of the Clock Stage or the Secondary Stage, if any, whether bidding in the Frequency Assignment Stage will be required.

ii. Treatment of unsold blocks

If there is a single unsold block, this block is treated in the same way as a single block won by a bidder without any existing holdings in the band until 2037.

If there are two or more unsold blocks[18], these unsold blocks will be treated as follows when determining permissible assignments as outlined above:

- If it is possible to assign all winners contiguous spectrum and keep the unsold blocks contiguous, then an assignment is permissible.
- If it is possible to assign all winners contiguous spectrum but only if unsold blocks are not contiguous, then an assignment is permissible if unsold spectrum is split into two contiguous but not adjacent sets. If there are exactly two unsold blocks, then they do not need to be adjacent.
- If it is not possible to assign all winners contiguous spectrum, then the unsold blocks are treated in the same way as the winnings of a bidder without any existing holdings in the band until 2037.

4.3.4.3 Bidding

The full set of permissible frequency assignments are visible only to PTS. Bidders are able to see their own assignment options, i.e. the sets of frequency blocks

[18] Observe that two or more unsold blocks can only occur if the Clock Stage ends after clock round 1 because of insufficient demand at the reserve price.

corresponding to their Clock Stage and Secondary Stage winnings within each permissible frequency assignment.

A bidder with a single assignment option will be assigned that option, will not be asked to bid and will not have to pay for this assignment.

A bidder with multiple assignment options may enter a bid for each assignment option. A bid consists of a price (in whole thousands of Swedish Kronor) for each assignment option, stating the amount the bidder is willing to pay to be assigned that option. The bid for an option can be zero.

Bidders do not have to submit Frequency Assignment Stage bids to be assigned the blocks they won in the Clock Stage or Secondary Stage. If a bidder chooses not to place a bid, PTS treats this as though the bidder had submitted for every option a bid with a price of zero.

4.3.4.4 Information provided before the bidding in the Frequency Assignment Stage takes place

Before the Frequency Assignment Stage, PTS informs each bidder of the following:

1. The start and end time of the Frequency Assignment Stage.
2. The bidder's assignment options.

4.3.4.5 Determination of the Winning Permissible Assignment

If there was more than one permissible assignment, PTS will determine the winning permissible assignment after the Frequency Assignment Stage has ended, as follows:

1. The value generated by each permissible assignment is the sum of bids submitted for assignment options making up this assignment.
2. The winning permissible assignment is the permissible assignment that generates the highest value.
3. If there are multiple permissible assignments that yield the same highest value, one of these will be selected at random.

4.3.4.6 Determination of the Frequency Assignment Stage Prices

The prices that bidders pay for the winning assignment are based on the concept of opportunity cost, see Appendix C.

For each possible subset of bidders, including for an individual bidder, the opportunity cost is calculated as follows:

1. Identify the permissible assignment that would generate the highest value if the bids from the current subset of bidders were zero (0) SEK, and

2. Subtract from this value the winning assignment's bids, excluding the bids from the current subset of bidders.
3. Any unsold frequency block is given a value of zero for the calculations in this part.

The price each bidder needs to pay for the position in the frequency band must meet the following conditions:

a. The total amount to be paid by each bidder cannot exceed the price of the bidder's winning bid.
b. The total amount to be paid, for each possible subset of bidders, must be at least equal to the opportunity cost of these bidders (subset).
c. The total amount to be paid must be the lowest amount that satisfies the above two conditions.
d. To determine how the total amount to be paid is split among the bidders, the sum across bidders of the squares of the difference between a bidder's payment minus the bidder's individual opportunity cost is minimized subject to the above three conditions.[19]

These conditions yield a unique solution for the prices for each bidder. The final price is rounded up to the nearest whole thousands of Swedish Kronor.

4.3.4.7 Information after the Conclusion of the Frequency Assignment Stage

After the Frequency Assignment Stage has concluded, each bidder is informed of:

- the specific frequency blocks assigned to the bidder,
- the assignment price to pay,
- the total price to pay, which is the sum of the prices from the Clock Stage, the potential Secondary Stage and the Frequency Assignment Stage.

4.4 Auction examples

The examples should be seen as fictitious when it comes to, for example, individual bidders' bidding behaviour, bids and number of bidders. Each example should be seen as a stand-alone example, unless otherwise stated.

[19] Observe that often the minimum sum is zero and, therefore, each bidder pays their individual opportunity cost.

4.4.1 Example 1 - Interpretation of a bid to reduce demand

Suppose that in clock round 4, Bidder A has a start demand of 4 blocks. In clock round 4, the opening price is 200 and the clock price is 250. Bidder A places a bid to reduce their demand from 4 blocks to 2 blocks at a price of 230.

This bid is interpreted as follows:

- For any price greater than or equal to 200 and smaller than 230, Bidder A would be willing to buy 4 blocks.
- At the bid price of 230, Bidder A would be willing to buy 4, 3 or 2 blocks.
- At any price above 230 and smaller than or equal to 250, Bidder A would be willing to buy 2 blocks.

4.4.2 Example 2 – Bid processing

Suppose that after clock round 3, excess demand is 5 blocks, resulting from the following posted demands:

- Bidder A: 5 blocks
- Bidder B: 2 blocks
- Bidder C: 3 blocks
- Bidder D: 2 blocks

The Clock Stage continues to clock round 4. The prices for clock round 4 are:

- Opening price: 150
- Clock price: 200

The bidders' start demands are equal to their posted demands from clock round 3. The following bids are placed in clock round 4:

- Bidder A: Reduced demand by 3 blocks to 2 blocks at a bid price of 170.
- Bidder B: Maintained demand at 2 blocks.
- Bidder C: Reduced demand by 3 blocks to 0 blocks at a bid price of 195.
- Bidder D: Maintained demand at 2 blocks.

The bids are processed as follows:

- Bidder B's bid to maintain demand is accepted. Bidder B's posted demand is determined to be 2 blocks.
- Bidder D's bid to maintain demand is accepted. Bidder D's posted demand is determined to be 2 blocks.
- Bidder A and C placed bids to reduce their demand. These bids are processed in ascending order of bid price, as follows:

    - A's bid is considered first. Because the reduction (3 blocks) is smaller than CED (5 blocks) it can be accepted fully. Bidder A's posted demand is set to 2 blocks. CED is reduced by 3 blocks and is now equal to 2 blocks.
    - C's bid is considered next. As the reduction (3 blocks) is greater than CED (2 blocks), it can only be accepted partially. Only a reduction by 2 blocks (the CED value) is accepted. Bidder C's posted demand is set to 1 block and CED is reduced to 0.
    - Bid processing ends.
- The posted price is determined to be the bid price of Bidder C, i.e. 195 per block.

At the posted price of 195, the bidders receive their respective posted demands:

- Bidder A: 2 blocks
- Bidder B: 2 blocks
- Bidder C: 1 block
- Bidder D: 2 blocks

As CED is 0, clock round 4 is the final clock round and the Clock Stage concludes.

4.4.3 Example 2 – Using MSR

Consider the situation from Example 2, but assume that Bidder C had specified an MSR in Round 1. In this case, the reduction from 3 blocks to 0 blocks by bidder C would have been fully accepted and the Clock Stage would have ended with one unsold block. This is because a bidder with an MSR cannot receive exactly 1 block.

In this case, the auction would proceed to the Secondary Stage. Bidder C would not be permitted to bid in the Secondary Stage (see Minimum Spectrum Requirement in section 4.3.2.3).

4.4.4 Example 3 – Permissible specific frequency assignments

Assume that the bidders in the Clock Stage wins frequency blocks as follows:

- Bidder A: 2 blocks
- Bidder B: 2 blocks
- Bidder C: 2 blocks
- Bidder D: 1 block

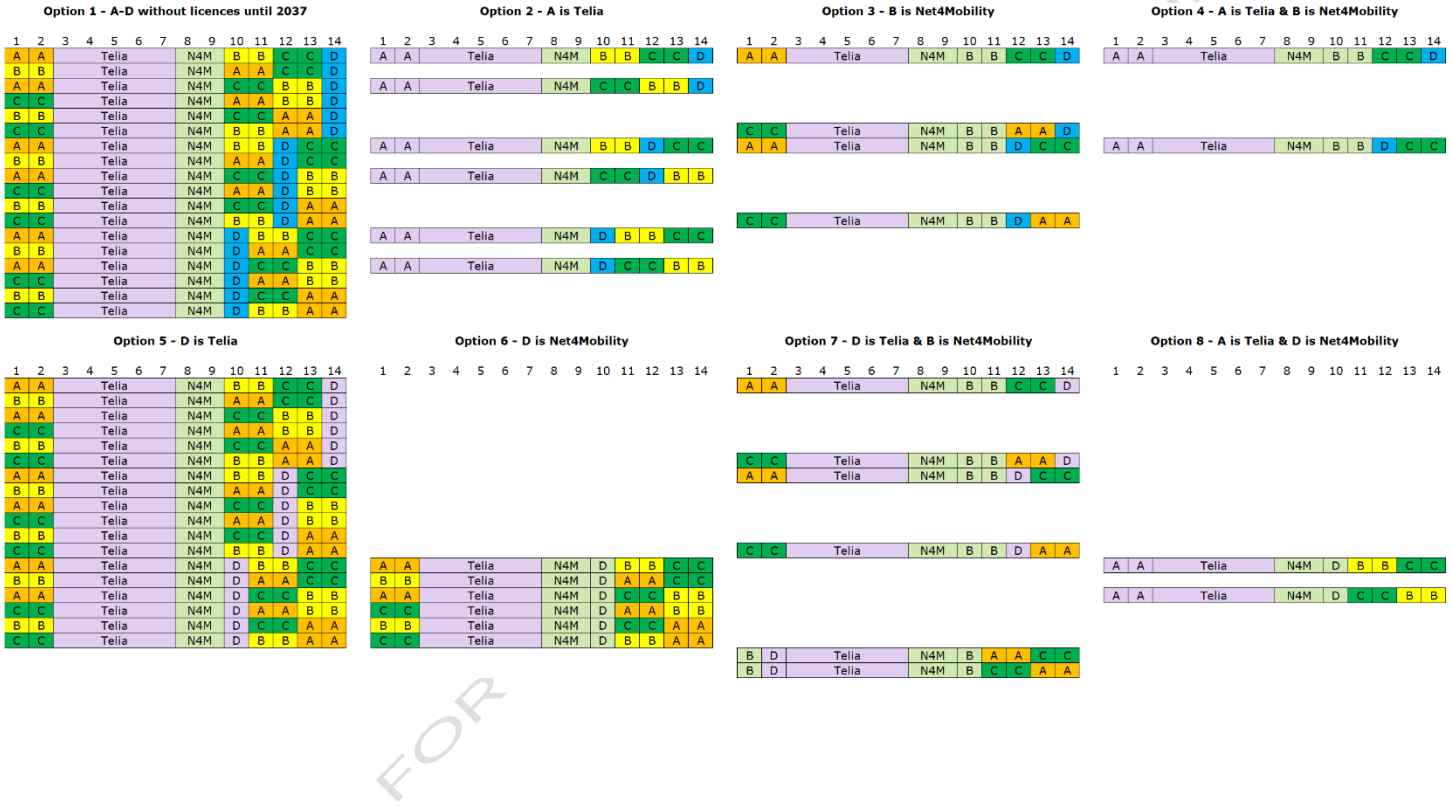
Make the following independent assumptions (other assumptions may lead to more assignment options than those shown in the figure below):

Option 1: None of the bidders A–D have a licence valid until 2037 in the band
Option 2: Bidder A is Telia
Option 3: Bidder B is Net4Mobility (N4M)
Option 4: Bidder A is Telia and Bidder B is Net4Mobility (N4M)
Option 5: Bidder D is Telia
Option 6: Bidder D is Net4Mobility (N4M)
Option 7: Bidder D is Telia and Bidder B is Net4Mobility (N4M)
Option 8: Bidder A is Telia and Bidder D is Net4Mobility (N4M)

Specific bidders in option 2–8 have been chosen to illustrate the application of rules taken existing licence holders until 2037 into account. The other bidders in option 2–8 are assumed not to have a licence valid until 2037 in the band (as in option 1).

This results in the following permissible frequency assignment options for each assumption:

Figure 3 Permissible frequency assignment options for each assumption in the example.



5. Payment of auction proceeds and processing fees

5.1 Payment of auction proceeds

Auction proceeds must be paid by winning bidders after the auction has concluded. Winning bidder is required to pay 50 percent of the auctions proceeds in connection with the conclusion of the auction and PTS decision on licences to use radio transmitters. The remaining 50 percent of the auction proceeds must be paid in connection with the licences coming into effect. PTS will send invoices at these times for each respective part of the auction proceeds. The invoices shall be paid by the bidder within 30 days of the invoice date. If the amount due is not paid, the licence will be recalled by PTS.

In case of a transfer or lease of a licence, or part of a licence, before the auction proceeds for the licence have been fully paid, the transferor must pay the remainder of the proceeds before the lease or transfer is planned to take place. I accordance with Chapter 3, Sections 25 and 28 §§ of LEK, any transfer or lease of a licence is subject to permission by the Post and Telecom Authority.

5.2 Payment of processing fees

Processing fees must be paid by winning bidders after the auction has concluded. The processing fee for winning bidders is distributed in proportion to the amount of the awarded spectrum per bidder.

The total amount of spectrum on which the processing fee will be based is 70 MHz (2×35 MHz) in the 1800 MHz band. The costs on which the processing fee are based will be limited to a maximum of 3 million SEK for the entire auction procedure.

The processing fee will be finalised in connection with the decision on licences to use radio transmitters. The invoice for the fee must be paid within 30 days of the invoice date.

6. Appendices

Appendix A	Licence conditions 1800 MHz band
Appendix B	Confirmation of application
Appendix C	Establishing prices in the Frequency Assignment Stage (mathematical description)