

Proposals to make auction regulations for the mmWave award

Notice of Ofcom's proposal to make
regulations for the award of the 26 GHz and
40 GHz spectrum bands

Consultation

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1. Overview

- 1.1 In November 2023 and April 2024, we set out our decisions for awarding spectrum in the 26 GHz and 40 GHz bands. This document sets out our proposals for the Auction Regulations that would implement those decisions.

What we are proposing – in brief

This document provides notice of, and invites stakeholders' views on, Ofcom's proposals to make regulations for the award by auction of radio spectrum licences in the 26 GHz and 40 GHz bands. These regulations would give effect to the policy decisions set out in our auction design decision documents published on 8 November 2023 for the principal stage and 16 April 2024 for the assignment stage.

We invite comments on these proposals by 8 July 2024.

This overview is a simplified high-level summary only. The proposed regulations we are consulting on are described in the full document below, which should be read in conjunction with the auction design decision documents published on 8 November 2023 and 16 April 2024.

2. Notice

- 2.1 We are planning to award wireless telegraphy licences for equipment operating within the following spectrum bands: 2.4 GHz of spectrum within the 25.1-27.5 GHz frequency range (the “26 GHz band”) and 3 GHz of spectrum within the 40.5-43.5 GHz frequency range (the “40 GHz band”).
- 2.2 On [8 November 2023](#) and [16 April 2024](#), we published documents setting out our decisions for the award of these licences by auction. This document provides formal notice to stakeholders of our intention to give effect to such proposals by making The Wireless Telegraphy (Licence Award) Regulations 2024 (the “Auction Regulations”).
- 2.3 The proposed Auction Regulations set out the procedure and rules that will apply for the award of wireless telegraphy licences to operate within the bands. In particular, they set out and implement our decisions for the auction design, which are explained in more detail in sections 3, 4 and 5 of the 8 November 2023 publication, and in the 16 April 2024 publication. As mentioned in Section 4 of the [March 2023 Statement and Consultation](#), the award licences will authorise licensees to use the relevant frequencies within the 26 GHz and 40 GHz bands in 68 designated ‘high density areas’ (i.e. major UK cities, towns and transport hubs) as defined in [Annex 10](#) of the September 2023 Statement.
- 2.4 A link to the draft of the proposed Auction Regulations is included in Annex 5, and the general effect of the proposed Auction Regulations is explained in section 3 of this document.
- 2.5 We have also published, alongside this consultation, the illustrative auction procedures for the principal stage and for the assignment stage in Annex 6 and 7.

Next steps

- 2.6 In accordance with the requirements of section 122(4) and (5) of the Wireless Telegraphy Act 2006, this document gives notice of our intention to make the proposed regulations. We invite stakeholders to provide comments on the drafting of the proposed Regulations by 5pm on 8 July 2024.
- 2.7 Subject to this consultation, we intend to make the final Auction Regulations, in advance of the auction.
- 2.8 The proposed Regulations are set out in Annex 5 to this document, which are also available on [Ofcom’s website](#).

3. General effect of the proposed Wireless Telegraphy (Licence Award) Regulations

The legislative framework

- 3.1 Under section 14(1), (2), (3), (4), (6) and (7) of the Wireless Telegraphy Act 2006 (the “WT Act”), we may make regulations to allow wireless telegraphy licences to be awarded by means of an auction.¹
- 3.2 We are giving notice of our proposal to make auction regulations in relation to the award of frequencies in the 26 GHz and 40 GHz bands (the “Auction Regulations”).
- 3.3 A link to the draft of the proposed Auction Regulations is included in Annex 5.

The proposed regulations

- 3.4 The proposed Auction Regulations set out the procedure and rules that would apply for the award of wireless telegraphy licences to operate within specified frequencies.
- 3.5 The proposed award process involves several stages. These are:
 - a) the **application stage**, in which applicants can apply to Ofcom to take part in the award process (Part 2 of the proposed Auction Regulations);
 - b) the **qualification stage**, in which Ofcom decides which applicants are qualified to participate in the award process, records their existing spectrum holdings and calculates the overall bid constraint that applies to each bidder (Part 3 of the proposed Auction Regulations);
 - c) the **principal stage**, in which bidding takes place and in which it is determined which bidders have won rights to use frequencies and for how many ‘lots’, but not the specific frequencies to be assigned to each bidder (Part 5 of the proposed Auction Regulations);
 - d) the **assignment stage**, in which bidders can bid for specific frequencies, and specific frequencies are assigned to winning bidders, which correspond to the quantity of lots which they won in the principal stage (Part 6 of the proposed Auction Regulations); and
 - e) the **grant stage**, where the licence fee payable by a winning bidder is determined by Ofcom in accordance with the regulations and in which that fee is paid and licences granted (Part 7 of the proposed Auction Regulations).
- 3.6 The proposed Auction Regulations also contain a section setting out the rules that will apply to applicants and bidders regarding the forfeit of deposit and exclusion from the award process (Part 8 of the proposed Auction Regulations).
- 3.7 The proposed Auction Regulations have been drafted in a way that reflects the chronology of the award process in these different stages.

¹ When doing so, section 122(7) of the WT Act enables us to make different provision for different cases and to make incidental provision.

Extent of application of the regulations

- 3.8 The proposed Auction Regulations would apply in the United Kingdom but would not extend to the Channel Islands or to the Isle of Man. The geographic scope of the award licences will be limited to the 68 designated high density areas.

Entry into force of the regulations

- 3.9 The proposed Auction Regulations would come into force on a particular day which will be specified in the final regulations when they are made. This date has yet to be determined and will depend on a number of factors, including responses to this Notice.

The radio frequencies which are available for award

- 3.10 The frequencies which are available in the award process are set out in Schedule 1 to the proposed regulations. This Schedule is entitled “Lots”.
- 3.11 Bids made during the award process will be for a wireless telegraphy licence (granted under the WT Act 2006) which authorises the use of 26 GHz frequency lots, or for a wireless telegraphy licence which authorises the use of 40 GHz frequency lots.
- 3.12 The different types of lots which are available in the award process are:
- a) **26 GHz lower lot:** this category consists of seven 200 MHz lots of spectrum in the frequency range 25.1-26.5 GHz.
 - b) **26 GHz upper lot:** this category consists of five 200 MHz lots of spectrum in the frequency range 26.5-27.5 GHz; and
 - c) **40 GHz lot:** this category consists of fifteen 200 MHz lots of spectrum in the frequency range 40.5-43.5 GHz.

Application stage

- 3.13 The application stage is described in detail at Part 2 of the proposed Auction Regulations.
- 3.14 The application requirements include the submission of:
- a) an application form which is set out in Schedule 2 to the Regulations, and which includes warranties on the part of the applicant. It must be signed by two authorised persons;
 - b) a document for each person who is not an associate of the applicant, but whom the applicant wishes to join its applicant group, signed by that person and two authorised persons on behalf of the applicant; and
 - c) an initial deposit of £1,000,000.
- 3.15 In previous Ofcom spectrum auctions, the initial deposit was set at £100,000, and then there was a required additional deposit before bidding commenced of £900,000. We propose changes in this award process. We proposed (and this is reflected in the draft regulations) that the initial deposit is £1 million. This reflects the fact that reserve prices are set at £1 million for each 40 GHz lot available in the award process (and at £2 million for each 26 GHz lower lot and also for each 26 GHz upper lot). So, each applicant would need to have at least £1 million on deposit before the first round of bidding in any event.
- 3.16 We note that the application process set out in the draft regulations involves a “last day for withdrawal” from the award process. This is a date notified by Ofcom. If applicants withdraw before that date, the deposit is not forfeited.

- 3.17 The document mentioned at paragraph 3.14.b is intended to cover advisers and other persons to whom the applicant will reveal confidential information in connection with the award process. Revealing confidential information would breach the regulations if it were to a person who was not included within the same bidder group, and could lead to exclusion from the award process and forfeiture of deposits (Part 8 of the proposed Auction Regulations).
- 3.18 The concepts of ‘applicant group’ and ‘bidder group’ in the proposed Auction Regulations are to ensure that the persons within company groups, and their advisers, keep information confidential. Bidder groups should not have overlapping members, and there is to be a separation of bidders during the award process, to ensure the integrity of the award process.
- 3.19 Applicant groups include associates, and ‘associate’ is defined as a person with a material interest in the applicant. Material interest is also defined with reference to particular sections in the Companies Act 2006 in Part 1 of the proposed Auction Regulations. Members of an applicant’s group also include persons that are not associates of the applicant (and in relation to which the applicant has submitted the document mentioned at paragraph 3.14.b).
- 3.20 In exceptional circumstances, Ofcom may change the day, time or place for delivery of application forms or the payment of the initial deposit. Ofcom will take reasonable steps to inform interested parties of a change.

Qualification stage

- 3.21 The qualification stage is described in detail at Part 3 of the proposed Auction Regulations.
- 3.22 Following the date for receipt of applications, Ofcom will notify each applicant of the names and associates of each other applicant.
- 3.23 This notification will also set a deadline by when applicants must notify Ofcom whether or not any members of their applicant group are also associates of another applicant. In such cases, applicants must also notify the other applicant(s) concerned.
- 3.24 In parallel with this exercise, Ofcom will also consider whether any members of one applicant group are also members of another applicant group.
- 3.25 Where Ofcom determines that applicants are members of the same applicant group, Ofcom will notify the applicants concerned and specify a deadline by when all the common memberships must be resolved (for example, the time by which a common associate must have disposed of or otherwise removed its ‘material interest’ in one or both of the applicants concerned, or by which one of the applicants concerned must have withdrawn from the award process).
- 3.26 Ofcom will then record the details of the members of each applicant group. Where there has been a change in the composition of an applicant group, the applicant must provide new versions of the documents already submitted, following that change. Each applicant group so recorded constitutes a ‘bidder group’ for the subsequent stages of the award process.
- 3.27 Ofcom then considers whether each applicant is qualified to participate in the award process.

- 3.28 Each applicant considered fit to hold a licence (in accordance with the provisions of regulation 8) and not having an overlap in its bidder group with another applicant, will qualify to participate in the award process.
- a) During the qualification stage, Ofcom may request an applicant to provide additional information or documentation by a specified deadline. In making its determination of whether an applicant is fit to hold a licence, Ofcom will take into account any failure by the applicant to provide the additional information by the relevant deadline.
 - b) In addition, in making its determination of whether an applicant is fit to hold a licence, Ofcom will take into account a number of factors including, for example, any action that is likely to distort the outcome of the award process.
- 3.29 Ofcom will notify each applicant whether it has qualified to bid in the award process, including the reasons an applicant has not qualified.
- 3.30 Following qualification there will be a period within which applicants may withdraw from the award process if they wish to do so. If an applicant does withdraw, it will be excluded from the award process and, unless the initial deposit has been forfeited in accordance with the Auction Regulations, its initial deposit will be refunded.
- 3.31 Ofcom will return initial deposits to applicants who do not qualify to bid in the award process or who withdraw from the award process at the end of the qualification stage, unless the initial deposit has been forfeited in accordance with the Auction Regulations. No interest accrued, if any, will be returned to applicants.
- 3.32 After the last day for withdrawal, Ofcom will determine and publish the number and names of bidders.

Eligibility

- 3.33 Before the principal stage commences, bidders can pay an additional deposit (regulation 13) which will be taken into account by Ofcom in accordance with regulation 14 for calculating the bidder's eligibility limit for the first primary bid round of the principal stage.
- 3.34 The concept of an 'eligibility limit' is used in the proposed Auction Regulations to determine how many lots a bidder may bid for (as described in Part 5). During the principal stage, the eligibility points used by a bidder must not exceed the bidder's eligibility limit. The concept of 'eligibility points' is explained in more detail in paragraphs 3.60- 3.63 of this document.
- 3.35 In order to determine eligibility limits for each bidder for the first principal stage round, Ofcom calculates the maximum number of lots each bidder could bid for in the first principal stage round, given the amount the bidder has on deposit, and the first principal stage round price for each 26 GHz lower lot, 26 GHz upper lot, and 40 GHz lot (regulation 14).

The principal stage

- 3.36 The principal stage is described in detail in Part 5 of the proposed Auction Regulations.

The first principal stage round

- 3.37 For the first principal stage round, the round prices for each of the three types of lot are set (in regulation 20) at a price of:
- a) £2m for each lot in 26 GHz lower and 26 GHz upper; and
 - b) £1m for each lot in 40 GHz.

- 3.38 In the first round, the bidder specifies (regulation 21):
- a) the number of 26 GHz lower lots for which it wishes to bid for;
 - b) the number of 26 GHz upper lots which it wishes to bid for; and
 - c) the number of 40 GHz lots which it wishes to bid for.
- 3.39 Each bidder will end each round committed to pay a certain price per lot (the “posted price”) and quantity of lots in each lot type (the “posted demand”). After the end of the first round, Ofcom determines the posted demand for each bidder for each lot type to be the number of lots of that type which the bidder bid for in the first principal stage round (regulation 22).
- 3.40 The posted price for each lot type after the end of the first round will be the same as the prices set out in 3.38.a and 3.38.b (regulation 21).
- 3.41 In the first principal stage round, a bidder which does not bid for at least one lot is excluded from the auction (regulation 21).

Submitting decisions in the second and subsequent principal stage rounds

- 3.42 At the start of the second and following rounds in the principal stage of the auction, Ofcom will announce (and notify to each bidder) a range of prices for each lot type between an “opening price” and a “clock price” (regulation 26). Specifically, for each lot type:
- a) The opening price is the lowest price in the range; it is equal to the previous round’s posted price for that lot type, and is in whole thousands of pounds.
 - b) The clock price is the highest price in the range, must be higher than the opening price, and is in whole thousands of pounds.
- 3.43 In each round, a bidder must submit on the auction software system the number of lots of each lot type which it wishes to bid for at the clock price (regulation 27). This is described in the regulations as the target number. The target number may be any quantity from (and including) zero up to an including the total number of lots available for the lot type in question.
- 3.44 Each bidder must submit three sets of bids in every round. If a bidder does not enter onto the auction system a target number in respect of one of the lot types when the round is open, and the round ends without that information being added, the auction system will submit sets of bids on the bidder’s behalf. Regulation 31 makes clear that such a bidder is deemed to have submitted zero lots for the type in question. In this regard, the auction design differs from previous OFCOM spectrum awards.
- 3.45 Bidders are constrained in the number of lots they can bid for by the eligibility rule. The rule is that the number of eligibility points associated with a set of bids, must be within the eligibility limit (regulation 50). That limit depends on bids made in the most recent round.
- 3.46 Bidders are also constrained by the sums they have on deposit. OFCOM (under regulation 55) require additional deposits to be paid to OFCOM as the bidding progresses. If the sums required are not paid by the relevant deadline, that bidder may not bid in further rounds (regulation 56).
- 3.47 The set of bids which are required to be submitted depends on the target number of lots of each type which the bidder wishes to bid for at the clock price and which is selected by the bidder on the auctions system.
- 3.48 Each set of bids includes one bid for the target number of lots desired at the clock price. The other bids in the set depend upon whether the bidder maintained, increased or decreased

demand. The reason that sets of bids are required in each round, in addition to a bid for the target number of lots, is that in this auction design a bidder can win a number of lots different from the target number – depending on what other bidders bid in the round in question. The auction has been designed this way to avoid unsold spectrum lots. It also allows bidders to switch demand between lot types as the rounds progress.

- 3.49 Where the bidder has submitted a:
- a) target number equal to the bidder's posted demand in the corresponding lot type, the bidder is described in the regulations as maintaining demand at the clock price in that lot type;
 - b) target number larger than the bidder's posted demand in the corresponding lot type, then the bidder is described in the regulations as increasing demand in that lot type.
 - c) target number smaller than the bidder's posted demand in the corresponding lot type, then the bidder is described in the regulations as decreasing demand in that lot type.
- 3.50 Where the bidder is increasing demand or decreasing demand, the bidder will also need to specify a nominated price that is either the opening price, the clock price, or any price between the opening and clock price (regulation 29 and 30).
- 3.51 Where the bidder is decreasing demand, the bidder will also need to specify whether the bid is a simple set of bids to decrease demand, or an all or nothing set of bids to decrease demand (regulation 30).
- 3.52 The bidder's specification of a target number of lots in a lot type generates a number of bids, which are called a "set of bids". Each bid within the set will be for a number of lots at a sum of money. These bids represent the bidder's demand from the opening price (inclusive) to the clock price (inclusive), at every £1,000 price level. The sets of bids for:
- a) maintaining demand are detailed in regulation 28;
 - b) increasing demand are detailed in regulation 29; and
 - c) decreasing demand are detailed in regulation 30.
- 3.53 If a bidder does not submit a target number for a lot type, that bidder will be deemed to have submitted a target number of zero lots for that lot type (regulation 31).

Determination of posted demand and posted price in the second and subsequent principal stage rounds

- 3.54 Once the round has ended, Ofcom collects all the sets of bids and processes them to determine the round results. The process is outlined below. As per the first round, each bidder will end each round committed to pay a certain price per lot (the "posted price") and quantity of lots in each lot type (the "posted demand").
- 3.55 The process for determining each bidder's posted demand for each lot type is specified in regulations 32 to 44:
- a) Ofcom collects all sets of bids to increase and all sets of bids to decrease demand across all lot types.
 - b) Ofcom calculates the price point (regulations 33 and 34) for all sets of bids to increase demand and all sets of bids to decrease demand.
 - c) Ofcom arranges (under regulation 35) all sets of bids to increase and all sets of bids to decrease demand in a ranking list in ascending order of price points. The ranking list determines the order in which Ofcom will consider each set of bids.

- d) In turn, Ofcom (under regulations 41 to 44) considers each set of bids to increase and each set of bids to decrease in the ranking list against two conditions to determine whether they can be removed from the ranking list or accorded reduced status (regulation 36).
The two conditions are:
 - i) Current excess demand (as defined in regulation 40) for a lot type cannot drop below (or further below) zero.
 - ii) A bidder's current eligibility capacity (as defined in regulation 42) cannot drop below zero.
- e) Each time a set of bids is removed from the ranking list or accorded reduced status, Ofcom (under regulation 37) remakes the ranking list including the sets of bids that have been accorded reduced status but excluding the sets of bids that have been removed from the list. Ofcom will then consider each set of bids in the new list starting from the top.
- f) Ofcom (under regulation 38) shall end the selection process once all sets of bids to increase and all sets of bids to decrease have been considered at least once and no set of bids can be removed from the ranking list or be accorded reduced status.

3.56 The posted price at the end of the round is equal to (under regulation 48):

- a) the clock price if current excess demand is greater than zero.
- b) the highest nominated price amongst all prices associated with the sets of bids to decrease which have been removed from the list or accorded reduced status if current excess demand is equal to zero.
- c) the opening price if current excess demand is equal to zero and no set of bids to decrease demand was removed from the list or accorded reduced status.
- d) The opening price if current excess demand is lower than zero.

3.57 The posted demand for each bidder for each lot type at the end of the round is equal to:

- a) The target number of lots nominated by a bidder, if that bidder has submitted a set of bids to maintain demand (regulation 46).
- b) The bidder's currently selected demand (as defined in regulation 39) at the end of the selection process (regulation 47), if that bidder has submitted a set of bids to increase demand or a set of bids to decrease demand.

3.58 Ofcom will also determine the excess demand for each lot type. Ofcom will do this, for each lot type, by subtracting the number of lots available in the award process from the sum of posted demand across all bidders (regulations 49).

End of the principal stage

3.59 After the end of each principal stage round, Ofcom shall determine whether there will be a further principal stage round. There will be a further principal stage round if there is positive excess demand for any of the lot types (regulation 58).

Eligibility points

3.60 Eligibility points are designed in part to encourage bidders to submit bids and decisions in a consistent fashion.

3.61 A bidder's eligibility limit in the first principal stage round is based on its total financial deposit payment before the start of the principal stage (regulation 14). In subsequent

rounds, a bidder's eligibility limit will be the number of eligibility points associated with its posted demand in the most recent round, as set out in regulations 53 and 54.

- 3.62 Each lot of 26 GHz lower and 26 GHz upper is associated with two eligibility points, and each lot of 40 GHz is associated with one eligibility point, as set out in regulation 51.
- 3.63 In the any round of the principal stage (including the first), a bidder cannot submit bids with a total eligibility, summed across all three lot types, greater than its eligibility limit (regulation 50).

Information made available during the principal stage bid rounds

- 3.64 Before the second principal stage round (and each subsequent principal stage round), Ofcom will notify a bidder of (regulation 25):
- a) Its eligibility limit for the next round;
 - b) the price range which applies in the next round to each lot type;
 - c) its posted demand in respect of each lot type from the last round;
 - d) the posted price for each lot type from the last round;
 - e) the excess demand for each lot type;
 - f) the date on which, and the times on that date within which, the next principal stage round will take place.
- 3.65 After the end of each day of the principal stage, Ofcom will publish on its website the level of excess demand for each lot type and the posted price for each lot type (regulation 57).

Determination of winning principal stage bids

- 3.66 When Ofcom determines there will be no further principal stage rounds (i.e. the principal stage has ended) each bidder will have won (regulation 59):
- a) the number of lots corresponding to their posted demand for 26 GHz lower lots;
 - b) the number of lots corresponding to their posted demand for 26 GHz upper lots; and
 - c) the number of lots corresponding to their posted demand for 40 GHz.
- 3.67 Each winning bidder will be committed to paying a "base price" for each lot of spectrum it has won (regulation 60). The base price for a lot of:
- a) 26 GHz lower is the posted price for 26 GHz lower in the last principal stage round;
 - b) 26 GHz upper is the posted price for 26 GHz upper in the last principal stage round;
 - c) 40 GHz is the posted price for 40 GHz in the last principal stage round.

Deposits during the principal stage

- 3.68 When a bidder has on deposit with Ofcom an amount which is less than its financial exposure in any round, Ofcom may require it to increase its deposit.
- 3.69 A bidder's financial exposure following a round corresponds to the sum of the following:
- a) that bidder's posted demand for 26 GHz lower lots, multiplied by the posted price for 26 GHz lower lots;
 - b) that bidder's posted demand for 26 GHz upper lots, multiplied by the posted price for 26 GHz upper lots; and
 - c) that bidder's posted demand for 40 GHz lots, multiplied by the posted price for 40 GHz lots.
- 3.70 Where Ofcom requires a bidder to increase its deposit during the principal stage, the further sum owed shall be no greater than the difference between the bidder's highest financial

exposure from any previous round, and the amount the bidder has on deposit (regulation 55).

- 3.71 The reason for this rule is to minimise non-payment risk and consequential effects and risks for other bidders who take part in the award.
- 3.72 Where a bidder fails to comply with a request from Ofcom that it increase its deposit, that bidder will not be entitled to submit any further principal stage bids (regulation 56). It will also be unable to submit an assignment stage bid form, which means it is deemed to have made assignment stage bid with a value of zero pounds (regulation 56).
- 3.73 Separately, a final principal stage deposit is required once the winning principal stage bids have been determined (regulation 64). A bidder's required final principal stage deposit shall be an amount such that the total amount the bidder has on deposit is at least its financial exposure for the last principal stage round. It will therefore reflect the base price for its winning principal stage bids.
- 3.74 In accordance with regulation 64, where the bidder does not provide Ofcom with the required final principal stage deposit by the deadline specified by Ofcom, it will not be allowed to submit an assignment stage bid form. In these circumstances, the bidder will be deemed to have made a valid assignment stage bid of zero pounds for all assignment stage options.

Publication of the principal stage results

- 3.75 In accordance with regulation 63, after the end of the principal stage, Ofcom will publish on its website the names of the winning bidders and, for each winning bidder, the number of lots won in each lot type and base prices. Ofcom will have already notified the bidders of the information published on the website, as detailed in regulation 62.

Process

- 3.76 Bidders are required to use the online auction system to submit their principal stage bid decisions. The deadline for submission of the decisions is set by Ofcom before the start of each round and will be notified to bidders.
- 3.77 If needed, Ofcom can alternatively substitute another electronic or manual system for bidders to submit principal stage decisions.

The assignment stage

- 3.78 The assignment stage is described in detail in Part 6 of the proposed Auction Regulations.
- 3.79 In what follows, "first period" means the period from the grant of the licence until 30th June 2029, and "second period" means the period after 30th June 2029.
- 3.80 There are four overall steps in the assignment stage, which are (regulation 71):
- i) the first assignment stage round for the assignment of 40 GHz lots for the first period and the second period and for the assignment of 26 GHz lower lots for the first period;
 - ii) the second assignment stage round for the assignment of 26 GHz upper lots for the first period;
 - iii) the assignment of 26 GHz upper lots and 26 GHz lower lots for the second period without bidding;

- iv) the third assignment stage round for the assignment of any 26 GHz lower lots and any 26 GHz upper lots (which were not assigned without bidding under subparagraph (iii)) for the second period by bidding.
- 3.81 Ofcom will inform the relevant bidders before each assignment stage round of the date and time of the assignment stage round, as well as the assignment stage options available to a bidder (regulation 97).

Assignment by bidding

- 3.82 In every assignment stage round (and separately for 40 GHz and 26 GHz lower in the first assignment stage round), Ofcom determines what assignment stage options a bidder may bid for. Each assignment stage option must satisfy the following rules:
- a) Each option would assign the bidder a contiguous frequency block of bandwidth that corresponds to the number of lots the bidder won in the principal stage;
 - b) If the bidder were assigned that assignment stage option:
 - i) All other winning bidders could be assigned a contiguous frequency block of bandwidth that corresponds to the lots each bidder won in the principal stage; and
 - ii) Any unsold spectrum (or leftover lots) would follow the relevant rules outlined below.
- 3.83 Any leftover lots in:
- a) 26 GHz lower would be placed as one contiguous block at the lowermost portion of the 26 GHz band (i.e. the leftover lots would include 26 GHz lower lot 1);
 - b) 26 GHz upper would be placed as one contiguous block at the uppermost portion of the 26 GHz band (i.e. the leftover lots would include 26 GHz upper lot 12); and
 - c) 40 GHz would form a contiguous frequency block to be located anywhere in the band.
- 3.84 There are also additional rules on each bidder's options in 26 GHz lower first period and 26 GHz upper first period. These are based on whether bidders won spectrum in only one of the two lot types in the principal stage, or in both lot types.
- 3.85 Winning principal stage bidders may place a bid on each of their assignment stage options, but are not required to submit any assignment stage bids. In order to bid for an assignment stage option, a bidder must specify on its assignment stage form the amount it would be willing to pay for that option and submit its completed assignment stage form to Ofcom using the electronic auction system. The Auction Regulations also set out alternative methods for submitting assignment stage forms if necessary.

Step 3: assignment without bidding

- 3.86 Assignment without bidding is outlined in regulation 88.
- 3.87 Any winner that won 26 GHz lower lots in the principal stage, but not 26 GHz upper lots, will be assigned the same lots for the second period as determined for the 26 GHz lower lots for the first period. Any winner that won 26 GHz upper lots in the principal stage, but not 26 GHz lower lots, will be assigned the same lots for the second period as determined for the 26 GHz upper lots for the first period. Any leftover lots in 26 GHz lower and 26 GHz upper will also be assigned to the same lots in the second period as determined in the first period.
- 3.88 If there is only one principal stage winner that won lots in both 26 GHz lower and upper, then that winner will be assigned the same lots for the second period as determined for the 26 GHz lower and upper lots for the first period.

Determination of winning assignments and additional prices

- 3.89 Ofcom will determine the winning assignment stage bids for each assignment stage round (26 GHz lower and 40 GHz will be calculated separately in the first round) in accordance with regulations 76, 81, 86 and 92.
- 3.90 The winning combination of assignment stage bids will be the valid combination of assignment stage bids having the highest total value of amounts bid.
- 3.91 Winning bidders may have to pay 'additional prices', as set out in regulations 77, 82, 87 and 93.
- 3.92 At the end of each assignment stage round, as detailed in regulation 104, Ofcom will inform each bidder of:
- a) Any assignment stage option (which may be two for assignment stage round 1) for which the bidder made a winning assignment stage bid; and
 - b) Any additional prices that the bidder may have to pay for that assignment stage round.

Required assignment stage deposit

- 3.93 For each assignment stage round, by a deadline to be specified by Ofcom, bidders need to have on deposit at least the amount which is the bidder's total base price for its winning principal stage bids, plus the amount which is the bidder's total price for its winning assignment stage bids in previous assignment stage rounds (if any), plus the amount corresponding to the bidder's highest assignment stage bid for the assignment stage round in question.² This is detailed in regulations 101, 102 and 103.
- 3.94 Where the bidder fails to pay any required assignment stage deposit, it shall be deemed to have made a valid assignment stage bid of zero pounds for all assignment stage options in that round.
- 3.95 Certain rules under the Regulations regarding exchange of confidential information between bidders would not apply, to facilitate spectrum trading between winning bidders in the 26 GHz and 40 GHz bands, between notification of all the assignment stage results and completion of the award process (regulation 124(2)). Winning bidders may start negotiating trades of their award licences a few days before we grant such licences, ready to submit a trading application to Ofcom as soon as the award process is completed.

The grant stage

- 3.96 The grant stage is described in detail in Part 7 of the proposed Auction Regulations.

Licences available in the auction

- 3.97 Regulation 107 sets out the licences which Ofcom proposes to make available under the auction. These are:
- a) 40 GHz licences;
 - b) 26 GHz lower lot first period licence;
 - c) 26 GHz upper lot first period licence; and
 - d) 26 GHz lot second period licence.

² For the first assignment stage round, the bidder must have on deposit the sum total of the highest bid in 26 GHz and the highest bid in 40 GHz.

- 3.98 Following the end of the assignment stage, Ofcom will determine (for each licence to be awarded under the auction) the particular licence fee and the precise frequencies to be included in the licence.

Licence fees and total auction sums

- 3.99 Separate licence fees will be calculated in respect of each licence that a winning bidder has won.
- 3.100 A winning bidder's 40 GHz licence fee, detailed in regulation 108, is the sum of the 40 GHz lot total base price and the bidder's 40 GHz lot additional price (if any).
- 3.101 A winning bidder's 26 GHz lower licence fee for the first period, detailed in regulation 109, is the sum of the 26 GHz lower total base price and the bidder's 26 GHz lower lot first period additional price (if any).
- 3.102 A winning bidder's 26 GHz upper licence fee for the first period, detailed in regulation 110, is the sum of the 26 GHz upper total base price and the bidder's 26 GHz upper lot first period additional price (if any).
- 3.103 A winning bidder's 26 GHz licence fee for the second period, detailed in regulation 111, is the second period additional price (if any).
- 3.104 The total auction sum is the amount payable by a bidder before Ofcom will grant any licences. The total auction sum payable by a winning bidder is the sum of its licence fees (regulation 116).
- 3.105 When Ofcom has determined the total auction sum payable by each winning bidder, it will notify each bidder of its total auction sum. It will also set a deadline by which bidders that have less than their total auction sum on deposit must increase their deposit to the level of the amount owed (regulations 117 and 118).
- 3.106 Regulation 119(2) provides that, where a bidder does not have its total auction sum on deposit by the deadline specified by Ofcom, it will not receive a refund of its deposit, which will (where not already forfeited) be forfeited. It will also not be entitled to the grant of any licences and will remain liable to pay the total auction sum to Ofcom.

Granting of licences and payment of refunds

- 3.107 If a winning bidder has its total auction sum on deposit with Ofcom by the deadline specified under regulation 118, then, under regulation 119, Ofcom will grant licences to that bidder for the relevant frequencies assigned and refund to the bidder the difference (if any) between the amount of that deposit (less any sum forfeited) and the total auction sum (regulations 121).
- 3.108 Interest, if any, will not be paid to applicants or bidders.

Completion of the award process

- 3.109 After the grant of licences, and the payment of refunds to bidders, Ofcom will complete the award process by publishing on the Ofcom website the names of all the licensees, the details of the frequency ranges comprised in the licences awarded, the licence fees and details of the bids (regulation 123). Where a bidder did not meet the requirements relating to the amount payable, Ofcom will also publish the details of the licences which would have been awarded, and fees which would have been paid.

Forfeit of deposit and exclusion

- 3.110 The proposed Regulations contain rules concerning the forfeit of deposits and exclusion of qualified applicants or bidders in Part 8.
- 3.111 A list of events is set out in regulation 126, and the occurrence of such events can lead to forfeiture of deposits and exclusion from the award process, as set out in regulation 124. Bids made by excluded bidders are deemed to be invalid, as set out in regulation 125.

A1. Responding to this consultation

How to respond

- A1.1 Ofcom would like to receive views and comments on the issues raised in this document, by 5pm on 8 July 2024.
- A1.2 You can download a response form from <https://www.ofcom.org.uk/consultations-and-statements/category-2/proposals-to-make-auction-regulations-for-the-mmwave-award>. You can return this by email or post to the address provided in the response form.
- A1.3 If your response is a large file, or has supporting charts, tables or other data, please email it to mmwave.allocation@ofcom.org.uk, as an attachment in Microsoft Word format, together with the cover sheet.
- A1.4 Responses may alternatively be posted to the address below, marked with the title of the consultation:
- Enabling mmWave spectrum for new uses.
Ofcom
Riverside House
2A Southwark Bridge Road
London SE1 9HA
- A1.5 We welcome responses in formats other than print, for example an audio recording or a British Sign Language video. To respond in BSL:
- send us a recording of you signing your response. This should be no longer than 5 minutes. Suitable file formats are DVDs, wmv or QuickTime files; or
 - upload a video of you signing your response directly to YouTube (or another hosting site) and send us the link.
- A1.6 We will publish a transcript of any audio or video responses we receive (unless your response is confidential)
- A1.7 We do not need a paper copy of your response as well as an electronic version. We will acknowledge receipt of a response submitted to us by email.
- A1.8 You do not have to answer all the questions in the consultation if you do not have a view; a short response on just one point is fine. We also welcome joint responses.
- A1.9 It would be helpful if your response could include direct answers to the questions asked in the consultation document. The questions are listed at Annex 4. It would also help if you could explain why you hold your views, and what you think the effect of Ofcom's proposals would be.
- A1.10 If you want to discuss the issues and questions raised in this consultation, please contact Arianna Pedrinzani on 020 7783 4192, or by email to mmwave.allocation@ofcom.org.uk.

Confidentiality

- A1.11 Consultations are more effective if we publish the responses before the consultation period closes. This can help people and organisations with limited resources or familiarity with the issues to respond in a more informed way. So, in the interests of transparency and good regulatory practice, and because we believe it is important that everyone who is interested in an issue can see other respondents' views, we usually publish responses on the Ofcom website at regular intervals during and after the consultation period.
- A1.12 If you think your response should be kept confidential, please specify which part(s) this applies to and explain why. Please send any confidential sections as a separate annex. If you want your name, address, other contact details or job title to remain confidential, please provide them only in the cover sheet, so that we don't have to edit your response.
- A1.13 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and try to respect it. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.
- A1.14 To fulfil our pre-disclosure duty, we may share a copy of your response with the relevant government department before we publish it on our website.
- A1.15 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's intellectual property rights are explained further in our Terms of Use.

Next steps

- A1.16 Following this consultation period, Ofcom plans to publish a statement.
- A1.17 If you wish, you can register to receive mail updates alerting you to new Ofcom publications.

Ofcom's consultation processes

- A1.18 Ofcom aims to make responding to a consultation as easy as possible. For more information, please see our consultation principles in Annex 2.
- A1.19 If you have any comments or suggestions on how we manage our consultations, please email us at consult@ofcom.org.uk. We particularly welcome ideas on how Ofcom could more effectively seek the views of groups or individuals, such as small businesses and residential consumers, who are less likely to give their opinions through a formal consultation.
- A1.20 If you would like to discuss these issues, or Ofcom's consultation processes more generally, please contact the corporation secretary:
- A1.21 Corporation Secretary
Ofcom
Riverside House
2a Southwark Bridge Road
London SE1 9HA
Email: corporationsecretary@ofcom.org.uk

A2. Ofcom's consultation principles

Ofcom has seven principles that it follows for every public written consultation:

Before the consultation

A2.1 Wherever possible, we will hold informal talks with people and organisations before announcing a big consultation, to find out whether we are thinking along the right lines. If we do not have enough time to do this, we will hold an open meeting to explain our proposals, shortly after announcing the consultation.

During the consultation

A2.2 We will be clear about whom we are consulting, why, on what questions and for how long.

A2.3 We will make the consultation document as short and simple as possible, with an overview of no more than two pages. We will try to make it as easy as possible for people to give us a written response.

A2.4 We will consult for up to ten weeks, depending on the potential impact of our proposals.

A2.5 A person within Ofcom will be in charge of making sure we follow our own guidelines and aim to reach the largest possible number of people and organisations who may be interested in the outcome of our decisions. Ofcom's Consultation Champion is the main person to contact if you have views on the way we run our consultations.

A2.6 If we are not able to follow any of these seven principles, we will explain why.

After the consultation

A2.7 We think it is important that everyone who is interested in an issue can see other people's views, so we usually publish the responses on our website at regular intervals during and after the consultation period. After the consultation we will make our decisions and publish a statement explaining what we are going to do, and why, showing how respondents' views helped to shape these decisions.

A3. Consultation coversheet

Basic details

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

Confidentiality

Please tick below what part of your response you consider is confidential, giving your reasons why

- Nothing
- Name/contact details/job title
- Whole response
- Organisation
- Part of the response

If you selected 'Part of the response', please specify which parts:

If you want part of your response, your name or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

Yes No

Declaration

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom aims to publish responses at regular intervals during and after the consultation period. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here.

Name

Signed (if hard copy)

A4. Consultation questions

Question 1: Do you have any comments on our proposals to make Wireless Telegraphy (Licence Award) Regulations [2024], which are set out in draft form in Annex 5?

A5. Draft of the Wireless Telegraphy (Licence Award) Regulations 2024

A5.1 This annex is [published as a separate document](#).

A6. Illustrative auction procedures for the principal stage

Introduction

- A6.1 In Annex 6 of the November 2023 Statement and Consultation³, we set out the illustrative auction procedures for the principal stage of the award. Additionally, in section 4 of the April 2024 Statement,⁴ we said we were minded to increase the initial deposit that applicants will be required to submit from £100k to £1m.
- A6.2 We are now republishing the illustrative auctions procedures for the application and principal stages, so that these may be read in conjunction with the draft Auction Regulations. As noted in paragraph A9.1 of the March 2023 Statement and Consultation,⁵ we are providing these procedures for illustrative purposes only, to help stakeholders understand the auction design. For the avoidance of doubt, the Auction Regulations will take precedence in case of any differences.
- A6.3 This version of the illustrative auction procedures for the principal stage reflects the proposed increase of the initial deposit, and includes annotations where key terms differ from those used in the draft Auction Regulations.

Application and initial deposit

- A6.4 Applicants will be required to provide Ofcom with certain information in order to apply to participate in the auction. The information to be provided to Ofcom, the deadline for its submission and the form of submission will be specified by Ofcom.
- A6.5 Along with their application, applicants will be required to submit an initial monetary deposit of £1,000,000, which might be forfeited in whole or in part if the applicant subsequently breaches the Auction Regulations. Any interest on deposits will be retained by Ofcom and passed to HM Treasury.
- A6.6 After the deadline for applications, Ofcom will notify each applicant of the name of every other applicant and its “associates” (i.e., every person having a material interest in the other applicants’ businesses). Applicants will then need to ensure they comply with the auction rules which will not allow for two or more associated applicants to participate in the auction (the “bidder association rules”).⁶ They will need to do so by a deadline specified by Ofcom, and it may be the case that some applicants have to withdraw their application to prevent another applicant from failing to qualify in the auction.

³ [November 2023 Statement and Consultation](#)

⁴ [April 2024 Statement](#)

⁵ [March 2023 Statement and Consultation, annex 9](#)

⁶ Other qualification criteria to ensure that applicants are suitable to hold a licence will also apply. The provisions for qualification are similar to those used in recent awards by Ofcom and are specified in the draft Auction Regulations.

- A6.7 After the deadline for complying with the bidder association rules, Ofcom will assess which applicants qualify to participate in the auction. To do so, Ofcom may require additional information from specific applicants.
- A6.8 Following the last day for withdrawals from the award, Ofcom will determine the list of qualified applicants (i.e., “bidders”), and return the initial deposit to any applicants who fail to qualify. Only qualified applicants will be allowed to participate in the auction.
- A6.9 Before the first round of the auction takes place, each bidder may decide to provide an additional deposit to Ofcom, which will determine the bidder’s initial eligibility limit. This will be in addition to the initial monetary deposit of £1,000,000. The initial eligibility limit will determine the maximum number of lots that the bidder can bid for in the first round of the auction.

Electronic Auction System

- A6.10 The auction will be run over the internet using an Electronic Auction System (“EAS”). No specialist hardware or software will be required on bidders’ terminals, as the EAS interface will run on a standard web browser.
- A6.11 Ofcom also expects to make a stand-alone version of the software available to applicants a few days after they have applied to participate in the auction. This software will replicate the EAS and will be available to bidders until shortly before the auction begins. Applicants will be able to use it to practise bidding, as part of their internal training.

Lot structure

Lot categories

- A6.12 We will make licences for the relevant spectrum available for bidding in the following lot categories⁷, which all relate to the use of spectrum in high density areas:
- 26 GHz lower:** this lot category consists of 7x200 MHz lots of spectrum in the frequency range 25.1-26.5 GHz.
 - 26 GHz upper:** this lot category consists of 5x200 MHz lots of spectrum in the frequency range 26.5-27.5 GHz.
 - 40 GHz:** this lot category consists of 15x200 MHz lots of spectrum in the frequency range 40.5-43.5 GHz.

Eligibility

- A6.13 The eligibility points associated with each lot within a lot category are:
- 2 eligibility points for each of the 7 lots of spectrum in the 26 GHz lower lot category.
 - 2 eligibility points for each of the 5 lots of spectrum in the 26 GHz upper lot category.
 - 1 eligibility point for each of the 15 lots of spectrum in the 40 GHz lot category.

⁷ In the Auction Regulations, a lot category is defined as a “lot type”.

Principal stage

Use of frequency generic lots

A6.14 The first stage of the auction (the “principal stage”) determines the number of frequency generic lots that each bidder would win in each lot category, and the associated prices for these lots. The specific frequencies are then determined in the assignment stage.

Clock auction format

A6.15 The principal stage uses the clock auction format.

Overview of the principal stage

A6.16 The principal stage consists of a number of rounds. In the first round, bidders request a number of lots, in each lot category, at the first round prices (which are equal to the reserve prices set by Ofcom).

A6.17 In each of the following rounds, Ofcom defines a range of prices for each lot in every lot category, by announcing an opening price and a clock price for each lot category. The opening price is the lowest price in the range and the clock price is the highest price in the range. Bidders must specify through bids how their demand changes (if at all) across the range of prices in each lot category. Bidders can either:

- a) maintain their demand from the previous round at all prices up to and including the clock price by submitting a bid to maintain demand, or
- b) request to change their demand from the previous round by specifying: (i) the bid type (i.e. a simple bid to decrease demand, an all of nothing bid to decrease demand or a bid to increase demand), (ii) the number of lots by which they wish to change their demand and (iii) the price (in the range) from which they request their demand to change. The nominated price of any changes in demand must be a price expressed in whole thousands of pounds and must be between, and including, the opening price and the clock price.

A6.18 At the end of each round, each bid to maintain demand is fully applied, while each bid to change demand is processed to check whether the change can be fully, partially, or not at all applied. A bid to decrease demand is fully applied if the change does not cause unsold spectrum in a lot category, while a bid to increase demand is fully applied if the change does not cause the bidder to exceed its eligibility limit.

A6.19 At the end of each round, if there is excess demand in at least one lot category, prices increase in all lot categories with excess demand and the principal stage continues. The principal stage ends when there is no excess demand in any lot category.

Scheduling of rounds

A6.20 Ofcom will inform bidders of the round schedule for each bidding day. We expect to set rounds that last between 15 to 45 minutes and intend to provide bidders with at least 15 minutes’ notice before the start of a round.⁸

⁸ We expect to set rounds with a longer duration early in the auction.

A6.21 When a round is scheduled, the start and the end time of the round will be announced by Ofcom.

First round in the principal stage

Prices

A6.22 The prices in the first round are the reserve prices set by Ofcom. Specifically, they are:

- a) £2m for each of the 7 lots of spectrum in the 26 GHz lower lot category.
- b) £2m for each of the 5 lots of spectrum in the 26 GHz upper lot category.
- c) £1m for each of the 15 lots of spectrum in the 40 GHz lot category.

Bid submission

A6.23 In the first round, bidders request a number of lots at the first round prices in each lot category.

A6.24 Subject to their eligibility limit (which is described below), bidders can request any number of lots from zero up to the available supply in each lot category.

Bidder's eligibility limit for the first round

A6.25 Bidders begin the first round with a set number of eligibility points. This is their “**eligibility limit**” for the first round.

A6.26 Each bidder's eligibility limit for the first round is calculated as: the bidder's deposit divided by £1 million, up to a maximum of 39 eligibility points.⁹

A6.27 A bidder's combination of bids (for each lot category) in the first round must not exceed the bidder's eligibility limit in that round. For example, if a bidder's eligibility limit for the first round is 24 eligibility points, the bidder could place bids for 3 lots in 26 GHz lower, 3 lots in 26 GHz upper, and 12 lots in 40 GHz. This is for a total of $(3 \times 2) + (3 \times 2) + (12 \times 1) = 24$ eligibility points, and thus within the limit.

A6.28 The bidder cannot submit bids for a total of eligibility points higher than its eligibility limit. The EAS will warn the bidder in such a situation.

End of the first round

A6.29 Each bidder ends the round committed to pay a certain price per lot (the “**posted price**”¹⁰) for a licence including a certain quantity of lots in each lot category (the “**posted demand**”).

A6.30 At the end of the first round, each bidder's posted demand is equal to the number of lots requested in the bidder's first round bid, with posted prices equal to first round prices (and to the reserve prices).

A6.31 Excess demand in a lot category is calculated as the difference between the aggregate demand for lots and the available supply of lots. Excess demand can be positive (i.e., there is excess demand in the lot category), negative (i.e., there is excess supply in the lot category), or zero (i.e., aggregate demand is equal to supply).

⁹ The calculation is rounded down to the nearest whole number in the event that the calculation results in a number that is not an integer.

¹⁰ A separate posted price is associated with each lot category and is the same for all bidders.

Second and following rounds in the principal stage

Prices

- A6.32 At the start of the second and following rounds in the principal stage of the auction, Ofcom will announce a range of prices for each lot category consisting of all price levels (i.e. all prices expressed in whole thousands of pounds) between an “opening price” and a “clock price”. Specifically:
- The **opening price** is the lowest price in the range; it is equal to the previous round’s posted price.
 - The **clock price** is the highest price in the range; it is the maximum to which the price for that lot category can rise in the current round.

Bid submission

A6.33 Each bidder begins the round committed to pay the opening price for each lot included in its previous round’s posted demand in every lot category. Bidders must specify through bids how their demand changes across the range of prices in each lot category.

A6.34 Each bidder can submit any one of the following types of bids in a lot category, which we outline in more detail below providing illustrative examples: ¹¹

- Bid to maintain demand;¹²
- Simple bid to decrease demand;¹³
- All or nothing bid to decrease demand;¹⁴
- Bid to increase demand.¹⁵

A6.35 Where a bidder submits a bid to change its demand in a lot category (bids (b), (c) or (d) above), such a bidder will be targeting a specific amount of lots. For ease of reference, in this annex we call this the “**targeted amount**”, ¹⁶ which is calculated by summing the bidder’s posted demand from the previous round and the change in demand targeted by the bidder in the current round. Where a bidder maintains demand (bid (a) above), its targeted amount is the posted demand in the last round.

A6.36 For example, a bidder’s posted demand in the previous round is 10 lots. In the current round, the bidder submits a simple bid to decrease demand by 2 lots. The targeted amount will therefore be: $10 - 2 = 8$ lots.

Bid types

Bid to maintain demand

¹¹ For simplicity, in this annex, we refer to each of these types of bids as single bids. However, as explained in the examples given below, each bid to maintain, decrease or increase demand effectively includes a set of bids (or commitments), where each bid/commitment specifies a number of lots for each price level between the opening and the clock price.

¹² In the Auction Regulations, a bid to maintain demand is defined as a “set of bids to maintain demand”.

¹³ In the Auction Regulations, a simple bid to decrease demand is defined as a “simple set of bids to decrease demand”.

¹⁴ In the Auction Regulations, an all or nothing bid to decrease demand is defined as an “all or nothing set of bids to decrease demand”.

¹⁵ In the Auction Regulations, a bid to increase demand is defined as a “set of bids to increase demand”.

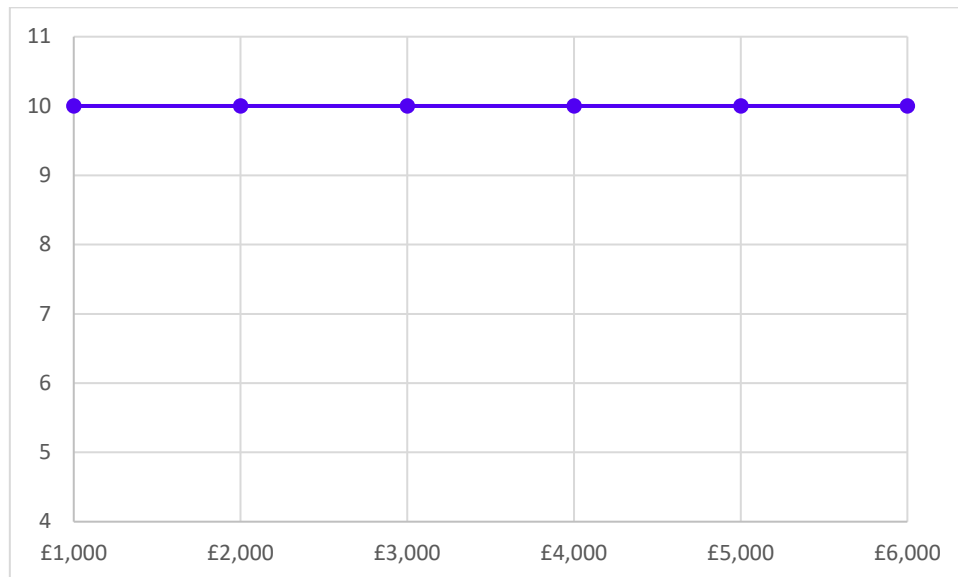
¹⁶ In the Auction Regulations, the targeted amount is defined as the “target number of lots”.

A6.37 A “**bid to maintain demand**” is a commitment to pay any price level from the opening price up to (and including) the round’s clock price for each lot included in the posted demand from the previous round.¹⁷

A6.38 For example, a bidder’s posted demand in the previous round is 10 lots. In the current round, the opening and clock prices are £1,000 and £6,000 respectively. The bidder submits a bid to maintain demand. As shown in figure A6.1, this means that the bidder commits to pay up to £6,000 (i.e. £1,000, £2,000, £3,000, £4,000, £5,000 or £6,000) per lot for a licence including 10 lots.

A6.39 When submitting a bid to maintain demand, a bidder only specifies that it maintains demand in a lot category. The bidder does not need to expressly specify a nominated price because a bid to maintain demand implies that the bidder is willing to pay any price level up to (and including) the clock price in order to maintain its posted demand from the previous round.

Figure A6.1: example of a bid to maintain demand¹⁸



The vertical axis represents the number of lots requested by the bidder in each lot category. The horizontal axis represents the price level the bidder is committed to pay for each lot.

Simple bid to decrease demand

A6.40 As set out above, a bid to decrease demand can be either a “**simple bid**” or an “**all or nothing bid**”. A bidder submits a bid to decrease demand, in a lot category, when it wants to bid for a lower number of lots in a round compared to its posted demand in the previous round.

A6.41 When submitting a “**simple bid to decrease demand**”, a bidder specifies: (i) by how many lots it wishes to decrease its previous round’s posted demand and (ii) the price from which it wishes its decrease to be applied (the “**nominated price**”); this price can be any price level

¹⁷ In essence, a bidder submits a bid to maintain demand when it wants to bid for the same number of lots in a round as its posted demand in the previous round at any price up to the clock price.

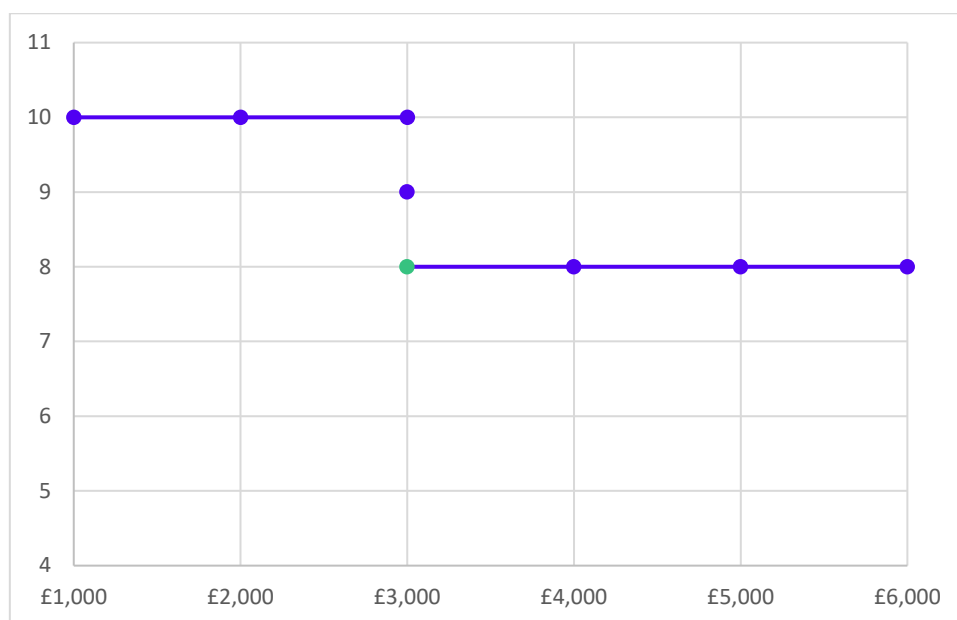
¹⁸ Each dot represents a commitment from the example above.

(expressed in whole thousands of pounds) between and including the opening and clock prices.¹⁹

A6.42 For example, a bidder’s posted demand in the previous round is 10 lots. In the current round, the opening and clock prices are £1,000 and £6,000 respectively. The bidder submits a simple bid to decrease demand by 2 lots (so the targeted amount is 8 lots) at a price of £3,000 per lot (so the nominated price is £3,000). As shown in figure A6.2, this means that the bidder commits to pay:

- up to £3,000 (i.e. £1,000, £2,000 or £3,000) per lot for a licence including 10 lots;
- £3,000 per lot for a licence including 8 or 9 lots (with a preference for 8 lots, rather than 9 or 10, if the price rises to £3,000 per lot; see the green dot in figure A6.2);
- or
- up to £6,000 (i.e. £4,000, £5,000, or £6,000) per lot for a licence including 8 lots, if the price rises above £3,000.

Figure A6.2: example of simple bid to decrease demand²⁰



The vertical axis represents the number of lots requested by the bidder in each lot category. The horizontal axis represents the price level the bidder is committed to pay for each lot.

All or nothing bid to decrease demand

A6.43 A bidder submits an “**all or nothing bid to decrease demand**”, in a lot category, when it wants to bid for a lower number of lots compared to its posted demand in the previous round, and it does not wish to risk winning an amount in between its posted demand and the targeted amount. An all or nothing bid is therefore used when the bidder wishes to decrease its posted demand or, if such a decrease cannot be fully applied, maintain its posted demand from the previous round at any price level up to the clock price.

¹⁹ By default, the EAS software will select the opening price for any bids to change demand, which bidders can then change and select a higher price level.

²⁰ Each dot represents a commitment from the example above. The green dot represents the bidder’s preference where there are multiple commitments at the same price.

A6.44 As for a simple bid to decrease demand, when submitting an all or nothing bid to decrease demand, a bidder specifies: (i) by how many lots it wishes to decrease its previous round's posted demand and (ii) the nominated price from which it wishes its decrease to be applied. The nominated price can be any price level (expressed in whole thousands of pounds) between and including the opening and clock prices. To place an all or nothing bid to decrease demand, a bidder also needs to specify that the decrease is conditional on it being fully applied and that the bidder is otherwise wishing to pay up to the clock price for each lot included in its posted demand in the previous round. In practice, bidders will be able to express this commitment by selecting a relevant option in the EAS (i.e., the "All or Nothing" option).

A6.45 An all or nothing bid to decrease can only be placed for a reduction of 2 or more lots (and not for a reduction of 1 lot).

A6.46 For example, a bidder's posted demand in the previous round is 10 lots. In the current round, the opening and clock prices are £1,000 and £6,000 respectively. The bidder submits an all or nothing bid to decrease demand by 2 lots (so the targeted amount is 8 lots) at a price of £3,000 per lot (so the nominated price for the decrease is £3,000). As shown in figure A6.3, this means that the bidder commits to pay:

- from £3,000 to £6,000 per lot (including £3,000 and £6,000) for a licence including 8 lots, which is the bidder's preference if (i) the price per lot rises to (or above) £3,000 and (ii) the decrease targeted by the bidder is fully applied; or
- from £1,000 to £6,000 per lot (including £1,000 and £6,000) for a licence including 10 lots, if (i) the price per lot does not rise above £3,000; or (ii) the price per lot rises above £3,000 and the decrease targeted by the bidder is not fully applied.²¹

Figure A6.3: example of an all or nothing bid to decrease demand²²



The vertical axis represents the number of lots requested by the bidder in each lot category. The horizontal axis represents the price level the bidder is committed to pay for each lot.

²¹ That is, the bidder prefers to finish the round with a commitment to pay for a licence including 8 lots, rather than 10, if the price per lot rises to £3,000 or higher.

²² Each dot represents a commitment from the example above. The green dots represent the bidder's preference where there are multiple commitments at the same price.

Bid to increase demand

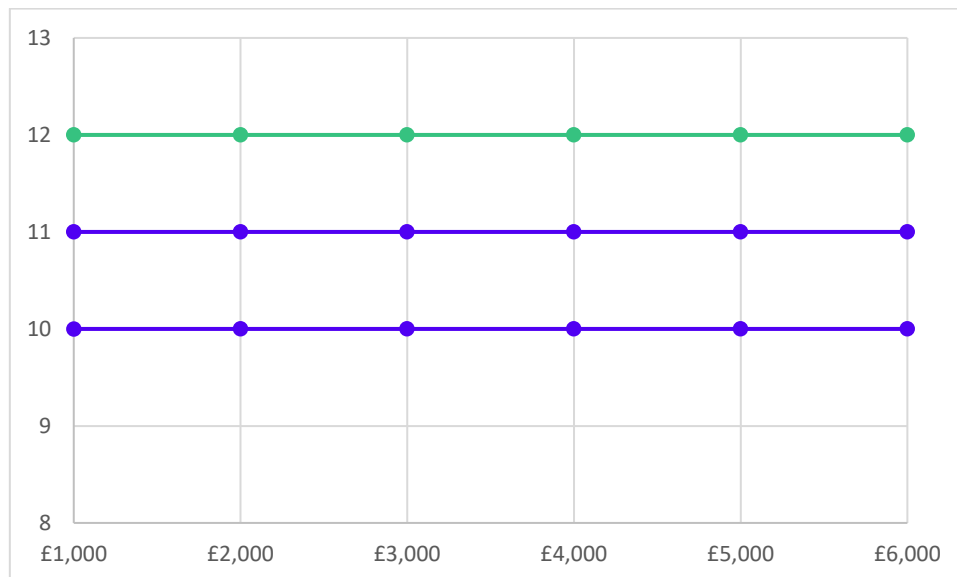
A6.47 A bidder submits a “**bid to increase demand**” when it wants to bid for a higher number of lots in a round compared to its posted demand.

A6.48 When submitting a bid to increase demand, a bidder specifies: (i) by how many lots it wishes to increase its previous round’s posted demand and (ii) a price within and including the opening and clock prices (the nominated price). As explained in more detail from paragraph A6.56 below, in this case the nominated price is only used for establishing the order in which the bid is processed. In particular, if a bidder submits two bids to increase demand in two different lot categories within the same round, the bid with the lower nominated price will be processed first.

A6.49 A bid to increase demand is a commitment to pay any price level from the opening price up to (and including) the round’s clock price for each lot included in the previous round’s posted demand, the targeted amount, or any number of lots in between these quantities, with a preference for the targeted amount at any price level (in figure A6.4 below, see the green dots).

A6.50 For example, a bidder’s posted demand in the previous round is 10 lots. In the current round, the opening and clock prices are £1,000 and £6,000 respectively. The bidder submits a bid to increase demand by 2 lots (so the targeted amount is 12 lots) at a nominated price of £3,000. The bidder commits to pay any price level between £1,000 and £6,000 (including £6,000) for a licence including 10, 11 or 12 lots, with a preference for 12 lots.²³

Figure A6.4: Example of a bid to increase demand²⁴



²³ The bidder therefore commits to:

- 10 lots at a price per lot of £1,000, £2,000, £3,000, £4,000, £5,000 or £6,000;
- 11 lots at a price per lot of £1,000, £2,000, £3,000, £4,000, £5,000 or £6,000; or
- 12 lots at a price per lot of £1,000, £2,000, £3,000, £4,000, £5,000 or £6,000;

with a preference for 12 lots, instead of 10 or 11, at any price level.

²⁴ Each dot represents a commitment from the example above. The green dots represent the bidder’s preference where there are multiple commitments at the same price.

The vertical axis represents the number of lots requested by the bidder in each lot category. The horizontal axis represents the price level the bidder is committed to pay for each lot.

Submitting bids

- A6.51 In each round, bidders will submit bids in the EAS. At any time before the end of the round, a bidder can modify its bids by submitting different bids. At the end of the round, the last submitted bid in each lot category is deemed the bidder's bid.
- A6.52 Where a bidder does not specify a bid for a lot category, Ofcom will deem that the bidder has submitted:
- a simple bid to decrease the previous round's posted demand to 0 lots, at the opening price, if the previous round's posted demand is greater than 0; or
 - a simple bid to maintain the previous round's posted demand, if the previous round's posted demand was 0.

Bidder's eligibility limit for the second and following rounds

- A6.53 Bidders begin the second and following rounds with an eligibility limit equal to the eligibility points associated with their posted demand for each of the lot categories, processed in the previous round. Therefore, a bidder's eligibility limit for the next round is the sum of:
- 2 multiplied by the posted demand in 26 GHz lower;
 - 2 multiplied by the posted demand in 26 GHz upper; and
 - the posted demand in 40 GHz.
- A6.54 When submitting bids in a round, a bidder cannot exceed its eligibility limit. This means that the eligibility used by a bidder for the submission of bids in a round (the "used eligibility") must be equal to, or lower than, the eligibility limit. The used eligibility is the sum of:
- 2 multiplied by the targeted amount in 26 GHz lower;
 - 2 multiplied by the targeted amount in 26 GHz upper; and
 - the targeted amount in 40 GHz.
- A6.55 The bidder will be unable to submit its bids (for each lot category) in a round if its used eligibility would be higher than its eligibility limit. The EAS will warn the bidder in such a situation. An example is provided in box A6.1 below.

Box A6.1: Examples of how the eligibility limit works

Example 1

Suppose there are two lot categories, 26 GHz lower and 40 GHz. Suppose the bidder's posted demand from the previous round is:

- 5 lots in 26 GHz lower;
- 2 lots in 40 GHz.

The bidder's eligibility limit for the current round is therefore: $(5 \times 2) + (2 \times 1) = 12$.

In this round, the bidder tries to submit the following bids:

- In 26 GHz lower, a simple bid to decrease by 2 lots (to 3 lots);
- In 40 GHz, a bid to increase by 3 lots (to 5 lots).

The bidder's used eligibility would therefore be: $(3 \times 2) + (5 \times 1) = 11$.

As the bidder does not exceed its eligibility limit, it will be able to submit its bids.

Example 2

Suppose the same set up as before. However, in this example, the bidder tries to submit the following bids:

- In 26 GHz lower, a bid to maintain;
- In 40 GHz, a bid to increase by 3 lots (to 5 lots).

The bidder's used eligibility would therefore be: $(5 \times 2) + (5 \times 1) = 15$.

As the bidder would exceed its eligibility limit, it will not be able to submit its bids. The EAS will warn the bidder and it will be required to modify its bids.

Bid processing

A6.56 Once the round has ended, Ofcom collects all the bids and processes them to determine the round results. After bid processing²⁵ is completed, Ofcom informs each bidder of the outcome of its bids (as explained in paragraph A6.70 below).

A6.57 As per the first round, each bidder will end each round committed to pay a certain price per lot (the "**posted price**"²⁶) for a licence including a certain quantity of lots in each lot category (the "**posted demand**"). The process by which posted demand and posted prices are determined in the second and subsequent rounds is explained from paragraph A6.58 below.

Processing bids

A6.58 As noted above, associated with each bid to maintain, decrease, or increase demand are commitments for a number of lots, between the bidder's posted demand from the previous round and its targeted amount in the current round, at all price levels between the opening price and the clock price. For simplicity, we say that, at the end of the bid processing:

- a) a bid to maintain or change demand is "**fully applied**"²⁷ where Ofcom selects a bidder's commitment associated with its targeted amount;
- b) a bid to change demand is "**partially applied**"²⁸ where Ofcom selects a bidder's commitment associated with a number of lots which is different from its posted demand in the previous round and its targeted amount;
- c) a bid to change demand is "**not applied at all**" where Ofcom selects a bidder's commitment associated with its posted demand in the previous round.²⁹

A6.59 Bids to maintain or change demand are **fully applied** in these circumstances:

- a) A bid to maintain demand is always fully applied.
- b) A bid to decrease demand is fully applied if it does not cause excess demand in the bid's lot category to drop below (or further below) zero.
- c) A bid to increase demand is fully applied if it does not cause the bidder's eligibility limit to be exceeded.

²⁵ In the Auction Regulations, the bid processing is defined as the "selection process".

²⁶ A separate posted price is associated with each lot category, and is the same for all bidders.

²⁷ In the Auction Regulations, when a bid is fully applied, it is defined as "being removed from the ranking list".

²⁸ In the Auction Regulations, when a bid is partially applied, it is defined as "being accorded reduced status".

²⁹ Bids can be processed multiple times. This is done to check whether a bid that is initially partially applied or not applied at all can later on be applied to a larger degree (or even fully applied) given the processing of other bids.

- A6.60 As explained in more detail below, once all bids to maintain demand have been fully applied, all bids to change demand are processed starting with those whose nominated price is closer to the opening price of their lot category. Where two or more bids in the same lot category have the same nominated price, their processing order is randomly selected.
- A6.61 In the event that a bid to increase or a simple bid to decrease cannot be fully applied, Ofcom would check whether it can be partially applied.³⁰ In the case of a:
- a) bid to **decrease** demand, selecting the bidder's commitment with the smallest amount of lots that would not cause excess demand to drop below (or further below) zero; or
 - b) bid to **increase** demand, selecting the bidder's commitment with the largest amount of lots that would not exceed the bidder's eligibility limit.
- A6.62 Box A6.2 below provides an example of a fully applied bid, a partially applied bid, and a bid which has not been applied at all.

Box A6.2: Example of bids which are fully applied, partially applied, and not applied at all

Suppose there is one lot category, 26 GHz lower. The opening price is 100³¹ and the clock price is 105. Excess demand at the end of the last round was 5 lots.

Suppose the following bids are submitted and are processed in the following order:

- 1) Bidder A, bid to maintain.
- 2) Bidder B, simple bid to decrease by 2 lots (at a price of 100).
- 3) Bidder C, simple bid to decrease by 4 lots (at a price of 102).
- 4) Bidder D, simple bid to decrease by 3 lots (at a price of 104).

The bids are processed starting with those whose nominated price is closer to the opening price (as will be explained in more detail from paragraph A6.63 below).

Specifically, the bids are processed as follows:

- 1) Bidder A, bid to maintain: fully applied as it does not violate either of the two rules: (i) **excess demand remains at 5 lots**; (ii) the bidder's eligibility limit is not exceeded as the same quantity is maintained.
- 2) Bidder B, simple bid to decrease by 2 lots: fully applied as it does not violate either of the two rules: (i) **excess demand is now equal to 3 lots**; (ii) the bidder's eligibility limit is not exceeded as the bidder has submitted a bid for a lower targeted amount.
- 3) Bidder C, simple bid to decrease by 4 lots: partially applied as applying it fully would cause negative excess demand (excess demand would be -1). Bidder C's posted demand is decreased by 3 lots. **Excess demand is 0.**
- 4) Bidder D, simple bid to decrease by 3 lots: not applied at all, as applying it fully or partially would cause negative excess demand.

³⁰ All or nothing bids cannot be partially applied.

³¹ In the auction, prices will be expressed in whole thousands of pounds. In this and the following examples, prices are expressed in smaller amounts for simplicity.

Order of processing bids

- A6.63 All simple bids to maintain are always processed first, and fully applied.
- A6.64 All bids to change demand (that is, bids to increase, simple bids to decrease, and all or nothing bids to decrease) are processed starting with those whose nominated price is closer to the opening price of their lot category. Specifically, the processing order is determined as follows:
- For each bid, the EAS calculates the “**price point**”, which is a percentage calculated as the difference between the nominated price and the opening price, divided by the difference between the clock price and the opening price. E.g. if, in a round, the nominated price, opening price, and clock prices are 105, 100, and 110 respectively, the price point is equal to 50% ($[105 - 100] / [110 - 100]$);
 - All the bids are sorted in ascending order of price points into a processing “**queue**” or “**ranking list**”;
 - In the event of multiple bids with the same price point, those bids would be entered in the queue in a random order.
- A6.65 When a bid to maintain, decrease or increase demand is:
- Fully applied, it leaves the queue, which means that no further processing is needed in respect of that bid;
 - Partially applied, the part of the bid that was applied leaves the queue while the remaining part stays in its position in the queue;
 - not applied at all, the bid stays in its position in the queue.
- A6.66 When a bid to maintain, decrease or increase demand is fully applied or, in the case of a bid to change demand, that bid is partially applied, processing restarts at the beginning of the queue to check whether preceding bids can now be fully or partially applied.
- A6.67 Bid processing ends when all bids to maintain, decrease or increase demand in the queue have been processed and no bid remaining in the queue can be fully or partially applied. Those bids remaining in the queue can then be discarded.
- A6.68 Box A6.3 below outlines how the EAS would process bids and execute the queue.

Box A6.3: Example of a step by step bid processing

Step (a) Process and fully apply all bids to maintain demand.

Step (b) Collect all remaining bids and calculate their price points.

Step (c) Sort all bids in ascending order of price points into a processing queue.

Step (d) Process the first bid in the queue (or go to step (f) if there are no more bids in the queue that can be applied fully or partially).

- If the bid is applied fully, remove the bid from the queue. Then, move to step (e).
- If the bid is partially applied, remove the part of the bid that can be applied from the queue and leave the remaining part in its position in the queue. Then, move to step (e).
- If the bid is not applied at all, leave the bid in its position in the queue. Then, move to step (e).

Step (e) Process the next bid in the queue (or go to step (f) if there are no more bids in the queue that can be fully or partially applied):

- 1) If the bid is fully applied, remove the bid from the queue. Then, return to step (d).
- 2) If the bid is partially applied, remove the part of the bid that can be applied from the queue and leave the remaining part in its position in the queue. Then, return to step (d).
- 3) If the bid is not applied at all, leave the bid in its position in the queue. Then, return to step (e).

Step (f) Discard all bids remaining in the queue (that is, the bids that cannot be fully or partially applied).

A6.69 An example of bid processing is provided in box A6.4 below.

Box A6.4: Example of processing bids

Suppose there are two bidders (bidder A and bidder B) and one lot category (26 GHz lower).

- Bidder A's posted demand from the previous round is 5 lots, and its eligibility limit for the current round is equal to $5 \times 2 = 10$ eligibility points.
- Bidder B's posted demand from the previous round is 5 lots, and its eligibility limit for the current round is equal to $5 \times 2 = 10$ eligibility points.

Excess demand is 3 lots. The opening and clock prices for the round are 100 and 105 respectively.

In the current round, the bids are the following:

- Bidder A, simple bid to decrease by 5 lots (to 0 lots) at price 102, which means a price point of 40%
- Bidder B, all or nothing bid to decrease by 4 lots (to 1 lot) at price 100, which means a price point of 0%.

After the round ends, bids are processed in order of price points.

Step (a): Bidder B, all or nothing bid to decrease by 4 lots (to 1 lot) at price 100, is processed first as it has the lowest price point (0%).

If the bid were fully applied:

- Bidder B's eligibility would be $1 \times 2 = 2$ and thus within the eligibility limit.
- Excess demand would be -1, and thus below zero.

Bidder B's bid cannot be fully applied as it would cause excess demand to drop below 0. As it is an all or nothing bid, it cannot be partially applied. Thus, the bid is not applied at all.

Step (b): Bidder A, simple bid to decrease by 5 lots (to 0 lots) at price 102, is processed next.

If the bid were fully applied:

- Bidder A's eligibility would be $0 \times 2 = 0$ and thus within the eligibility limit.
- Excess demand would be -2 , and thus below zero.

Bidder A's bid cannot be fully applied as it would cause excess demand to drop below zero. The bid can be applied partially; demand is decreased by 3 lots (to 2)³² instead of the full 5 lots. Excess demand is now zero.

We reassess the bids in the queue from the start since A's bid was partially applied. Bidder B's bid cannot be fully or partially applied. Next, Bidder A's bid cannot be fully or partially applied. At this point, bid processing ends because all bids in the queue have been processed and no bid remaining in the queue can be fully or partially applied.

Bidder A's posted demand is **2 lots**.

Bidder B's posted demand is **5 lots**.

The posted price per lot is 102, and excess demand is 0.

End of the round

A6.70 After the end of the round, the EAS informs each bidder of the bidder's results, showing the following information:

- Whether each bid was fully applied, partially applied, or not applied at all;
- The bidder's posted demand in every lot category;
- The posted price in each lot category (which are determined as explained below); and
- The bidder's eligibility limit for the next round.

Determining the posted prices

A6.71 After the end of the second and following rounds, the posted price in a lot category is determined as follows:

- If excess demand is greater than zero, the posted price is set to the clock price.
- If excess demand is zero and at least one bid (simple or all or nothing) to decrease demand was applied (either fully or partially) in the lot category, the posted price is set to the highest nominated price among all bids to decrease demand that was applied (either fully or partially).
- in all other cases, the posted price is set to the opening price.

We provide examples for each scenario (a) – (c) above. For these examples, the opening price is 100 and the clock price is 105.

- At the end of the round, excess demand is 2. The posted price is therefore set to 105.
- At the end of the round, excess demand is 0. The highest nominated price among all bids to decrease demand that were applied (partially or fully) was 104, associated with an all or nothing bid to decrease that was fully applied. The posted price is therefore set to 104.

³² In the Auction Regulations, a bidder's demand at any point during the bid processing is defined as "currently selected demand for lots of a particular lot type".

- At the end of the round, excess demand is 0. No bid to decrease demand was applied. The posted price is therefore set to 100.

Conclusion of the principal stage

A6.72 The principal stage continues to a further round if, after the end of the current round, excess demand is greater than zero in at least one of the three lot categories.

A6.73 The principal stage ends if, at the end of the current round, excess demand is equal to or less than zero in all three lot categories. The round will be referred to as the “**final principal stage round**” and, for every lot category:

- a) Each bidder would win its posted demand in the final principal stage round.
- b) Each bidder would be committed to pay the sum which is equal to:
 - i) the posted demand in 26 GHz lower multiplied by the posted price (per lot)³³ in 26 GHz lower;
 - ii) the posted demand in 26 GHz upper multiplied by the posted price (per lot) in 26 GHz upper; and
 - iii) the posted demand in 40 GHz multiplied by the posted price (per lot) in 40 GHz.

Information policy

Information released before the beginning of the principal stage

A6.74 Before the beginning of the principal stage, each bidder is informed of the following:

- a) the start and end time for the first round;
- b) the first round prices for each lot category; and
- c) the bidder’s eligibility limit for the first round.

Information released at the end of each principal stage round

A6.75 After the end of each principal stage round, except the final principal stage round, each bidder would be informed of the following:

- a) a summary of bids submitted by the bidder in the most recent round;
- b) the posted demand of the bidder for each lot category in the most recent round;
- c) the posted price for each lot category in the most recent round;
- d) the start and end time for the next principal stage round;
- e) the opening and clock prices for each lot category for the next principal stage round;
- f) the bidder’s eligibility limit for the next principal stage round; and
- g) the excess demand for each lot category in the most recent round.

³³ In the Auction Regulations, the posted price in a lot category in the final principal stage round is defined as the “base price”.

Information released at the end of the principal stage

A6.76 At the end of the principal stage, each bidder is informed that the principal stage has concluded.

A6.77 Each bidder is informed of the following:

- a) the bidder's total number of lots won in each lot category and the associated price; and
- b) every other bidder's total number of lots won in each lot category and the associated price.
- c) the number of unsold lots in each lot category, if any.

Example of bid submission and processing

A6.78 The following section illustrates how the principal stage works, through bidding and the processing of bids.

A6.79 For simplicity, both examples A6.1 and A6.2 assume only two lot categories (26 GHz lower and 40 GHz), instead of the three lot categories of the auction. The lot structure is the same as in the real auction (7 lots available in 26 GHz lower and 15 lots available in 40 GHz). The eligibility points for each band are also the same as in the real auction (2 eligibility points for each 26 GHz lower lot and 1 eligibility point for each 40 GHz lot). Price increments between rounds are fixed and equal to 10 for 26 GHz lower and 5 for 40 GHz. There are two bidders (bidder A and B) with initial eligibility limits of 24 and 15 points respectively.

A6.80 Example A6.1 is from the point of view of bidder A, showing a stylised and simplified example of what the bidder sees and the bids it submits.

A6.81 Example A6.2 illustrates all bidders' actions (A and B), as well as the mechanics of bid processing as performed by Ofcom. Bidders would not be able to see the bid processing mechanism, but we have included this to illustrate the implementation of the rules.

Example A6.1: bid submission

Bidder A begins the auction with an eligibility limit of 24 points.

Round 1

At the beginning of the round, the EAS will present bidder A with the following information:

Table A6.1: information provided to bidder A at the beginning of round 1

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
First round price	100	50	
Bidder A			Eligibility limit: 24

Bidder A enters the following bids:

- 26 GHz lower, bid for 7 lots.
- 40 GHz, bid for 10 lots.

Bidder A's bids are:

- For a number of lots lower than or equal to each lot category's available supply.
- Within the bidder's eligibility limit: $(7 \times 2) + (10 \times 1) = 24$.

Thus, bidder A will be allowed to submit its bids.

At the end of the round, once bid processing is completed, the EAS informs Bidder A of the following results:

Table A6.2: information provided to bidder A at the end of round 1

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Bidder A	Posted demand: 7 lots	Posted demand: 10 lots	Eligibility: $(7 \times 2) + (10 \times 1) = 24$
Excess demand	5 lots	0 lots	
Posted price	100	50	

The principal stage continues to round 2.

Round 2

At the beginning of the round, the EAS will present bidder A with the following information:

Table A6.3: information provided to bidder A at the beginning of round 2

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Opening price	100	50	
Clock price	110	55	
Bidder A	Posted demand from the previous round: 7 lots	Posted demand from the previous round: 10 lots	Eligibility limit: 24

Bidder A enters the following bids:

- 26 GHz lower, simple bid to decrease by 1 lot (to 6 lots), at a nominated price of 105 per lot;
- 40 GHz, bid to maintain demand (at 10 lots).

Bidder A's used eligibility is: $(6 \times 2) + (10 \times 1) = 22$. The eligibility limit is not exceeded.

Thus, bidder A will be allowed to submit its bids.

At the end of the round, once bid processing is completed, the EAS informs Bidder A of the following results:

Table A6.4: information provided to bidder A at the end of round 2

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Bidder A submitted bid	Simple bid to decrease by 1 lot (to 6 lots) at price 105. Fully applied.	Bid to maintain (at 10 lots)	
Bidder A posted demand	6 lots	10 lots	Eligibility: 22
Excess demand	2 lots	4 lots	
Posted price	110	55	

The principal stage continues to round 3.

Round 3

At the beginning of the round, the EAS will present bidder A with the following information:

Table A6.5: information provided to bidder A at the beginning of round 3

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Opening price	110	55	
Clock price	120	60	
Bidder A	Posted demand from the previous round: 6 lots	Posted demand from the previous round: 10 lots	Eligibility limit: 22

Bidder A enters the following bids:

- 26 GHz lower, all or nothing bid to decrease by 2 lots (to 4 lots), at a nominated price of 113;
- 40 GHz, bid to maintain demand (at 10 lots).

Bidder A's used eligibility is 18. The eligibility limit is not exceeded.

Thus, bidder A will be allowed to submit its bids.

At the end of the round, once bid processing is completed, the EAS informs Bidder A of the following results:

Table A6.6: information provided to bidder A at the end of round 3

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Bidder A submitted bid	All or nothing bid to decrease by 2 lots (to 4 lots) at price 113. Fully applied.	Bid to maintain (at 10 lots)	
Bidder A posted demand	4 lots	10 lots	Eligibility: 18
Excess demand	0 lots	4 lots	
Posted price	113	60	

The principal stage continues to round 4.

Round 4

At the beginning of the round, the EAS will present bidder A with the following information:

Table A6.7: information provided to bidder A at the beginning of round 4

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Opening price	113	60	
Clock price	123	65	
Bidder A	Posted demand from the previous round: 4 lots	Posted demand from the previous round: 10 lots	Eligibility limit: 18

Bidder A enters the following bids:

- 26 GHz lower, bid to maintain demand (at 4 lots);
- 40 GHz, all or nothing bid to decrease by 5 lots (to 5 lots), at a nominated price of 60.

Bidder A's used eligibility is 13. The eligibility limit is not exceeded.

Thus, bidder A will be allowed to submit its bids.

At the end of the round, once bid processing is completed, the EAS informs Bidder A of the following results:

Table A6.8: information provided to bidder A at the end of round 4

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Bidder A submitted bid	Bid to maintain demand (at 4 lots)	All or nothing bid to decrease by 5 lots (to 5 lots) at price 60. Not applied at all.	
Bidder A posted demand	4 lots	10 lots	Eligibility: 18
Excess demand	0 lots	0 lots	
Posted price	113	65	

Bidder A will be informed that the principal stage has ended, how much spectrum it has won, and the corresponding price to pay.

- Bidder A wins 4 lots in 26 GHz lower and 10 lots in 40 GHz. Bidder A pays $(4 \times 113) + (10 \times 65) = 1102$.

Example A6.2: bid processing

Bidder A and bidder B begin the auction with an eligibility limit of 24 and 15 points respectively.

Round 1

The prices for the first round and the bids from the two bidders are as shown in the table below.

Table A6.9: prices and submitted bids for round 1

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
First round price	100	50	
Bidder A	Bids for 7 lots	Bids for 10 lots	Eligibility limit: 24 Used eligibility: $(7 \times 2) + (10 \times 1) = 24$
Bidder B	Bids for 5 lots	Bids for 5 lots	Eligibility limit: 15 Used eligibility: $(5 \times 2) + (5 \times 1) = 15$

In the first round, all bids are fully applied. Thus, at the end of the round, the results are as follows:

Table A6.10: results for round 1

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Bidder A	Posted demand: 7 lots	Posted demand: 10 lots	Eligibility: $(7 \times 2) + (10 \times 1) = 24$
Bidder B	Posted demand: 5 lots	Posted demand: 5 lots	Eligibility: $(5 \times 2) + (5 \times 1) = 15$
Aggregate demand	12 lots	15 lots	
Excess demand (aggregate demand minus available supply)	5 lots	0 lots	
Posted price	100	50	

Since there is excess demand in 26 GHz lower, the principal stage continues to round 2.

Round 2

The prices for the second round and the bids from the two bidders are as shown in the table below.

Table A6.11: prices and submitted bids for round 2

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Opening price	100	50	
Clock price	110	55	
Bidder A	Simple bid to decrease by 1 lot (to 6 lots) at a nominated price of 105 per lot	Bid to maintain (at 10 lots)	Eligibility limit: 24 Used eligibility: 22
Bidder B	Simple bid to decrease by 2 lots (to 3 lots) at a nominated price of 107 per lot	Bid to increase by 4 lots (to 9 lots) at a nominated price of 53 per lot	Eligibility limit: 15 Used eligibility: 15

Once all bids are submitted, the EAS processes the bids as follows:

Step (a): process and fully apply all bids to maintain demand

As it is a bid to maintain the previous demand, Bidder A's bid in 40 GHz is processed first, and it is fully applied.

Step (b): collect all bids to change demand and calculate their price points

- Bidder A, 26 GHz lower: $(105 - 100) / (110 - 100) = 50\%$
- Bidder B, 26 GHz lower: $(107 - 100) / (110 - 100) = 70\%$
- Bidder B, 40 GHz: $(53 - 50) / (55 - 50) = 60\%$.

Step (c): sort all bids in ascending order of price points into a queue

- Bidder A, 26 GHz lower, -1 (to 6 lots)³⁴, price point: 50%
- Bidder B, 40 GHz, +4 (to 9 lots), price point: 60%
- Bidder B, 26 GHz lower, -2 (to 3 lots), price point: 70%

Step (d): process the bids in the queue

Bidder A, 26 GHz lower, -1 (to 6 lots) is processed first. The bid is fully applied as bidder A stays within its eligibility limit for the round and does not cause excess demand to drop below 0. The bid is fully applied and leaves the queue. **Excess demand in 26 GHz is now 4 lots. Eligibility for bidder A is now: $(6 \times 2) + (10 \times 1) = 22$.**

Thus, the queue is now:

- ~~1) Bidder A, 26 GHz lower, -1 (to 6 lots), price point: 50%~~
- 2) Bidder B, 40 GHz, +4 (to 9 lots), price point: 60%
- 3) Bidder B, 26 GHz lower, -2 (to 3 lots), price point: 70%

Bidder B, 40 GHz, +4 (to 9 lots) is processed next. The bid cannot be fully or partially applied, as bidder B would exceed its eligibility limit for the round. This is because the bidder is already at its eligibility limit of 15. Therefore, the bid is not applied at all and remains in the queue. **Excess demand in 40 GHz is now 0 lots. Eligibility for bidder B is now: $(5 \times 2) + (5 \times 1) = 15$.**

Bidder B, 26 GHz lower, -2 (to 3 lots) is processed next. The bid is fully applied and leaves the queue. **Excess demand in 26 GHz is now 2 lots. Eligibility for bidder B is now: $(3 \times 2) + (5 \times 1) = 11$**

Thus, the queue is now:

- ~~1) Bidder A, 26 GHz lower, -1 (to 6 lots), price point: 50%~~
- 2) Bidder B, 40 GHz, +4 (to 9 lots), price point: 60%
- ~~3) Bidder B, 26 GHz lower, -2 (to 3 lots), price point: 70%~~

³⁴ For simplicity, throughout this example, we identify:

- a simple bid to decrease with the notation (-) followed by the number of lots the bidder requests to decrease its demand by.
- a bid to increase with the notation (+) followed by the number of lots the bidder requests to increase its demand by.
- an all or nothing bid with the notation AON (-) followed by the number of lots the bidder requests to decrease its demand by.

The queue is retested from the beginning. **Bidder B, 40 GHz, +4 (to 9 lots)** is processed next. The bid is fully applied and leaves the queue. **Excess demand in 40 GHz is now 4 lots. Eligibility for bidder B is now: $(3 \times 2) + (9 \times 1) = 15$**

Thus, the queue is now:

- 1) ~~Bidder A, 26 GHz lower, 1 (to 6 lots), price point: 50%~~
- 2) ~~Bidder B, 26 GHz lower, 2 (to 3 lots), price point: 70%~~
- 3) ~~Bidder B, 40 GHz, +4 (to 9 lots), price point: 80%~~

Step (e): bid processing ends

At the end of the round, the results are as follows:

Table A6.12: results for round 2

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Bidder A	Posted demand: 6 lots	Posted demand: 10 lots	Eligibility: 22
Bidder B	Posted demand: 3 lots	Posted demand: 9 lots	Eligibility: 15
Aggregate demand	9 lots	19 lots	
Excess demand (aggregate demand minus available supply)	2 lots	4 lots	
Posted price	110 (clock price, as excess demand is greater than zero)	55 (clock price, as excess demand is greater than zero)	

Since there is excess demand in 26 GHz lower and 40 GHz, the principal stage continues to round 3.

Round 3

The prices for the third round and the bids from the two bidders are as shown in the table below.

Table A6.13: prices and submitted bids for round 3

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Opening price	110	55	
Clock price	120	60	

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Bidder A	All or nothing bid to decrease by 2 lots (to 4 lots) at a nominated price of 113 per lot	Bid to maintain (at 10 lots)	Eligibility limit: 22 Used eligibility: 18
Bidder B	Simple bid to decrease by 1 lot (to 2 lots) at a nominated price of 115 per lot	Bid to increase by 2 lots (to 11 lots) at a nominated price of 58 per lot	Eligibility limit: 15 Used eligibility: 15

Once all bids are submitted, the EAS processes the bids as follows:

Step (a): as it is a bid to maintain the previous demand, Bidder A's bid in 40 GHz is processed first, and it is fully applied.

Step (b):

Bidder A, 26 GHz lower: 30%

Bidder B, 26 GHz lower: 50%

Bidder B, 40 GHz: 60%.

Step (c):

Bidder A, 26 GHz lower, AON -2 (to 4 lots), price point: 30%

Bidder B, 26 GHz lower, -1 (to 2 lots), price point: 50%

Bidder B, 40 GHz, +2 (to 11 lots), price point: 60%

Step (d):

Bidder A, 26 GHz lower, AON -2 (to 4 lots) is processed first. The bid can be fully applied, so it is fully applied and leaves the queue. **Excess demand in 26 GHz is now 0 lots. Eligibility for bidder A is now 18.**

Thus, the queue is now:

~~1) Bidder A, 26 GHz lower, AON -2 (to 4 lots), price point: 30%~~

2) Bidder B, 26 GHz lower, -1 (to 2 lots), price point: 50%

3) Bidder B, 40 GHz, +2 (to 11 lots), price point: 60%

Bidder B, 26 GHz lower, -1 (to 2 lots) is processed. The bid cannot be fully or partially applied as it would cause excess demand to drop below 0 (excess demand would be -1). The bid remains in the queue. **Excess demand in 26 GHz is now 0 lots. Eligibility for bidder B is now 15.**

Bidder B, 40 GHz, +2 (to 11 lots) is processed. The bid cannot be fully or partially applied, as bidder B would exceed its eligibility limit for the round. This is because the bidder is already at its eligibility limit of 15. The bid remains in the queue. **Excess demand in 40 GHz is now 4 lots. Eligibility for bidder B is now 15.**

Thus, the queue is now:

- 1) ~~Bidder A, 26 GHz lower, AON 2 (to 4 lots), price point: 30%~~
- 2) Bidder B, 26 GHz lower, -1 (to 2 lots), price point: 50%
- 3) Bidder B, 40 GHz, +2 (to 11 lots), price point: 60%

Step (e): Bid processing ends and the remaining bids in the queue are discarded. At the end of the round, the results are as follows:

Table A6.14: results for round 3

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Bidder A	Posted demand: 4 lots	Posted demand: 10 lots	Eligibility: 18
Bidder B	Posted demand: 3 lots	Posted demand: 9 lots	Eligibility: 15
Aggregate demand	7 lots	19 lots	
Excess demand (aggregate demand minus available supply)	0 lots	4 lots	
Posted price	113 (price associated to the last bid which caused excess demand to drop to zero)	60 (clock price, as excess demand is greater than zero)	

Since there is excess demand in 40 GHz, the principal stage continues to round 4.

Round 4

The prices for the fourth round and the bids from the two bidders are as shown in the table below.

Table A6.15: prices and submitted bids for round 4

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Opening price	113	60	
Clock price	123	65	
Bidder A	Bid to maintain (at 4 lots)	All or nothing bid to decrease by 5 lots (to 5 lots) at a nominated price of 60	Eligibility limit: 18 Used eligibility: 13

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Bidder B	Bid to maintain (at 3 lots)	Simple bid to decrease by 4 lots (to 5 lots) at a nominated price of 65.	Eligibility limit: 15 Used eligibility: 11

Once all bids are submitted, the EAS processes the bids as follows:

Step (a): as they are bids to maintain the previous demand, Bidder A's bid in 26 GHz lower and Bidder B's bid in 26 GHz lower are processed first, and they are fully applied.

Step (b):

- Bidder A, 40 GHz: 0%
- Bidder B, 40 GHz: 100%.

Step (c):

- 1) Bidder A, 40 GHz, AON -5 (to 5 lots), price point: 0%
- 2) Bidder B, 40 GHz, -4 (to 5 lots), price point: 100%

Step (d):

Bidder A, 40 GHz, AON -5 (to 5) is processed first. The bid is not applied at all as it would cause excess demand to drop below 0 (excess demand would be -1). The bid cannot be partially applied as it is an all or nothing bid. The bid remains in the queue. **Excess demand in 40 GHz is now 4 lots. Eligibility for bidder A is now 18.**

Bidder B, 40 GHz, -4 (to 5) is processed next. The bid can be fully applied, so it is fully applied and leaves the queue. **Excess demand in 40 GHz is now 0 lots. Eligibility for bidder B is now 11.**

Thus, the queue is now:

- 1) Bidder A, 40 GHz, AON -5 (to 5 lots), price point: 0%
- ~~2) Bidder B, 40 GHz, -4 (to 5 lots), price point: 50%~~

The queue is reassessed from the beginning. No more bids can be applied.

Step (e): Bid processing ends and the remaining bids in the queue are discarded. At the end of the round, the results are as follows:

Table A6.16: results for round 4

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Bidder A	Posted demand: 4 lots	Posted demand: 10	Eligibility: 18
Bidder B	Posted demand: 3 lots	Posted demand: 5 lots	Eligibility: 11
Aggregate demand	7 lots	15 lots	

	26 GHz lower (supply: 7 lots)	40 GHz (supply: 15 lots)	
Excess demand (aggregate demand minus available supply)	0 lots	0 lots	
Posted price	113	65	

Since there is no excess demand in any lot category, the principal stage ends. Bidders win their last posted demand and pay – for each lot – the corresponding posted price.

- Bidder A wins 4 lots in 26 GHz lower and 10 lots in 40 GHz. Bidder A pays $(4 \times 113) + (10 \times 65) = 1102$.
- Bidder B wins 3 lots in 26 GHz lower and 5 lots in 40 GHz. Bidder A pays $(3 \times 113) + (5 \times 65) = 664$.

Deposits

Top up deposits during the principal stage

- A6.82 At any point during the principal stage, Ofcom may require a bidder to increase its deposit up to an amount equal to the bidder's posted demand from the previous round multiplied by the posted prices for the relevant lot categories.
- A6.83 In the event Ofcom requires one or more bidders to increase its deposit, Ofcom would specify a deadline for the relevant bidders to make any additional deposits and provide details of how to make the additional deposit.
- A6.84 If the relevant bidder does not provide Ofcom with the top up deposit as required, it would not be allowed to submit bids in the next principal stage round nor in any subsequent principal stage rounds.³⁵
- A6.85 The bidder would not be excluded from the award process for not having provided the sufficient top up deposit, and it would still win its last posted demand (if any) in the final principal stage round. However, the bidder would not be granted a licence for its final processed demand lots unless it provides Ofcom with the total auction sum payable, following the end of the assignment stage.

³⁵ The bidder would also be unable to submit bids in the assignment stage and will be deemed to have made a valid bid for a value of 0 pounds for each of its assignment options. The assignment stage rules are discussed in detail in A7.

Required final principal stage deposit

- A6.86 After the final principal stage round, by a deadline to be specified by Ofcom, bidders need to have on deposit at least the sum of the “**total base price**”³⁶ for each of the 26 GHz lower, 26 GHz upper, and 40 GHz lot categories.
- A6.87 If the bidder does not provide Ofcom with the required final principal stage deposit, it would not be excluded from the award process. However, it would not be allowed to submit assignment stage bids and would be deemed to have made valid assignment stage bids with a value of zero pounds for all its assignment stage options. The bidder would not be granted a licence for its final processed demand lots unless it provides Ofcom with the total auction sum payable, following the end of the assignment stage.
- A6.88 Bidders who breach the Auction Regulations may forfeit part or all of their deposits.

Emergencies and extraordinary events

- A6.89 Ofcom will retain powers to address proven cases of emergencies or extraordinary events that might otherwise compromise the auction, such as the powers to reschedule or rerun rounds, provide bidders with alternative means to submit their bids, disregard bids and exclude bidders. We will publish more information on how we intend to act in a proven case of emergency in the bidder guidance.

³⁶ A bidder’s total base price is the sum of the amounts payable in respect of each lot category where the bidder has won any lot(s), calculated as the number of lots associated with a bidder’s posted demand in the final principal stage round multiplied by the corresponding posted price (per lot) for the lot category.

A7. Illustrative auction procedures for the assignment stage (with no negotiation period)

Introduction

- A7.1 In annex 7 of the November 2023 Statement and Consultation³⁷, we set out the illustrative auction procedures for the assignment stage of the award (with no negotiation period).
- A7.2 Additionally, in Section 2 of the April 2024 Statement³⁸, we set out our decision not to include a negotiation period in the assignment stage of the auction. However, we said we would enable bidders to start negotiating in the period immediately after notifying the assignment stage results to bidders and before the auction licences have been granted. We also set out our decision to adopt the assignment stage rules as described in the November 2023 Statement and Consultation, and not to include rules governing the location of any unsold spectrum in the 40 GHz band in the assignment stage of the auction, other than to require that any unsold 40 GHz lots are treated as a single, contiguous block.
- A7.3 We are now republishing the illustrative auctions procedures for the assignment stage, so that these may be read in conjunction with the draft Auction Regulations. We are providing these procedures for illustrative purposes only, to help stakeholders understand the auction design. For the avoidance of doubt, the Auction Regulations will take precedence in case of any differences. This version of the illustrative auction procedures for the assignment stage includes annotations where key terms differ from those used in the draft Auction Regulations.

Overview

- A7.4 In the assignment stage, bidders bid for the specific frequencies of the generic lots of spectrum won in the principal stage.
- A7.5 The assignment stage comprises of multiple rounds, where each round has a sealed bid auction format with a second price rule.
- A7.6 Bidders place bids on their preferred frequencies and Ofcom determines the highest value combination of bids which could be accommodated. At the end of each assignment stage round, each bidder is assigned the frequencies in accordance with the winning combination. The price each bidder pays is calculated using the nearest-Vickrey price method.

Assignment stage rounds

- A7.7 For the 40 GHz band, Ofcom will run:

³⁷ [November 2023 Statement and Consultation](#)

³⁸ [April 2024 Statement](#)

- i) A single assignment stage round for 40 GHz (40.5-43.3 GHz).^{39,40}
- A7.8 For the 26 GHz band, Ofcom will run up to three assignment stage rounds:
- i) An initial assignment stage round for 26 GHz lower (25.1-26.5 GHz);⁴¹
 - ii) An initial assignment stage round for 26 GHz upper (26.5-27.5 GHz);⁴²
 - iii) If required, a final assignment stage round for 26 GHz lower and upper (25.1-27.5 GHz).⁴³
- A7.9 The single assignment stage round for 40 GHz and the initial assignment stage round for 26 GHz lower will be scheduled for the same time. Afterwards, the other 26 GHz band assignment stages will run sequentially, according to the list in paragraph A7.8.
- A7.10 For the 26 GHz band, the final assignment stage round will only take place if the initial assignment stage rounds do not produce an assignment that gives all bidders contiguous holdings. Otherwise, if all winning bidders have contiguous holdings after the initial rounds, the final assignment stage round will not take place. Winning bidders will each be licensed to use the same contiguous holdings for 15 years.

Permissible assignment plans

- A7.11 In every assignment stage round, Ofcom determines a set of “**permissible assignment plans**”. These are all possible combinations of allocations of specific frequencies that ensure that:
- a) Each bidder is assigned a frequency block which corresponds to the bandwidth it won in the principal stage.
 - b) Each bidder is assigned a contiguous frequency block.
 - c) Any unsold spectrum in the 26 GHz band meets the requirement listed in paragraph A7.19.
 - d) Any unsold spectrum in the 40 GHz band forms a contiguous frequency block to be located anywhere in the band.
- A7.12 The complete permissible assignment plans are only visible by Ofcom. Bidders are, instead, able to see in the EAS their “**assignment options**”, i.e., the frequency blocks, within each permissible assignment plan, available to the bidder.
- A7.13 Below we provide an example of permissible assignment plans and assignment options.

Box A7.1: Example of permissible assignment plans and assignment options

Consider two winning principal stage bidders (A and B) of 26 GHz lower. Available supply in 26 GHz lower is 7 lots as in the award.

³⁹ Winning bidders would each be granted a single licence for the full 15-year term, corresponding to their 40 GHz frequencies as determined in the single assignment stage round for 40 GHz.

⁴⁰ This is defined in the Auction Regulations as the “first assignment stage round for the assignment of 40 GHz lots for the first period and the second period and for the assignment of 26 GHz lower lots for the first period”.

⁴¹ This is defined in the Auction Regulations as the “first assignment stage round for the assignment of 40 GHz lots for the first period and the second period and for the assignment of 26 GHz lower lots for the first period”.

⁴² This is defined in the Auction Regulations as the “second assignment stage round for the assignment of 26 GHz upper lots for the first period”.

⁴³ This is defined in the Auction Regulations as the “third assignment stage round for the assignment of any 26 GHz lower lots and any 26 GHz upper lots for the second period”.

Suppose that in the principal stage:

- Bidder A wins 3 lots in 26 GHz lower;
- Bidder B wins 4 lots in 26 GHz lower.

Ofcom determines that there are two permissible assignment plans (AS.1 and AS.2 in table A7.1 below). Bidder A's assignment options are highlighted in yellow. Bidder B's assignment options are highlighted in red.

Table A7.1: Example of permissible assignment plans

26 GHz lower (GHz)							
	25.1-25.3	25.3-25.5	25.5-25.7	25.7-25.9	25.9-26.1	26.1-26.3	26.3-26.5
AS.1	A			B			
AS.2	B				A		

Within each permissible assignment plan, the bidder only sees its assignment options. Tables A7.2 and A7.3 indicate what bidder A and B would respectively see.

Table A7.2: Assignment options visible to Bidder A

26 GHz lower (GHz)							
	25.1-25.3	25.3-25.5	25.5-25.7	25.7-25.9	25.9-26.1	26.1-26.3	26.3-26.5
AS.1	A						
AS.2					A		

Table A7.3: Assignment options visible to Bidder B

26 GHz lower (GHz)							
	25.1-25.3	25.3-25.5	25.5-25.7	25.7-25.9	25.9-26.1	26.1-26.3	26.3-26.5
AS.1				B			
AS.2	B						

Additional rules for permissible assignment plans for the 26 GHz band

A7.14 In addition to the points listed in paragraph A7.11, the permissible assignment plans for the 26 GHz band follow additional rules (listed below) depending on how many bidders have won spectrum in both the 26 GHz lower and upper lot categories in the principal stage.

A7.15 In the case that no bidder has won both 26 GHz lower lots and 26 GHz upper lots,

- In the initial assignment stage round for 26 GHz lower, only bidders who have won 26 GHz lower lots would be presented with assignment options in that frequency range.

- ii) In the initial assignment stage round for 26 GHz upper, only bidders who have won 26 GHz upper lots would be presented with assignment options in that frequency range.
- iii) The final assignment stage round would not take place.

A7.16 In the case that only one bidder has won both 26 GHz lower lots and 26 GHz upper lots, that bidder would automatically be assigned the uppermost frequencies in 26 GHz lower and the lowermost frequencies in 26 GHz upper. Following this:

- i) In the initial assignment stage round for 26 GHz lower, bidders who have won only 26 GHz lower lots would only be presented with assignment options in the lower portion of that frequency range.⁴⁴
- ii) In the initial assignment stage round for 26 GHz upper, bidders who have won only 26 GHz upper lots would only be presented with assignment options in the upper portion of that frequency range.⁴⁵
- iii) The final assignment stage round would not take place.

A7.17 In the case that **multiple bidders have won both 26 GHz lower lots and 26 GHz upper lots**, the assignment options available to these bidders would not overlap with the assignment options available to bidders who have only won 26 GHz lower lots or 26 GHz upper lots. Specifically:

- i) In the initial assignment stage round for 26 GHz lower, bidders who have won only 26 GHz lower lots would only be presented with assignment options in the lower portion of that frequency range. Conversely, bidders who have won both 26 GHz lower lots and 26 GHz upper lots would only be presented with assignment options in the upper portion of 26 GHz lower.
- ii) In the initial assignment stage round for 26 GHz upper, the bidder who has won the uppermost portion of 26 GHz lower would automatically be assigned the lowermost portion of 26 GHz upper. Conversely, bidders who have won only 26 GHz upper lots would only be presented with assignment options in the upper portion of that frequency range. Bidders who have won both 26 GHz lower lots and 26 GHz upper lots but have not won the uppermost portion of 26 GHz lower would only be presented with assignment options in the remaining part of the frequency range.⁴⁶

A7.18 In the final assignment stage round, bidders who have won lots in both 26 GHz lower and upper would only be presented with assignment options for the upper portion of 26 GHz lower and the lower portion of 26 GHz upper.⁴⁷

A7.19 If there is unsold spectrum:⁴⁸

⁴⁴ The lower portion of the frequency range, in this case, indicates the frequencies below those automatically assigned to the bidder which has won lots across both 26 GHz lower and 26 GHz upper.

⁴⁵ The upper portion of the frequency range, in this case, indicates the frequencies above those automatically assigned to the bidder which has won lots across both 26 GHz lower and 26 GHz upper.

⁴⁶ “Remaining” means any spectrum: (i) above the spectrum assigned to the bidder that won the uppermost portion of 26 GHz lower, and (ii) below the spectrum assigned to any principal stage winners of only 26 GHz upper lots. Therefore, if there is only one such bidder, it would be automatically assigned specific “remaining” frequencies and would not need to bid.

⁴⁷ Bidders who won spectrum in only 26 GHz lower or 26 GHz upper would not participate in the final assignment stage round.

⁴⁸ These rules on unsold lots would apply for both the initial assignment stage rounds for 26 GHz lower and upper, as well as the final assignment stage round of 26 GHz.

- i) any unsold lot(s) in 26 GHz lower would be placed as one contiguous block at the lowermost portion of the 26 GHz band; and
- ii) any unsold lot(s) in 26 GHz upper would be placed as one contiguous block at the uppermost portion of the 26 GHz band.

Assignment stage bids

- A7.20 As mentioned, Ofcom determines a set of permissible assignment plans that meet the requirements listed in A7.11, and from A7.14 – A7.19.
- A7.21 If there is only one permissible assignment plan that meets these requirements, then bidders would be assigned the frequencies in accordance with this permissible assignment plan. If there are multiple assignment plans that meet these requirements, then the bidders who would be assigned alternative frequencies under these different plans are invited to submit bids for assignment options.
- A7.22 When placing an assignment stage bid, bidders specify the assignment option and the bid amount. The bid amount must be in whole thousands of pounds and at least zero.
- A7.23 Bidders do not have to submit assignment stage bids to be assigned the lots they won in the principal stage. Participation in the bidding process of the assignment stage is optional. If a bidder chooses not to bid in one or more assignment stage rounds, Ofcom will interpret this as the bidder having submitted a bid of zero for all of its assignment options.

Bid submission

- A7.24 Bidders bid through the EAS. For every round, the interface of the EAS will provide an assignment stage form that lists all assignment options available to the bidder.
- A7.25 To submit its list of assignment stage bids, a bidder needs to enter on its assignment stage form the bid amount for each of the assignment options it wishes to bid for (the bid amount for any options left blank would be set to zero).

Determining the winning permissible assignment plan

- A7.26 At the end of the assignment stage, Ofcom independently determines the winning plan in each assignment stage round.
- A7.27 For each permissible assignment plan, Ofcom calculates the plan's total value by summing the bids for the plan. The winning assignment plan is the one with the greatest total value. If multiple plans yield the greatest value, one is selected randomly.
- A7.28 Each bidder will be assigned frequencies in accordance with the winning permissible assignment plan.

Determining the additional prices

- A7.29 “**Additional prices**” are the additional amounts winners pay for their specific frequencies. They are calculated independently for each assignment stage round. The total additional price to be paid by a bidder is equal to the sum of the additional prices (if any) payable by the bidder as a result of the initial assignment stage round for 26 GHz lower,⁴⁹ the initial

⁴⁹ In the Auction Regulations, the additional price to be paid by a bidder as a result of the initial assignment stage round for 26 GHz lower is defined as the “26 GHz lower lot first period additional price”.

assignment stage round for 26 GHz upper,⁵⁰ the final assignment stage round for 26 GHz lower and upper,⁵¹ and the single assignment stage round for the 40 GHz band.⁵²

A7.30 Additional prices are based on nearest-Vickrey pricing, which we detail below. This is the same pricing method used in our previous auctions.

Additional price calculation based on the nearest-Vickrey pricing

A7.31 The first step in finding the additional price is calculating the Vickrey prices. A bidder's Vickrey price is the opportunity cost of the bidder winning. It is the smallest amount the bidder could have bid and not be displaced by the next best alternative plan. This amount is found by:

- a) Setting the bidder's non-winning bids to zero.
- b) Reducing the bidder's winning bid until an alternative plan has the same total value.
- c) The Vickrey price is the greater of zero and the reduced bid calculated in (b).

A7.32 Steps (a), (b) and (c) are repeated for each bidder.

A7.33 In many circumstances, the Vickrey prices are the additional prices.

A7.34 Sometimes, the sum of the Vickrey prices is less than the total value of an alternative plan.⁵³ This shortfall implies one or more bidders are willing to pay more for an alternative plan than the Vickrey total. In such a case, the Vickrey prices are raised for some bidders to satisfy the following four requirements.

A7.35 **First requirement:** Each bidder's additional price is between zero and its bid.

A7.36 **Second requirement:** The sum of additional prices must be sufficiently large that no bidder or group of bidders is willing to pay more for an alternative assignment. In this calculation, winning bids used in alternative plans are included at the additional price rather than the bid, and non-winning bids are reduced by the difference between the bidder's winning bid and the additional price.

A7.37 **Third requirement:** If multiple sets of additional prices satisfy the first and second requirements, Ofcom selects one that minimises the sum of additional prices.

A7.38 **Fourth requirement:** If there are multiple sets of additional prices that satisfy the first, second, and third requirements, Ofcom selects the one that is closest to the Vickrey prices. Nearest-Vickrey implies that the winners with surplus contribute equally to eliminate the shortfall identified in the second requirement. Mathematically, Ofcom minimises the following sum across all bidders through the following formula: $\sum (p_A - c_A)^2$, where p_A is the additional price for bidder A, and c_A is the Vickrey price for bidder A.

⁵⁰ In the Auction Regulations, the additional price to be paid by a bidder as a result of the initial assignment stage round for 26 GHz upper is defined as the "26 GHz upper lot first period additional price".

⁵¹ In the Auction Regulations, the additional price to be paid by a bidder as a result of the final assignment stage round for 26 GHz lower and 26 GHz upper is defined as the "26 GHz lot second period additional price".

⁵² In the Auction Regulations, the additional price to be paid by a bidder as a result of the assignment stage round for 40 GHz is defined as the "40 GHz lower lot additional price".

⁵³ Winning bids used in alternative plans are included at the additional price rather than the bid, and non-winning bids are reduced by the difference between the bidder's winning bid and the additional price.

Example of assignment stage

- A7.39 In this section, we provide an example of how bid submission and frequency allocation would work in the assignment stage. We also show how additional prices are calculated. The additional prices in the box A7.2 example are without a shortfall, whereas the box A7.3 example has a shortfall calculation and distribution.
- A7.40 For box A7.2, we consider four principal stage winning bidders (A, B, C, and D), and only two lot categories (26 GHz lower and 26 GHz upper). This example assumes the same structure of the award (7 lots available in 26 GHz lower and 5 lots available in 26 GHz upper).
- A7.41 For box A7.3, we consider three principal stage winning bidders (A, B, and C) and only one lot category (40 GHz). This example assumes the same structure of the award (15 lots available in 40 GHz).
- A7.42 To show the assignment stage rules in detail, both examples provide the permissible assignment plans as they would be seen by Ofcom (with the assignment options for each bidder). However, in the real award, each bidder would only be able to see its assignment options in a round.

Box A7.2: Example of assignment stage with no shortfall

Suppose that in the principal stage:

- Bidder A wins 2 lots in 26 GHz lower and 2 lots in 26 GHz upper;
- Bidder B wins 3 lots in 26 GHz lower and 1 lot in 26 GHz upper;
- Bidder C wins 2 lots in 26 GHz lower and 0 lots in 26 GHz upper;
- Bidder D wins 0 lots in 26 GHz lower and 2 lots in 26 GHz upper.

Multiple bidders (A and B) have won spectrum in both 26 GHz lower and 26 GHz upper.

Round (i): initial assignment stage round for 26 GHz lower

Permissible assignment plans

Ofcom determines that there are two permissible assignment plans, as shown in Table A.4 below. For easy visualization, we highlight bidder A's assignment options within those plans in yellow, bidder B's in red, and bidder C's in green.

Table A7.4: Permissible assignment plans and assignment options for the initial assignment stage round for 26 GHz lower

26 GHz lower							
	25.1-25.3	25.3-25.5	25.5-25.7	25.7-25.9	25.9-26.1	26.1-26.3	26.3-26.5
AS.1	C		A		B		
AS.2	C		B			A	

Bidder C would automatically be assigned the lower portion of 26 GHz lower (25.1-25.5 GHz).

Bidder A would be presented with the assignment options of 25.5-25.9 GHz, and 26.1-26.5 GHz.

Bidder B would be presented with the assignment options of 25.9-26.5 GHz, and 25.5-26.1 GHz.

Assignment stage bids

Each bidder bids⁵⁴ for their assignment options within the two permissible assignment plans (as shown in table A.5 below)

Bidder A bids 0 for the 25.5-25.9 GHz frequencies, and 70 for the 26.1-26.5 GHz frequencies.

Bidder B bids 0 for the 25.5-26.1 GHz frequencies, and 50 for the 25.9-26.5 GHz frequencies.

Bidder C is presented with only one permissible assignment option, which is the 25.1-25.5 GHz frequencies. For this reason, they cannot bid.

Table A7.5: Assignment stage bids

26 GHz lower							
	25.1-25.3	25.3-25.5	25.5-25.7	25.7-25.9	25.9-26.1	26.1-26.3	26.3-26.5
AS.1	C - 0		A - 0		B - 50		
AS.2	C - 0		B - 0			A - 70	

Determining the winning permissible assignment plan

Ofcom determines which of the permissible assignment plans yields the highest total value:

- Option 1 yields a total value of 0+0+50 = 50.
- Option 2 yields a total value of 70.

Thus, in this case, the winning permissible assignment plan is Option 2 as it yields the highest value of 70.

Determining the prices

Firstly, we need to find the Vickrey price for each bidder’s winning bid. We start with bidder A. We:

- reduce all of A’s non-winning assignment stage bids to 0 (this does nothing since A had no other bids greater than 0);
- incrementally reduce bidder A’s winning bid of 70, until an alternative permissible assignment plan has the same bid value as Option 2. A’s bid is reduced down to 50, at which point Option 2 has the same bid value as Option 1.

⁵⁴ For the examples, we assume that prices and commitments must be in whole pounds. For the actual auction prices and commitments are in whole thousands of pounds.

- The Vickrey price for bidder A is 50.

Table A7.6: Assignment options with A's reduced bids

26 GHz lower							
	25.1-25.3	25.3-25.5	25.5-25.7	25.7-25.9	25.9-26.1	26.1-26.3	26.3-26.5
AS.1	C – 0		A - 0		B - 50		
AS.2	C - 0		B - 0			A – 50 (reduced, originally 70)	

We repeat these steps for bidder B and C. Since both have winning bids of 0 in Option 2, both of their Vickrey prices are 0.

Next, we check whether there is a shortfall caused by Vickrey prices. There is no shortfall since the sum of Vickrey prices (50) is equal to the only alternative assignment stage option 1 (50).

The winning frequencies and corresponding prices to pay are:

- Bidder A wins the 26.1-26.5 GHz frequencies and pays 50 (in addition to the base price determined in the principal stage).
- Bidder B wins the 25.5-26.1 GHz frequencies and pays 0 (in addition to the base price determined in the principal stage).
- Bidder C wins the 25.1-25.5 frequencies GHz and pays 0 (in addition to the base price determined in the principal stage).

Round (ii): initial assignment stage round for 26 GHz upper

Permissible assignment plans

Ofcom determines that there is one permissible assignment plan, as shown in table A7.7 below.

Table A7.7: Permissible assignment plans and assignment options for the initial assignment stage round for 26 GHz upper

26 GHz upper (GHz)					
	26.5-26.7	26.7-26.9	26.9-27.1	27.1-27.3	27.3-27.5
AS.1	A		B	D	

In round 1, bidder A won the 26.1-26.5 GHz frequencies (i.e. the uppermost part of 26 GHz lower). Thus, bidder A will automatically be assigned the lowermost part of 26 GHz upper.

Bidder D is the only bidder to have won lots in only 26 GHz upper. Bidder D is therefore automatically assigned the uppermost frequencies.

Bidder B can therefore only win the remaining frequencies 26.9 – 27.1 GHz.

As there is only a single permissible assignment plan, bidders will be automatically assigned the frequencies without bidding in round 2. Thus,

- Bidder A is assigned the 26.5-26.9 GHz frequencies and pays 0.
- Bidder B is assigned the 26.9-27.1 GHz frequencies and pays 0.
- Bidder D is assigned the 27.1-27.5 GHz frequencies and pays 0.

Round (iii): Final assignment stage round for 26 GHz

Permissible assignment plans

Ofcom determines that there are two permissible assignment plans, as shown in table A7.8 below.

Table A7.8: Permissible assignment plans and assignment options for the final assignment stage round for 26 GHz

	26 GHz (GHz)											
	25.1-25.3	25.3-25.5	25.5-25.7	25.7-25.9	25.9-26.1	26.1-26.3	26.3-26.5	26.5-26.7	26.7-26.9	26.9-27.1	27.1-27.3	27.3-27.5
AS.1	C		A				B				D	
AS.2	C		B				A				D	

Only bidders A and B participate in round 3. This is because these bidders have won lots in both the 26 GHz lot categories. Bidder C and D will keep the frequencies won during the initial assignment stage rounds, at the lowermost and uppermost parts of the 26 GHz band respectively.

Assignment stage bids

Each bidder bids for their assignment options within the two permissible assignment plans (see table A7.9):

- Bidder A bids 0 for the 25.5-26.3 GHz frequencies, and 40 for the 26.3-27.1 GHz frequencies.
- Bidder B bids 10 for the 25.5-26.3 GHz frequencies, and 0 for the 26.3-27.1 GHz frequencies.

Table A7.9: Assignment stage bids

	26 GHz (GHz)											
	25.1-25.3	25.3-25.5	25.5-25.7	25.7-25.9	25.9-26.1	26.1-26.3	26.3-26.5	26.5-26.7	26.7-26.9	26.9-27.1	27.1-27.3	27.3-27.5
AS.1	C		A - 0				B - 0				D	
AS.2	C		B - 10				A - 40				D	

Determining the winning permissible assignment plan

The winning permissible assignment plan is Option 2 as it yields the highest value of 50. Option 1 yields a value of 0.

Determining the prices

The prices to be paid are determined with the same process as before. The winning frequencies and corresponding prices to pay are thus the following:

- Bidder A wins the 26.3-27.1 GHz frequencies and pays 0.
- Bidder B wins the 25.5-26.3 GHz frequencies and pays 0.

Therefore, at the end of the assignment stage:

- Bidder A wins the 26.1-26.5 frequencies and the 26.5-26.9 GHz frequencies for the initial licence and the 26.3-27.1 GHz frequencies for the final licence. It pays 50 (in addition to the base price determined in the principal stage).
- Bidder B wins the 25.5-26.1 GHz frequencies and the 26.9-27.1GHz frequencies for the initial licence and the 25.5-26.3 GHz frequencies for the final licence. It pays 0 (in addition to the base price determined in the principal stage).
- Bidder C wins the 25.1-25.5 GHz frequencies for the entire licence duration. It pays 0 (in addition to the base price determined in the principal stage).
- Bidder D wins the 27.1-27.5 GHz frequencies for the entire licence duration. It pays 0 (in addition to the base price determined in the principal stage).

Box A7.3: Example of assignment stage with a shortfall

Suppose that in the principal stage:

- Bidder A wins 3 lots in 40 GHz;
- Bidder B wins 3 lots in 40 GHz;
- Bidder C wins 9 lots in 40 GHz;

Round (i): final assignment stage round for 40 GHz

Ofcom determines that there are six permissible assignment plans, as shown in Table A7.10 below. In this example, for easy visualization, location 1 refers to frequencies 40.5-40.7 GHz; location 2 refers to frequencies 40.7-40.9 GHz; etc.; location 15 refers to frequencies 43.3-43.5 GHz. We highlight bidder A’s assignment options within those plans in yellow, bidder B’s in red, and bidder C’s in green.

Table A7.10: Permissible assignment plans and assignment options for the final assignment stage round for 40 GHz

40 GHz																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
AS.1	A		B			C										
AS.2	A		C							B						
AS.3	B		A			C										

40 GHz		
AS.4	B	C
AS.5	C	A
AS.6	C	B

Assignment stage bids

Each bidder bids for their assignment options within the permissible assignment plans (as shown in table A7.11 below)

- Bidder A bids 22 for location 1 to 3, 0 for location 4 to 6, 0 for location 10 to 12, and 0 for location 13 to 15.
- Bidder B bids 0 for location 1 to 3, 30 for location 4 to 6, and 0 for location 13 to 15.
- Bidder C bids 40 for location 1 to 9, 0 for location 4 to 12, and 0 for location 7 to 15.

Table A7.11: Assignment stage bids

40 GHz															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AS.1	A – 22			B – 30			C – 0								
AS.2	A – 22			C – 0						B – 0					
AS.3	B – 0			A – 0			C – 0								
AS.4	B – 0			C – 0						A – 0					
AS.5	C – 40						A – 0			B – 0					
AS.6	C – 40						B – 0			A – 0					

Determining the winning permissible assignment plan

Ofcom determines which of the permissible assignment plans yields the highest total value:

- Option 1 yields a total value of $22+30+0 = 52$.
- Option 2 yields a total value of 22.
- Options 3, and 4 yield a total value of 0.
- Options 5, and 6 yield a total value of 40.

Thus, in this case the winning permissible assignment plan is Option 1 as it yields the highest value of 52.

Determining the prices

Firstly, we need to find the Vickrey price for each bidder’s winning bid. We start with bidder A. We:

- Reduce all of A’s non-winning assignment stage bids to 0 (this does nothing since A had no other bids greater than zero);
- Incrementally reduce bidder A’s winning bid of 22, until an alternative permissible assignment round has the same bid value as Option 1. A’s bid is reduced down to 10, at which point Option 1 has the same bid value as Options 5 and 6.
- The Vickrey price for bidder A is 10.

Table A7.12: Assignment options with A’s reduced bids.

40 GHz															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AS.1	A – 22 (reduced to 10)			B – 30			C – 0								
AS.2	A – 22 (reduced to 10)			C – 0								B – 0			
AS.3	B – 0		A – 0			C – 0									
AS.4	B – 0		C – 0								A – 0				
AS.5	C – 40						A – 0			B – 0					
AS.6	C – 40						B – 0			A – 0					

We repeat these steps for bidder B and C.

We incrementally reduce bidder B’s winning bid of 30, until an alternative permissible assignment plan has the same bid value as Option 1. B’s bid is reduced down to 18, at which point Option 1 has the same bid value as Options 5 and 6. The Vickrey price for bidder B is 18.

Since bidder C has a winning bid of 0 in Option 1, the Vickrey price for bidder C is 0.

Next, we check whether there is a shortfall caused by Vickrey prices. There is a shortfall since the sum of Vickrey prices (28) is lower than assignment stage option 5 and 6 (40). This is due to bidders A and B outbidding a larger bidder, C, for a location. We therefore need to raise the Vickrey prices for some bidders based on the four requirements.

First requirement

Bidder A’s payment is between 0 and its bid of 22.

Bidder B’s payment is between 0 and its bid of 30.

Bidder C’s payment is 0.

Second requirement

The sum of additional prices must be sufficiently large that no bidder or group of bidders is willing to pay more for an alternative assignment.

In this case bidder C was willing to pay 40 more for option 5 and 6 than its final placement in option 1. However, bidder A and B's Vickrey prices sum to 28. Therefore, the sum of Vickrey prices for A and B must be raised to at least 40.

Third requirement

Ofcom must select the additional prices that minimise the additional payments.

The sum of additional prices from A and B must therefore be 40 and no larger.

Therefore, the shortfall is 12 (40 – 28).

Fourth requirement

We split the shortfall equally amongst A and B, subject to the constraint that no winner pays more than its bid.

Bidder A's additional price is therefore 10 (Vickrey price) + 6 (shortfall share) = 16

Bidder B's additional price is therefore 18 (Vickrey price) + 6 (shortfall share) = 24

The additional prices of A and B are below each of their respective bids, so we do not need to reallocate any excess.

Therefore, at the end of the assignment stage:

- Bidder A wins location 1 to 3 (40.5 GHz – 41.1 GHz frequencies) and pays 16 (in addition to the base price determined in the principal stage).
- Bidder B wins location 4 to 6 (41.1 – 41.7 GHz frequencies) and pays 24 (in addition to the base price determined in the principal stage).
- Bidder C wins location 7 to 15 (41.7 – 43.5 GHz frequencies) and pays 0 (in addition to the base price determined in the principal stage).

Deposit

Required assignment stage deposit

A7.43 For each assignment stage round, by a deadline to be specified by Ofcom, bidders need to have on deposit at least the sum of the total base price for each of the 26 GHz lower, 26 GHz upper, and 40 GHz lot categories,⁵⁵ previous assignment stage round additional prices (if any), plus the amount corresponding to the bidder's highest assignment stage bid for the assignment stage round in question.

A7.44 If the bidder does not provide Ofcom with the assignment stage deposit, all the assignment stage bids for the assignment stage round in question submitted by the bidder (if any) would be deemed to be invalid.

A7.45 As a result, the bidder would be deemed to have made a valid assignment stage bid with a value of zero pounds for all available assignment stage options in that round.

⁵⁵ See paragraph A6.86.

Total auction sum

- A7.46 After the end of the assignment stage, Ofcom will notify each bidder of the total auction sum payable by them.
- A7.47 Where a bidder's total auction sum is less than the amount it has on deposit, Ofcom would specify a deadline by which it must pay the difference between the amounts.
- A7.48 A bidder that does not provide the total auction sum payable by the deadline will not be entitled to the grant of any licences, nor a refund of its deposit. Such a bidder will also remain liable to pay the difference between its deposit and its total auction sum payable.

Information released at the end of each assignment stage round

- A7.49 At the end of each assignment stage round, each bidder is informed of:
- a) The frequencies assigned to the bidder;
 - b) The additional price to be paid for a licence authorising use of the frequencies;
 - c) The start and end time for the next assignment stage round (if any).
- A7.50 Additionally, if no further assignment stage round is to take place, each bidder will receive a message indicating the end of the assignment stage.

Information released at the end of the auction

- A7.51 The auction ends with the completion of the grant stage, in which the licences are awarded to the relevant parties. At this point, the following information would be released to all bidders:
- a) the frequencies assigned to each bidder that has been awarded spectrum; and
 - b) the price paid by each bidder that has been awarded spectrum, including a breakdown of that bidder's base price and any additional prices.
- A7.52 After the auction, Ofcom would also publish information on its website, including:
- a) the names of the winning bidders and the frequencies won by those bidders (and licence fees paid);
 - b) the names of those winning bidders (if any) that failed to pay their total auction sum on time and who therefore failed to obtain licences in the auction, despite making winning bids; and
 - c) details of principal stage bids and assignment stage bids for all bidders and all rounds.