

Appendix E:
Auction Rules
for the
Award of Spectrum Use
Rights
in the 26 GHz and
3600 MHz ranges

NON BINDING TRANSLATION

1 General information

1.1 Overview

1.1.1 A total of 1.4 GHz from the 26 GHz band will be awarded, plus the remaining spectrum in the 3600 MHz band from the 2019 award. Spectrum in the 26 GHz band will be awarded at national level and comprises the following:

- 400 MHz in the duplex gap (25.5–25.9 GHz)
- 1000 MHz at the upper end of the band (26.5–27.5 GHz)

The relevant spectrum in the 3600 MHz band will be awarded at regional level and comprises between 10 and 60 MHz, depending on the region.

1.1.2 The 400 MHz in the duplex gap within the 26 GHz band and the relevant spectrum in the 3600 MHz band will be auctioned as specific frequency blocks. The spectrum at the upper end of the 26 GHz band will first be auctioned as abstract frequency blocks. Specific frequencies will then be assigned during a second stage.

1.1.3 The award procedure is therefore a two-stage process:

- The first stage is used to award the specific frequency block in the 26 GHz band, the five abstract blocks in the 26 GHz band and the specific frequency blocks in the 3600 MHz band.
- A second stage is used to determine the specific frequencies at the upper end of the 26 GHz band that are to be assigned to each of the winners of the abstract frequency blocks from the first stage.

1.1.4 In stage 1, the frequency blocks will be auctioned in a simultaneous multi-round auction utilising the Enhanced SMRA (ESMRA) auction format. In this format, bidders use the first round of bidding to state the number of blocks they wish to acquire at the minimum price in each lot category. If this round results in excess demand, then additional rounds are held. For each round, the auctioneer specifies an initial price and a round price (per block) for each lot category. Bidders may restate their demand from the last round at the respective round price or submit bids to change their demand. In the latter case, they can state a price between the respective initial price and the respective round price. Bids to reduce demand will be accepted in bid processing only insofar as these bids do not lead to excess supply or do not have the effect of increasing an existing excess supply. Bids to increase demand will be accepted only insofar as this is possible while accounting for confirmed bids to reduce demand, in accordance with the rules of activity and any spectrum caps that may be applicable. Full details of provisions governing bid submission and processing can be found in 4.5 and 4.6.

1.1.5 A further round will be held if excess demand is present in at least one lot category. The process ends once there is no excess demand in any lot category.

- 1.1.6 The initial prices for subsequent rounds and the prices that are to be paid by successful bidders are determined through bid processing, based on whether the confirmed demand implies an excess demand and, if this is not the case, whether one or more bids to reduce demand have been confirmed, either in whole or in part. Full details of provisions governing price determination can be found in 4.7.
- 1.1.7 Applicants may take part in the first two stages of the auction procedure if they have not been excluded from the spectrum award procedure based on Art. 16 Par. 9 of the Telecommunications Act 2021 (TKG 2021).
- 1.1.8 The maximum amount of spectrum that a bidder may acquire at auction is limited as follows:
- the spectrum caps set by the Telekom-Control-Kommission (TKK) (see also section 6.4 of the Tender Document and the terms under 3); and
 - the bidding limit resulting from the bank guarantee provided by the bidder (cf. section 6.3 of the Tender Document).
- 1.1.9 Stage 2 is conducted as a single sealed bidding round in which winners of spectrum in lot category A (26.5–27.5 GHz frequency range) submit bids for various combinations of specific frequency blocks, thereby enabling the mutually compatible assignment of contiguous spectrum to the winners of spectrum (assignment options). Winning bids are identified by determining the combination of mutually compatible bids with the highest total value. The winners receive the actual frequency blocks contained in their respective winning bids at what are termed 'additional prices', which are calculated on the basis of a modified second price rule. The second stage of the auction procedure is open to those applicants who in the preceding stages acquired abstract frequency blocks, where more than one assignment option exists for these blocks.
- 1.1.10 The total price to be paid by a successful bidder is calculated as the sum of successful bids during the first stage, plus the additional price.
- 1.1.11 The auctioneer is the TKK or a member as commissioned by that body. The TKK may also entrust the handling of the auction to members of the Telecommunications Division of the Austrian Regulatory Authority for Broadcasting and Telecommunications (RTR).

1.2 Bids and bid submission

- 1.2.1 All bids are submitted electronically via auction software (EAS). The process for bid submission is described in detail in the auction software user guide, which will be provided to bidders in good time before the commencement of the first stage of the procedure.
- 1.2.2 It will be permitted to submit bids by means other than EAS (by phone or email, for example) only in exceptional cases, if technical issues arise that make it impossible to submit a bid using the auction software. The

auctioneer is responsible for deciding whether such an exceptional case applies. A detailed description of the process for submitting bids without EAS is given in the rules of procedure. Bids will only be accepted if they are valid within the meaning of the Auction Rules and conform to the bank guarantee rules set out in section 6.3 of the Tender Document.

1.3 Collusion and cancellation of the procedure

- 1.3.1 Any coercion of applicants or the applicants' shareholders, whether direct or indirect, with the intent of influencing the course or result of the auction (collusive behaviour) is prohibited. Collusive behaviour on the part of applicants before or during the auction procedure can lead to their exclusion from subsequent stages of the procedure (Art. 16 Par. 10 TKG 2021). The auctioneer is entitled to take all suitable measures to prevent collusive behaviour.
- 1.3.2 Other potential grounds for exclusion from the procedure include threats against competitors as well as disclosure of participation in the auction, of bids, or of bidding strategies, even prior to the auction procedure.
- 1.3.3 In this context, reference is also made to the provisions of general competition law and to Art. 168b of the Austrian Criminal Code (StGB).
- 1.3.4 The TTK is entitled to cancel the auction procedure if collusion between applicants is discovered and an efficient, fair and non-discriminatory procedure cannot be conducted (Art. 16 Par. 13 No. 1 TKG 2021), or if there are other important reasons that would impair the proper and correct organisation and completion of the auction procedure. In such cases, the TTK will decide whether the procedure should be terminated in accordance with section 2.4 of the Tender Document or whether a new auction date should instead be set.

2 Items for auction

2.1 Items for auction in stage 1

- 2.1.1 The spectrum available at the upper end of the 26 GHz band (blocks LA1 to LA5) will be awarded as abstract frequency blocks. The spectrum in the duplex gap in the 26 GHz band (block LB1) and in the 3600 MHz band (blocks LC1–LC7) will be awarded as specific frequency blocks. Abstract frequency blocks are defined based on their respective bandwidth, specific frequency blocks based on their specific spectrum location. A more detailed description of the frequency ranges, terms and conditions of use as well as the licence terms for the blocks is given in section 3 of the Tender Document. Table 1 provides an overview of the lots available in this stage.
- 2.1.2 For the purpose of applying the rules of activity, each block is assigned a certain number of bidding points in stage 1. The bidding points are listed in Table 1.

2.1.3 The round prices for the first round correspond to the minimum bids listed in Table 1, each for a single frequency block in the respective lot category.

Table 1: Lot categories in stage 1

Lot category	Number	Region	Bandwidth (MHz)	Frequency blocks	Points	Minimum price (Euro)
A	5	National	200	LA1 – LA5	10	1.900.000
B	1		400	LB1	10	3.800.000
C1	1	A1u	40	LC1	4	1.357.500
C2	1	A1r	10	LC2	0	98.000
C3	1	A4u	60	LC3	2	247.000
C4	1	A4r	60	LC4	2	290.500
C5	1	A5u	60	LC5	1	161.000
C6	1	A5r	60	LC6	1	126.500
C7	1	A6u	10	LC7	0	50.000

* See section 3 in the Tender Document for the region designations.

2.2 Items for auction in stage 2

2.2.1 To determine the specific assignment options in stage 2, blocks at the upper end of the 26 GHz band (26.5–27.5 GHz) are numbered consecutively, starting at the upper end of the frequency range, as LA1 to LA5 (cf. section 3 of the Tender Document). Table 2 lists the specific frequency assignments for the respective blocks.

Table 2: Summary of specific frequency assignments

Block designation	Frequency range/GHz
LA1	27.3–27.5
LA2	27.1–27.3
LA3	26.9–27.1
LA4	26.7–26.9
LA5	26.5–26.7

2.2.2 The auctioneer uses the frequency blocks acquired by the bidders during the first stage to determine a potential assignment of blocks for each bidder, such that contiguous spectrum is assigned to each bidder while also keeping together any unsold spectrum as a contiguous block. The bidders then bid on these assignment options.

3 **Spectrum caps**

To safeguard competition in downstream markets, the volume of spectrum in the 26 GHz band that a bidder may acquire by auction is limited to a maximum of 1000 MHz. No limitations are set with respect to the relevant spectrum in the 3600 MHz band (cf. section 6.4 of the Tender Document).

4 **Stage 1:**

4.1 **General information**

4.1.1 This stage uses the Enhanced Simultaneous Multi-Round Auction (ESMRA) format. Bids are submitted in one or more bidding rounds.

4.1.2 In the first bidding round, bidders specify the number of blocks in each category that they wish to acquire at the minimum prices as given in Table 1.

4.1.3 From the second bidding round onwards, the auctioneer specifies an initial price and a round price for each lot category. Bidders may confirm their demand at the round price or may change their demand by specifying a price between the initial price and the round price (**specified demand**).

4.1.4 At the end of each bidding round, the bids received are processed in order to determine whether another bidding round is required. During this bidding processing procedure, reductions to demand in one lot category (plus potentially associated with increases in demand in another lot category, i.e. a demand change) will be accepted only insofar as this does not lead to excess supply in the corresponding lot category. Completion of the bidding processing procedure results in a final price for each lot category and **confirmed demand** for each bidder in each lot category.

4.1.5 If, based on these confirmed demands, the overall demand in at least one lot category is greater than the available supply, a further bidding round will be needed. This round will use the final price determined by bid processing as the initial price and a new round price will be set. If there is no excess demand in any lot category, this stage is concluded and each bidder receives their confirmed demand quantity in each lot category at the respective final price.

4.2 **Bidding rounds**

4.2.1 A bidding round is a period of time set by the auctioneer within which bidders submit their bids.

4.2.2 The scheduling of bidding rounds is at the discretion of the auctioneer. In particular, the auctioneer may schedule the round duration and the time between the rounds as is considered appropriate to ensure the proper

and expeditious completion of the auction. However, no bidding round is planned to last less than 20 minutes or more than two hours.

- 4.2.3 Clock rounds will not start before 8 am or after 7 pm. No limit is placed on the number of bidding rounds per day.
- 4.2.4 The auctioneer informs bidders of the start of a bidding round at least 10 minutes before the round is due to start. At the same time, the auctioneer provides each bidder with the following information:
- Length of the planned bidding round
 - Initial price and the round prices for each lot category
 - Eligibility to bid in the planned bidding round, as derived by applying the rules of activity
 - Maximum bid amount (bid limit) resulting from the bank guarantee provided by the bidder
 - Number of round extension rights remaining to the bidder

From the second bidding round onwards, bidders are also given the following information:

- Their specified demand from the previous round for each lot category
 - Their confirmed demand from the previous round for each lot category
 - Confirmed overall demand in the previous round in each lot category
- 4.2.5 At the end of each auction day, the auctioneer also informs bidders about the provisional round plan for the following day. This information is non-binding and the auctioneer may elect to hold fewer rounds than the number originally planned. The number of rounds held on an auction day never exceeds the number announced by the auctioneer the day before.

4.3 **Round extension rights**

- 4.3.1 At the start of stage 1, each bidder receives three round extension rights.
- 4.3.2 If a bidder with open round extension rights had a positive confirmed demand in the previous bidding round for at least one lot category and does not submit a bid within the round time as set by the auctioneer, then the round is extended automatically by up to 30 minutes. As a result, the bidder forfeits one of their round extension rights but gains additional time to submit a bid.
- 4.3.3 A round in which one or more bidders have exercised a round extension right ends no later than 30 minutes after the expiry of the normal round duration. Alternatively, the round ends when all bidders who exercised a round extension right in this round have successfully submitted a bid.

- 4.3.4 Bidders who submitted a bid during the specified (normal) round time cannot make any changes to their submitted bid in the additional round time. Bidders who have used up all of their round extension rights without having submitted a bid in the specified round time cannot submit a bid during the extension time.
- 4.3.5 Bidders may exercise no more than one round extension right per round.
- 4.4 **Round prices**
- 4.4.1 In each bidding round from the second round onwards, the auctioneer specifies an initial price and a round price per frequency block for each lot category.
- i The initial price results from the processing of the bids in the previous round (see 4.8.2).
 - ii The round price is calculated by the auctioneer, who applies a set increment to the initial price.
- 4.4.2 The setting of price increments is at the discretion of the auctioneer. Price increments may vary across the individual lot categories and may be specified as a percentage increment or as an absolute increment (in addition, round prices may, if required, be rounded up to the next multiple of EUR 1,000).
- 4.4.3 The auctioneer will set the price increments so as to ensure that the auction completes in an orderly and expeditious manner. However, the round price will not be more than 15% higher than the initial price (plus any amount as needed to round the round price up to the next multiple of EUR 1,000).
- 4.4.4 At the end of each auction day, the auctioneer informs bidders about the increments planned for the next auction day. This information is nonetheless non-binding, and the auctioneer may choose to set the increments at a lower level than announced if considered appropriate to improve the efficiency of the procedure. This means that round prices do not increase more quickly than bidders would anticipate from the preliminary information they received.
- 4.5 **Bids and bid restrictions**
- 4.5.1 A bid is a binding offer to acquire the number of blocks specified in the bid (the specified demand) in the respective lot category at the price associated with the bid.
- 4.5.2 In the first round, bidders specify the number of blocks in each lot category that they wish to acquire at the minimum price as given in Table 1.
- 4.5.3 From the second round onwards, bidders may maintain their demand in each lot category (i.e. submit a bid having the same number of blocks as the bid in the previous round) or change their demand.

- 4.5.4 Bids that leave the demand unchanged from the previous round must be submitted at the respective round price, as set by the auctioneer.
- 4.5.5 To submit a bid that changes the demand from the previous round, the bidder must specify a bid amount (per block) meeting these conditions:
- i Integer multiple of EUR 1,000
 - ii Neither lower than the initial price nor higher than the round price
- 4.5.6 If a bidder changes their bid by more than one block (in lot category A), then they may distribute the total change over multiple steps, specifying a bid amount per block for each step. In this case, the following restrictions apply:
- i The amounts bid per block must vary across the varying steps.
 - ii If the bids are arranged in ascending order by amount bid per block, then the specified demands must all rise in the case of a demand increase and must all fall in the case of a demand reduction (uniformity rule).

The following Example 1 illustrates these restrictions.

Example 1: Restrictions applied to bids to change demand

We assume that the initial price p_S for category A in a round is 1,000,000 per block and the round price p_R is 1,100,000. A bidder who has expressed demand for four blocks in the previous round and wishes to reduce this demand to two blocks may submit the following bids, for example:

- Reduction to three blocks with a bid amount per block of $b(3) \geq 1,000,000$;
- Reduction to two blocks with a bid amount per block of $1,100,000 \geq b(2) > b(3)$

A bidder who has expressed demand for two blocks in the previous round and wishes to increase this demand to four blocks may submit the following bids, for example:

- Increase to three blocks with a bid amount per block of $b(3) \geq 1,000,000$;
- Increase to four blocks with a bid amount per block of $1,100,000 \geq b(4) > b(3)$

- 4.5.7 A bid to reduce demand by more than one block (in lot category A) can be submitted as an 'all-or-nothing' bid. During bid processing, an all-or-nothing bid will either be confirmed to its full extent or not confirmed at all. Otherwise, it is possible for such a bid to also be confirmed only in part, e.g. the demand reduction will not be confirmed to its full extent.
- 4.5.8 To clarify: by submitting an all-or-nothing bid, the bidder accepts that, in the event of the bid not being confirmed, they will acquire the same number of blocks as in the previous round at the new round price.
- 4.5.9 The bid amount per block in a bid submitted to reduce demand specifies the price at which the bidder wishes to reduce their demand quantity and is therefore the maximum price that the bidder is prepared to pay for a greater number of blocks (unless the bid in question is an all-or-nothing

bid). The bid amounts specified in such bids may have a determinative effect on the price (see 4.7.3).

Example 2: Bids to reduce demand

We assume that a bidder submits bids to reduce demand as in example 1, with bid amounts per block of $b(3) = 1,000,100$ and $b(2) = 1,010,000$. These bids mean that the bidder

- still wishes to acquire four blocks up to a price of 1,000,100 (inclusive);
- is now only interested in three blocks at a price higher than 1,000,100 but not greater than 1,010,000; and
- would acquire two blocks at a price higher than 1,010,000 but not greater than 1,100,000.

If the bidder were to submit a single bid to reduce their demand to two blocks at a bid amount per block of $b(2) = 1,010,000$, then this would mean that the bidder

- still wishes to acquire three or four blocks up to a price of 1,010,000 (inclusive); and
- is now only interested in two blocks at a price higher than 1,010,000 but not greater than 1,100,000.

If the bidder were to submit this bid as an all-or-nothing bid, then this means that the bidder

- still wishes to acquire four blocks up to a price of 1,010,000 (inclusive); and
- would prefer to acquire two blocks at a price higher than 1,010,000 but not greater than 1,100,000; but
- is also prepared to acquire four blocks at a price of 1,100,000 if the bidder's demand reduction cannot be accepted to its full extent.

In this case, there is no price at which the bidder would acquire three blocks.

4.5.10 A bid to increase demand indicates that the bidder is prepared to acquire the number of blocks specified in the bid at any price between the initial price and the round price, and will accept any number of blocks between the number equal to the demand in the previous round and the number specified in the bid. Accordingly, the bid amount per block specified in the bid does not determine the price but is nonetheless relevant for bid processing (see 4.6.2ii).

Example 3: Bids to increase demand

We assume that a bidder submits bids to increase demand as in example 1, with bid amounts per block of $b(3) = 1,000,100$ and $b(4) = 1,010,000$. These bids mean that, independently of the specified bid amounts, the bidder wishes to acquire a minimum of two and a maximum of four blocks at any price up to 1,100,000.

4.5.11 In each round, the bids submitted by the bidder must comply with the following restrictions:

- i The demand specified in each lot category must not exceed the number of blocks available.

- ii The amount of spectrum associated with the demand specified in lot categories A and B must not exceed the spectrum cap.
- iii The activity associated with the demand as specified across all lot categories must not exceed the bidder's bidding eligibility. Meaning of terms:
 - Activity means the sum of the bidding points calculated from the bid submitted by the bidder, further assuming that all bids to change demand are accepted to their full extent (i.e. the activity is determined based on the specified demand, not the confirmed demand—see the example given below).
 - In the first round, bidding eligibility is the total bidding points of the maximum number of blocks to be acquired under the spectrum cap. In following rounds, bidding eligibility equals the bidder's activity in the previous round.
- iv The total bid amount, which is calculated from the bids submitted while assuming that all bids to change demand are accepted to their full extent (see the example given below), must not exceed the bidder's bidding limit.

Restrictions ii) and iii) are also taken into account during bid processing (see 4.6).

Example 4: Determination of activity and total bid amount

We assume that a bidder submits a bid that

- increases their demand in lot category A from two to three blocks;
- leaves their demand in lot category B unchanged at a single block; and
- reduces their demand in all lot categories C1 to C7 from a single block to zero blocks.

The activity associated with this bid is calculated from its total bidding points, i.e. $30 + 10 = 40$. This is done independently of whether one of the bids to reduce demand in categories C1, C3, C4, C5 or C6 is not accepted, which would mean that it is not possible to change from all blocks in the 3600 MHz band to an additional block in the 26 GHz band and would, in turn, result in the total bidding points across confirmed demand being less than 40.

The total bid value of this bid is calculated by totalling the round prices in categories A and B, independently of the fact that the value for the confirmed demand may be lower or higher.

If a bid to reduce demand is submitted in multiple steps, then the total bid value is calculated by assuming that these steps will be accepted to their full extent. For example, the following bid in lot category A is assigned a value of zero for the overall bid calculation, independently of whether this demand reduction is accepted in whole or in part.

- 2 blocks at 1,000,000
- 1 block at 1,400,000
- 0 blocks at 1,800,000

4.5.12 Bids are submitted using the auction software and must be received within the period of time set for the round by the auctioneer. The submission of bids without EAS is permitted only in exceptional cases (see 1.2.2).

4.5.13 If a bidder does not submit a bid in a lot category in which their confirmed demand was positive in the previous round, then this is handled in bid processing as a bid to reduce the bidder's demand to zero at the initial price.

4.6 Bid processing

4.6.1 Once the round has ended, the auction system processes the bids submitted, including the bids generated according to 4.5.13.

4.6.2 Bid processing is as follows:

- i First, all bids that have left demand unchanged are confirmed in each lot category.
- ii The demand confirmed in the previous round is then temporarily confirmed for all bids submitted to change demand. This produces a temporarily confirmed overall demand for each lot category.
- iii Following this, bids to change demand are then processed sequentially in ascending order on the basis of price points, which are calculated from the bid amounts specified in each case. The price point for a bid to change demand is calculated as the initial price subtracted from the bid amount per block divided by the initial price subtracted from the round price (and is therefore between 0 and 1). The order in which bids with an identical price point are processed is decided randomly. This ordering of the bids results in a processing queue.

Example 5: Calculation of price points

We assume that a bidder submits bids to reduce demand as in example 2. This results in the following price points:

- For the bid to reduce demand from four to three blocks:

$$\frac{1,000,100 - 1,000,000}{1,100,000 - 1,000,000} = \frac{100}{100,000} = 0,001$$

- For the bid to reduce demand from three to two blocks:

$$\frac{1,010,000 - 1,000,000}{1,100,000 - 1,000,000} = \frac{10,000}{100,000} = 0.1$$

This ensures that the bid to reduce demand from four to three blocks will be processed before the bid to reduce demand from three to two blocks.

- iv During processing, a bid to change demand may be considered in whole or in part (unless it is an all-or-nothing bid), or may not be considered at all. This may result in a new temporarily confirmed

demand for a bidder in the respective lot category, which will then be used to update the temporarily confirmed overall demand in this lot category.

- v Bids to increase demand will be confirmed to the extent possible while considering the rules of activity and the spectrum caps, and in conjunction with the bids as previously confirmed and as temporarily confirmed for a specific bidder.
- vi Bids to reduce demand will be confirmed only insofar as these bids do not lead to excess supply or do not have the effect of augmenting any existing excess supply. An all-or-nothing bid will be confirmed to its full extent only if this does not result in excess supply. Otherwise, it will not be confirmed at all.
- vii Bids to change demand that are confirmed to their full extent will be removed from the processing queue. Bids that are not confirmed or not confirmed to their full extent remain in the queue. In subsequent processing steps, these bids are rechecked to see if the demand change can be confirmed to a greater extent.
- viii Once a bid has been confirmed in whole or in part, processing restarts. A check is then made to see whether there are bids in the processing queue with a lower price point that have not yet been confirmed or have not yet been confirmed to their full extent.
- ix Bid processing ends once all bids have been confirmed to their full extent and have therefore been removed from the queue or once it is no longer possible to confirm at least one of the remaining bids in the queue to a fuller extent while complying with the restrictions as given in (v) and (vi).

Once bid processing has completed, the temporarily confirmed demand for bidders becomes confirmed demand. This confirmed demand is then used to calculate the confirmed overall demand in each lot category as well as the initial price for the next round.

Example 6: Illustration of bid processing

For simplicity's sake, the following example assumes that only three lot categories exist. We assume the number of available blocks, the round prices and the bids from three bidders as presented in the table below. Each block is worth one bidding point.

	Category A (5 blocks)	Category B (1 block)	Category C (1 block)
Initial price	100	100	100
Round price	110	110	110
Confirmed total demand in previous round	6	3	1

Bidder 1	Demand stays at 3*	Demand stays at 1*	No bid Confirmed demand in previous round was 1* Price point: 0
Bidder 2	Reduction in demand from 3* to 0 at 105 Price point: 0.5	Demand stays at 1*	Increase in demand from 0* to 1 at 108 Price point: 0.8
Bidder 3	Increase in demand from 0* to 1 at 107 Price point: 0.7	Reduction in demand from 1* to 0 at 101 Price point: 0.1	No bid No demand in the previous round. Confirmed demand was 0*

* Indicates confirmed demand in previous round

Bid processing then proceeds as follows:

The temporarily confirmed overall demand is determined first, based on the bids that leave demand unchanged as well as the confirmed demand from the previous round for bids submitted to achieve a change in demand:

- Category A: 6
- Category B: 3
- Category C: 1

Following this, the queue of bids submitted to change demand is as follows:

- S1: Bidder 1, category C, 1 -> 0 (PP 0)
- S2: Bidder 3, category B, 1 -> 0 (PP 0.1)
- S3: Bidder 2, category A, 3 -> 0 (PP 0.5)
- S4: Bidder 3, category A, 0 -> 1 (PP 0.7)
- S5: Bidder 2, category C, 0 -> 1 (PP 0.8)

Bid S1 cannot be confirmed to its full extent because this would result in excess supply. S1 therefore remains in the queue. The temporarily confirmed demand for bidder 1 in category C is still 1 and the temporarily confirmed overall demand in category C also stays at 1.

Bid S2 can be confirmed to its full extent and is removed from the queue. The temporarily confirmed demand for bidder 3 in category B is 0 and the temporarily confirmed overall demand is 2. The new queue is as follows:

- S1: Bidder 1, category C, 1 -> 0 (PP 0)
- ~~S2: Bidder 3, category B, 1 -> 0 (PP 0.1)~~
- S3: Bidder 2, category A, 3 -> 0 (PP 0.5)
- S4: Bidder 3, category A, 0 -> 1 (PP 0.7)
- S5: Bidder 2, category C, 0 -> 1 (PP 0.8)

Bid processing restarts. Bid S1 still cannot be confirmed.

Bid S3 can be partially confirmed but not to its full extent. The maximum reduction in demand that can be accepted without creating excess supply in category A is a reduction from 3 blocks to 2 blocks. The temporarily confirmed demand for bidder 2 in category A is therefore 2 and the temporarily confirmed overall demand is 5. The bid remains in the queue.

Bid processing restarts. Bid S1 still cannot be confirmed. The same applies to bid S3.

Bid S4 can be confirmed to its full extent and is removed from the queue. The temporarily confirmed demand for bidder 3 in category A is 1 and the temporarily confirmed overall demand is 6. The new queue is as follows:

- S1: Bidder 1, category C, 1 -> 0 (PP 0)
- ~~S2: Bidder 3, category B, 1 -> 0 (PP 0.1)~~
- S3: Bidder 2, category A, 3 -> 0 (PP 0.5)
- ~~S4: Bidder 3, category A, 0 -> 1 (PP 0.7)~~
- S5: Bidder 2, category C, 0 -> 1 (PP 0.8)

Bid processing restarts. Bid S1 still cannot be confirmed. Bid S3 can now be confirmed to a greater extent but, as before, not to its full extent. The temporarily confirmed demand for bidder 2 in category A is 1 and the temporarily confirmed overall demand is 5. The new queue is as follows:

- S1: Bidder 1, category C, 1 -> 0 (PP 0)
- ~~S2: Bidder 3, category B, 1 -> 0 (PP 0.1)~~
- S3: Bidder 2, category A, 3 -> 0 (PP 0.5)
- ~~S4: Bidder 3, category A, 0 -> 1 (PP 0.7)~~
- S5: Bidder 2, category C, 0 -> 1 (PP 0.8)

Processing restarts—there are no changes in relation to bid S1 or bid S3.

Bid S5 can be confirmed to its full extent and is removed from the queue. The temporarily confirmed demand for bidder 2 in category C is 1 and the temporarily confirmed overall demand is 2. The new queue is as follows:

- S1: Bidder 1, category C, 1 -> 0 (PP 0)
- ~~S2: Bidder 3, category B, 1 -> 0 (PP 0.1)~~
- S3: Bidder 2, category A, 3 -> 0 (PP 0.5)
- ~~S4: Bidder 3, category A, 0 -> 1 (PP 0.7)~~
- ~~S5: Bidder 2, category C, 0 -> 1 (PP 0.8)~~

Bid processing restarts. Bid S1 can now be confirmed to its full extent and is removed from the queue. The temporarily confirmed demand for bidder 1 in category C is 0 and the temporarily confirmed overall demand is 1. The new queue is as follows:

- ~~S1: Bidder 1, category C, 1 -> 0 (PP 0)~~
- ~~S2: Bidder 3, category B, 1 -> 0 (PP 0.1)~~
- S3: Bidder 2, category A, 3 -> 0 (PP 0.5)
- ~~S4: Bidder 3, category A, 0 -> 1 (PP 0.7)~~
- ~~S5: Bidder 2, category C, 0 -> 1 (PP 0.8)~~

Bid processing restarts. Bid S3 still cannot be confirmed to any greater extent and processing therefore comes to an end.

The confirmed demand is therefore as follows:

	Category A (5 blocks)	Category B (1 block)	Category C (1 block)
Total	5	2	1
Bidder 1	3	1	0
Bidder 2	1	1	1
Bidder 3	1	0	0

The demand reduction submitted by bidder 2 in category A was not accepted to its full

extent. Since there is still excess demand in category A, a further round with new initial and round prices is therefore required. For the determination of these prices, cf. 4.7.

4.7 **Price determination**

- 4.7.1 On the basis of the bids as processed, a price is determined per lot category that is either set as the initial price for the next round or, if no further rounds are required, represents the final price for stage 1.
- 4.7.2 If the confirmed overall demand in a lot category exceeds supply, then the price corresponds to the round price for the round.
- 4.7.3 If the confirmed overall demand is the same as the supply in a lot category and at least one bid to reduce demand has been confirmed in whole or in part, then the price is the same as the highest bid amount from all bids submitted to reduce demand that were confirmed in whole or in part (i.e. the price corresponds to the price that exactly balances out the supply and demand).
- 4.7.4 If the confirmed overall demand is equal to or less than the supply in a lot category, without a bid for a reduction of the demand having been accepted, then the price corresponds to the initial price for the round.

Example 7: Illustration of price determination

The following prices are determined based on the bid processing in the previous example:

Category A: 105—the amount bid by bidder 2, whose demand reduction submitted at this price was confirmed in part.

Category B: 110—the round price for the round, because there is excess demand.

Category C: 100—the amount bid by bidder 1, in accordance with 4.5.13.

4.8 **End of stage**

- 4.8.1 The stage ends after a round in which the confirmed overall demand does not exceed supply in any lot category. The bidders receive blocks equal to their confirmed demand at the respective determined price.
- 4.8.2 If there is excess demand in at least one lot category, then another bidding round is held, in which the prices determined according to 4.7 are set as the initial prices.

4.9 **Information at the end of bidding rounds**

- 4.9.1 At the end of each bidding round, excepting the last bidding round in a stage, the auctioneer provides each bidder with the following information:
- i The bids submitted by the respective bidder.
 - ii The confirmed demand for the respective bidder in each lot category.

- iii The bidder's bidding eligibility for the next bidding round.
 - iv The remaining round extension rights for the respective bidder.
 - v The aggregated demand for each lot category.
- 4.9.2 At the end of the last bidding round in each stage, the auctioneer informs each bidder about the number of blocks awarded to the respective bidder in each category and at which price.

5 **Stage 2**

5.1 **General information**

- 5.1.1 Stage 2 is used for the assignment of specific frequencies to the winners of frequency blocks in lot category A (frequency range 26.5–27.5 GHz).
- 5.1.2 The assignment of spectrum is conducted in a sealed bidding procedure with a modified second-price rule, and bidders accordingly submit sealed bids for the assignment options available to them.
- 5.1.3 Bids are submitted using the auction software and must be received within the period of time set for the round by the auctioneer. The submission of bids without EAS is permitted only in exceptional cases (cf. 1.2.2). There are no round extensions in this bidding round.

5.2 **Assignment options**

- 5.2.1 After completion of the first stage, the auctioneer informs all winners about any assignment options that are relevant for them, namely all potential combinations of assignments of specific frequencies that ensure the following:
- i The bandwidth of the assignment corresponds exactly to the amount of spectrum that the respective bidder has won in the first stage.
 - ii The frequency assignments to a bidder within the particular frequency range are contiguous.
 - iii No option excludes the assignment of contiguous frequency blocks to other winners of spectrum in the particular frequency range or the maintenance of any non-assigned blocks as contiguous blocks at the upper or lower end of the respective band.

5.3 **Assignment bids**

- 5.3.1 Assignment bids are submitted using the auction software and must be received within the period of time set for the round by the auctioneer. There are no round extensions in this bidding round.
- 5.3.2 An assignment bid specifies the maximum amount that the bidder is prepared to pay for an assignment option in order to be assigned the spectrum specified in that option.

5.3.3 Any amount (as an integer multiple of 1,000 EUR) can be bid for the individual assignment options. The minimum bid in the assignment stage is EUR 0 for each assignment option. There is no ceiling set for maximum bids.

5.3.4 If bidders do not submit an assignment bid for a potential assignment option designated for them, a corresponding bid of EUR 0 is generated automatically for that option. If bidders do not submit an assignment bid before the end of the assignment round, bids with bid amounts of EUR 0 each are generated automatically for each assignment option.

5.4 **Determination of winners and prices**

5.4.1 After the end of the bidding round, the auctioneer determines, from all bids submitted by bidders and generated automatically by the auction software, the combination of bids in each case that is able to satisfy the following conditions:

- i Exactly one bid per bidder is considered.
- ii The assignment of frequency blocks associated with the bids is mutually compatible and spectrum is uniquely assigned.
- iii The sum of bid amounts is not lower than the sum of each alternative combination of bids that satisfies the first two conditions.
- iv If only a single combination of assignment bids satisfies the conditions given in (iii), then this is the combination of successful bids.
- v If multiple combinations of assignment bids meet the conditions given in (iii), then the combination of successful assignment bids is determined at random.
- vi Individual bidders receive the frequency blocks as specified in their bid within the successful combination of bids and pay the additional price in accordance with the rules below.

5.4.2 An additional price required to be paid by the successful bidder is determined for each successful assignment bid. Additional prices are determined collectively for all bidders and must meet the following conditions:

- i The additional price for each and every successful bid cannot be negative. The additional price for any and every successful bid cannot be higher than the amount bid.
- ii Additional prices are those prices with the lowest total value that satisfy the condition given in rule (i) and ensure that the combination of successful bids at the respective additional prices satisfies the conditions given in rule 5.4.1. Accordingly, additional prices are the lowest prices that successful individual bidders would have had to bid in order to have been successful with their bids.

- iii If only one combination of prices satisfies the conditions given in rules (i) and (ii), then those prices, rounded up to an integer euro value, are used as the additional prices.
- iv Where multiple groups of prices fulfil these conditions, the combination of additional prices is used that best approximates the combination of opportunity costs as determined for each winner individually, in each case rounded up to an integer euro value. The opportunity costs determined individually for a bidder constitute the lowest bid in accordance with rule (i), ensuring that the combination of successful bids satisfies the conditions in rule 5.4.1 if all other winners pay their original bid amount.

A formal description of the process for determining additional prices is provided in appendix B.

5.5 **End of stage 2**

5.5.1 Once the auctioneer has determined the successful additional bids and the additional prices to be paid for those bids, bidders are informed about the specific frequency assignments.

5.5.2 Individual bidders are also informed about the additional price they have to pay.

6 **End of the auction**

Once the auction is completed, all bidders are provided with the following information:

- The spectrum acquired by each bidder in each category.
- The overall price to be paid by each bidder.

Appendix B: Determination of additional prices

The following procedure results in additional prices that satisfy the criteria in rule 5.4.2.

The following definitions apply here:

- W : Number of bidders who have won spectrum in the band and who therefore participate in stage 3.
- β_i^* : Value of the successful assignment bid from bidder i in the combination of assignment bids determined in compliance with rule 5.4.1
- v^{-C} : Maximum bid value from the winners determined in accordance with rule 5.4.1 if the bids from bidders in $C \subseteq W$ are set to zero (that is, $v^{-W} = 0$ and $v^{-\emptyset} = \sum_{i \in W} \beta_i^*$)
- $\sigma(C)$: Opportunity costs of assignment of spectrum in the successful assignment bids of bidders in $C \subseteq W$, i.e. $\sigma(C) = v^{-C} - \sum_{i \notin C} \beta_i^*$.
- p_i Assignment price for bidder i

Step 1: Determine a price combination p^* that minimises revenues as a solution to the optimisation problem below:

$$\min \sum_{i \in W} p_i$$

applying the ancillary conditions:

$$\sum_{i \in C} p_i \geq \sigma(C) \forall C \subseteq W$$

Step 2: If $\sum_{i \in W} p_i^* = \sum_{i \in W} \sigma(\{i\})$, the solution is unambiguous and the prices that minimise revenues are identical to the individual opportunity costs

Step 3: Otherwise, determine the additional prices by solving the following optimisation problem:

$$\min \sum_{i \in W} (p_i - \sigma(\{i\}))^2$$

applying the ancillary conditions

$$\sum_{i \in C} p_i \geq \sigma(C) \forall C \subseteq W$$

$$\sum_{i \in W} p_i = \sum_{i \in W} p_i^*$$

Step 4: The prices determined are rounded up to integer EUR values.