Auction 110 Clock Phase Technical Guide

1 Introduction

This technical guide details the bidding procedures for the first phase—the clock phase—of Auction 110 as described in the *Auction 110 Procedures Public Notice*.[1] The *Auction 110 Assignment Phase Technical Guide* describes the bidding procedures for the second part of Auction 110—the assignment phase.

Pursuant to the *3.45 GHz Second Report and Order*, the 3.45–3.55 GHz band will be reconfigured and licensed in uniform 10-megahertz blocks in each of the 406 PEAs in the contiguous United States.[2] In most PEAs, new licensees generally will have unrestricted use of all ten frequency blocks. In other areas, licensees must coordinate with incumbent federal operations in the band. In some of the PEAs where coordination is required, all ten blocks will be subject to the same requirements. In others, the requirements may vary depending upon the frequency block—specifically, in 72 PEAs, four blocks (A through D) will be subject to different requirements than the remaining six blocks (E through J). Finally, in three PEAs (PEAs 041, 044, and 227), eight blocks (A through H) will be subject to restrictions resulting from the Special Temporary Authority (STA) granted to Lockheed Martin Corporation, whereas the remaining two blocks (I and J) will not be subject to any restrictions.[3]

The Commission has established the categories for bidding as follows: in the PEAs where all ten blocks are the same—*i.e.,* all ten generally are unrestricted or all ten are subject to the same requirements—the ten generic blocks will be considered Category 1, or "Cat1," blocks. In the PEAs subject to cooperative sharing requirements or restrictions where the requirements differ according to the frequency, the A through D blocks will be considered Category 1, or "Cat1," while blocks E through J will be considered Category 2, or "Cat2." In the three PEAs subject to restrictions resulting from the STA granted to Lockheed Martin Corporation, the A through H blocks will be considered Category 1, or "Cat1," while blocks I and J will be considered Category 2, or "Cat2."

For the clock phase, a product is the pairing of a PEA and a category. In most PEAs there will be a single product (Cat1), and in 75 PEAs there will be two products (Cat1 and Cat2).

The clock phase will consist of a series of timed bidding rounds. In the first round, bidders will indicate their demands for products at the opening prices, or minimum opening bids. In each round after the first round, a range of prices is associated with each product. The *start-of-round price* is the lowest price in the range, and the *clock price* is the highest price in the range. During the round, bidders will submit bids indicating demand for generic blocks in a product, at a price they specify that is greater than or equal to the start-of-round price and less than or equal to the clock price. After each bidding round closes, the bids

[1] *See Auction of Flexible-Use Licenses in the 3.45-3.55 GHz Band for Next Generation Wireless Services; Notice and Filing Requirements, Minimum Opening Bids, Upfront Payments, and Other Procedures for Auction 110, Bidding in Auction 110 Scheduled to Begin October 5, 2021*, AU Docket No. 21-62, Public Notice, DA 21-655 (rel. June 9, 2021).

[2] *See generally Facilitating Shared Use in the 3100-3550 MHz Band*, WT Docket No. 19-348, Second Report and Order, Order on Reconsideration, and Order of Proposed Modification, FCC 21-32 (Mar. 18, 2021) (*3.45 GHz Second Report & Order*).

[3] *Lockheed Martin Request for Part 90 Special Temporary Authority to Operate Two Radiolocation Service Sites in the 3.45 GHz Band*, ULS File No. 0009581172, Order, DA 21-693 (WTB June 16, 2021).

are processed. Bid processing determines the quantity of a bidder's requested demand that is applied (the *processed demand*) and the *posted price* of each product for the round.

If, after the bids are processed, there is no excess demand for blocks in any product, the clock phase of the auction will end and the *final clock phase price* for each product will be equal to the posted price of the last round. Otherwise, the auction will continue with a new clock round in which a product's start-of-round price equals the posted price of the previous round.

The Commercial Spectrum Enhancement Act, as amended by the Spectrum Act, requires that the total cash proceeds from the auction must equal at least 110% of the estimated relocation or sharing costs provided to the Commission by the National Telecommunications and Information Administration (NTIA). The Commission's rules require that this statutory requirement is met by establishing a reserve price. NTIA has estimated that the relocation or sharing costs for eligible Federal entities assigned to frequencies in the 3.45–3.55 GHz band will be $13,432,140,300.[4] Therefore, the Commission has established a single aggregate reserve price, net of bidding credits, for the auction to ensure that total cash proceeds from the auction equal at least $14,775,354,330.

If the reserve price has been met when the clock phase concludes, then the auction will proceed with the assignment phase. Otherwise, the auction will end, and no new licenses will be assigned.

Section 2 describes the bidding requirements. Section 3 describes the calculations for the bidding information shown to bidders. Section 4 describes the types of bids bidders can submit. Section 5 describes how bids are processed after a round. Section 6 describes how the system checks whether the reserve price has been met, and Section 7 describes the stopping rule. Section 8 describes the information policy, and Section 9 describes how the system sets up the next round if the stopping rule has not been met after a round.

2 Bidding Requirements

A bidder in the auction indicates in each round its demand for blocks of the products it desires at current prices. When submitting a bid, the bidder specifies a quantity and a price. The price can be the start-of-round price, the clock price, or any price in between (an "intra-round bid").

In order to give bidders flexibility to express their demands, the auction includes two types of bids: simple bids and switch bids. A simple bid can be submitted for any product. A switch bid can only be submitted for a PEA with two categories. Section 4 provides detailed explanations and examples of these bid types.

A bidder may submit only one of the two types of bids for a given product in a round: simple bids or switch bids. For example, if a bidder submits a simple bid for a given product, then it cannot also submit a switch bid involving that product in the same round.

[4] Letter from Carolyn Roddy, Deputy Assistant Secretary for Communications and Information, National Telecommunications and Information Administration, to the Honorable Ajit Pai, Chairman, Federal Communications Commission, Attachment, (January 14, 2021).

In the first round of the auction, a bidder may only submit a bid for a product at the opening price (the minimum opening bid) for that product and only for a quantity that is greater than 0.

For all subsequent rounds, a bidder may either submit a bid to maintain its demand for a product at the round's clock price or submit a bid to change its demand for the product at a price that is greater than or equal to the start-of-round price and less than or equal to the clock price. The bid quantity must be greater than or equal to 0.

Starting in round 2, a bidder may submit multiple bids for the same product in a round. For example, a bidder that begins a round with processed demand of 2 blocks for a product might submit one bid to reduce its demand for that product from 2 to 1 at a price of $5,500 and another bid to reduce its demand for the product from 1 to 0 at a price of $5,800.

In each PEA, there is an aggregation limit of 4 blocks. This implies that a bidder cannot bid for a quantity that is greater than 4 for a product. Moreover, in the case of a PEA with two categories, a bidder cannot submit bids if the sum of the bid quantities across the two products in the PEA exceeds 4.

If, in a PEA with two categories, the bidder wishes to submit multiple bids per product, the bidding system will determine whether the bids satisfy the aggregation limit based on the bid with the highest price for each product—in other words, on the quantities that the bidder would have of each product after bid processing for the round, if its bids for the two products were applied.

In Round 1, a bidder will *not* be allowed to submit a bid or a collection of bids if the bidder's activity for the round would exceed the bidder's eligibility for the round. In any round after Round 1, a bidder will *not* be allowed to submit a bid or collection of bids if the bidder's activity for the round would exceed the bidder's *contingent bidding limit* for the round.[5] The bidder's contingent bidding limit for the round is equal to the contingent bidding percentage for the round times the bidder's eligibility for the round, rounded up to the nearest integer (see Section 3.3). This implies that, if a bidder's eligibility for the round is equal to 0, then the bidder will not be able to submit any bids.

A bidder may *not* submit two different bids that involve the same product at the same price. For example, the bidder cannot submit a simple bid for 2 blocks of a given product and a simple bid for 0 blocks of that product both at the same price.

If a bidder submits multiple bids for a product in a round, all of those bids must be monotonic in terms of price. That is, if all of those bids are put in ascending order by price, the corresponding quantities must all either increase or decrease starting from the bidder's processed demand from the previous round. For example, in a PEA with one category, suppose that the bidder has processed demand of 2 blocks, the start-of-round price is $100,000, and the clock price is $110,000. Then, the bidder can submit a bid to reduce its demand to 1 block at $103,000 and another bid to further reduce its demand to 0 blocks at $105,000, but cannot submit a third bid to increase its demand to 1 block at $107,000.

[5] Even though a bidder may be allowed to submit activity that exceeds its eligibility, the bidder's processed activity cannot exceed its eligibility. Therefore, if a bidder submits activity that exceeds its eligibility, some of its bids will not be applied during bid processing. See Sections 3.3, 5.3, and 9.1 for more information.

3 Calculations for Bidding Information

In the following sections, R denotes the set of all products.

3.1 Activity

When a clock round is open for bidding, the *activity* of a bidder is calculated as the total number of bidding units associated with the demand the bidder indicates it is willing to accept at the clock price, given all bids that the bidder has submitted.[6] In other words, the activity of bidder i in round t is:

$$\sum_{r \in R} q_{t,i,r} \cdot b_r$$

Where:

- $q_{t,i,r}$ denotes the requested demand of bidder i for product r at the clock price of round t, given all bids that bidder i has submitted so far in this round. In particular, if all the bids that are submitted by bidder i for product r are applied during bid processing, then its processed demand will be $q_{t,i,r}$.
- b_r denotes the number of bidding units associated with product r.

At the beginning of a round, *i.e.*, before the bidder has submitted any bids in this round, the bidder's activity is equal to 0.

Example 1: Products 1 and 2 are in different PEAs. Product 1 has 10 bidding units and product 2 has 8bidding units. For product 1, the start-of-round price is $5,000 and the clock price is $6,000. For product 2, the start-of-round price is $4,000 and the clock price is $4,800. Suppose that, after the previous round, bidder i has processed demand of 2 blocks for product 1 and 4 blocks for product 2. The bidder has submitted the following bids in the current bidding round:

- Product 1: a simple bid for 1 block at price $5,500, and a simple bid for 0 blocks at price $ 5,700. (See Section 4.1 for a description of simple bids.)
- Product 2: a simple bid for 2 blocks at price $4,500.

After the bidder has submitted these three bids, its activity is: $(0 \cdot 10) + (2 \cdot 8) = 16$ bidding units.

3.2 Required Activity

A bidder's required activity in round t is the minimum total number of bidding units associated with the bidder's processed demand that the bidder must have after the bid processing of round t in order to maintain the same eligibility in round $t + 1$.

The required activity of bidder i in round t is calculated by multiplying the activity requirement percentage for round t with the eligibility of bidder i in round t. The result is rounded down to the nearest integer. The activity requirement percentage may change from round to round. The activity

[6] The bidding system provides the activity calculation, as described here, during the bidding round. Processed activity and processed demand cannot be determined until after the round's bids have been processed, so will be made available to bidders after the round.

requirement percentage will be set within a range of 90% and 100% inclusive, and the initial activity requirement percentage will be set at 95%.

3.3 Contingent Bidding Limit

A bidder's *contingent bidding limit* for a round represents the maximum activity that the bidder can submit for the round. For Round 1, the contingent bidding limit of bidder i is equal to the bidder's initial eligibility.

For any round $t > 1$, the contingent bidding limit of bidder i is calculated by multiplying the contingent bidding percentage for round t with the eligibility of bidder i for round t. The result is rounded up to the nearest integer. The contingent bidding percentage may change from round to round. The contingent bidding percentage will be set within a range of 100% and 140% inclusive, and the initial contingent bidding percentage will be set at 120%.

Example 2: Consider a round $t > 1$. The contingent bidding percentage for round t is 120% and the eligibility of bidder i for round t is 156 bidding units. Then, the bidder's contingent bidding limit for round t is calculated as 120% of 156, which after rounding up to the nearest integer yields 188. That is, the bidder can submit bids with activity of up to 188 bidding units.

The bidding system, however, will not apply bids that would result in the bidder having processed activity that exceeds its eligibility. Note also that the price point associated with a bid determines the order in which the bid will be processed. Therefore, a bidder submitting bids with activity that exceeds its eligibility—that is, bids not all of which can be applied—should indicate price points that reflect its preferences for the order in which it wishes its bids to be processed by the system. *See* Section 5.2 for the definition of price point.

Example 11 in Section 9.1 illustrates a scenario where the contingent bidding limit is used properly to address the potential for loss of bidding eligibility under some circumstances. Example 12 in Section 9.1 provides some case studies where the contingent bidding limit is not used properly.

3.4 Payment Information Available While the Round Is Open for Bidding

For the convenience of bidders, the bidding system will provide information about the financial exposure created by bids during the course of the auction.

The following notation is used in this section:

- $q_{t,i,r}$ denotes the requested demand of bidder i for product r at the clock price of round t, given all bids that bidder i has submitted so far in this round. In particular, if all the bids that are submitted by bidder i for product r are applied during bid processing, then its processed demand will be $q_{t,i,r}$.
- $P_{t,r}$ denotes the clock price in round t for product r.
- BC_i denotes the bidding credit percentage of bidder i.
- R denotes the set of all products.

- S denotes the set of all products in small markets.[7]
- $RC_{t,i}$ denotes the requested commitment of bidder i in round t (defined in Section 3.4.1).

3.4.1 Requested Commitment

A bidder's *requested commitment* during a clock round t is the total bid amount calculated at the round's clock prices, given the bids that the bidder has submitted so far in round t. During the round, bids for the round will not yet have been processed, so the requested commitment is an estimate of a bidder's commitment, and the estimate is updated as bids are submitted. The requested commitment of bidder i in a clock round t is calculated according to the following formula:

$$RC_{t,i} = \sum_{r \in R} q_{t,i,r} \cdot P_{t,r}$$

At the beginning of a round, *i.e.*, before the bidder has submitted any bids in this round, the bidder's requested commitment is equal to 0.

Example 3: For product 1, the start-of-round price is $5,000 and the clock price is $6,000. For product 2, which is in a different PEA, the start-of-round price is $4,000 and the clock price is $4,800. Suppose that, after the previous round, bidder i has processed demand of 4 blocks for product 1 and 4 blocks for product 2. The bidder has submitted the following bids in the current bidding round:

- Product 1: a simple bid for 3 blocks at price $5,500, and a simple bid for 2 blocks at price $5,700. (See Section 4.1 for a description of simple bids.[8])
- Product 2: a simple bid for 2 blocks at price $4,500.

By submitting these bids, the bidder indicates that (1) it is willing to purchase 2 blocks of product 1 at the clock price of $6,000 per block, and (2) it is willing to purchase 2 blocks of product 2 at the clock price of $4,800 per block. After submitting these three bids, the bidder's requested commitment is:

$$(2 \cdot \$6{,}000) + (2 \cdot \$4{,}800) = \$21{,}600$$

3.4.2 Bidding Credit Discounts on Requested Commitment

This section describes the calculations for requested commitment bidding credit discounts in a round t. All bidding credit discounts are rounded to the nearest dollar. Rounding is only done at the very end of a given calculation, that is, after performing any summations and/or minimizations in a formula.

[7] PEAs that are subject to the small market bidding credit cap in Auction 110 are those PEAs with a population of 500,000 or less, which correspond to PEAs 118–211, 213–263, 265–297, 299–359, and 361–411. *See Updating Part 1 Competitive Bidding Rules et al.*, WT Docket Nos. 14-170, 05-211, GN Docket No. 12-268, RM-11395, Report and Order, Order on Reconsideration of the First Report and Order, Third Order on Reconsideration of the Second Report and Order, Third Report and Order, 30 FCC Rcd 7493, 7546-47, paras. 127-28 (2015).

[8] For example, a simple bid for 2 blocks at a price of $5,700 indicates that at a price of $5,700 up to the clock price of $6,000, the bidder demands 2 blocks.

Rural Service Provider Bidding Credit. If bidder i qualifies for the rural service provider bidding credit, then in round t,

Its *uncapped requested commitment discount* is:

$$BC_i \cdot RC_{t,i}$$

Its *requested commitment discount* is:

$$min\{\$10 \text{ million}, BC_i \cdot RC_{t,i}\}$$

This is equal to the bidder's requested commitment multiplied by its bidding credit percentage and then capped at $10 million.

Small Business Bidding Credit. If bidder i qualifies for the small business bidding credit, then in a clock round t,

Its *uncapped requested commitment discount in small markets* is:

$$BC_i \cdot \sum_{r \in S} q_{t,i,r} \cdot P_{t,r}$$

Note that the summation is across all products in small markets. The uncapped requested commitment discount in small markets is calculated by multiplying the bidder's requested commitment in small markets with its bidding credit percentage.

Its *uncapped requested commitment discount* (across all markets) is:

$$BC_i \cdot RC_{t,i}$$

Its *requested commitment discount* (across all markets) is:

$$min\left\{\$25 \text{ million}, BC_i \cdot \sum_{r \in R \setminus S} q_{t,i,r} \cdot P_{t,r} + min\left\{\$10 \text{ million}, BC_i \cdot \sum_{r \in S} q_{t,i,r} \cdot P_{t,r}\right\}\right\}$$

This calculation first caps the bidder's discount in small markets at $10 million, then adds the bidder's discount from all other markets (*i.e.*, markets that are not subject to the small market bidding cap) and caps the sum at $25 million.

3.4.3 Requested Net Commitment

A bidder's *requested net commitment* is equal to its requested commitment minus its requested commitment discount.

3.5 Payment Information Available After the Round Has Been Processed

After bid processing for a round, the bidding system will provide payment information to the bidder based on its processed demands and the posted prices for the round. The calculations are similar to the corresponding calculations for requested commitment and bidding credit discounts that are conducted during a round (as described in Section 3.4), except that the bidder's processed demand ($d_{t,i,r}$) is used instead of the bidder's requested demand at the clock price ($q_{t,i,r}$), and a product's posted price ($p_{t,r}$) is used instead of the product's clock price ($P_{t,r}$).

In addition to the notation of Section 3.4, the following notation is used in this section:

- $d_{t,i,r}$ denotes the processed demand of bidder i for product r after round t.
- $p_{t,r}$ denotes the posted price of product r after round t.
- $C_{t,i}$ denotes the commitment of bidder i after round t (defined in Section 3.5.1).

3.5.1 Commitment

The bidder's *commitment* from the previous round is a dollar value that is calculated from the bidder's processed demands and the posted prices after the bid processing of the previous round.

The commitment of bidder i after round t is given by the following formula:

$$C_{t,i} = \sum_{r \in R} d_{t,i,r} \cdot p_{t,r}$$

3.5.2 Bidding Credit Discounts on Commitment

This section describes the calculations for bidding credit discounts on a bidder's commitment after round t. All bidding credit discounts are rounded to the nearest dollar. Rounding is only done at the very end of a given calculation, that is, after performing any summations and/or minimizations in a formula.

Rural Service Provider Bidding Credit. If bidder i qualifies for the rural service provider bidding credit, then after round t,

Its *uncapped commitment discount* is:

$$BC_i \cdot C_{t,i}$$

Its *commitment discount* is:

$$min\{\$10 \text{ million}, BC_i \cdot C_{t,i}\}$$

Small Business Bidding Credit. If bidder i qualifies for the small business bidding credit, then after round t,

Its *uncapped commitment discount in small markets* is:

$$BC_i \cdot \sum_{r \in S} d_{t,i,r} \cdot p_{t,r}$$

Its *uncapped commitment discount* (across all markets) is:

$$BC_i \cdot C_{t,i}$$

Its *commitment discount* (across all markets) is:

$$min\left\{\$25 \text{ million}, BC_i \cdot \sum_{r \in R \setminus S} d_{t,i,r} \cdot p_{t,r} + min\left\{\$10 \text{ million}, BC_i \cdot \sum_{r \in S} d_{t,i,r} \cdot p_{t,r}\right\}\right\}$$

3.5.3 Net Commitment

A bidder's *net commitment* after round t is equal to its commitment after round t minus its commitment discount.

4 Bid Types

There are two types of bids:

Simple Bids: These bids indicate a desired quantity of a product at a price. During processing, if it is not possible to apply the simple bid in its entirety, it may be applied partially.[9]

Switch Bids: These bids allow a bidder to request to switch its demand for a quantity of a product from one category of generic blocks to another category within the same PEA. Switch bids may be applied partially, but the increase in demand in the "to" category will always match in quantity the reduction in the "from" category.

Below, a more detailed explanation is provided along with examples to illustrate each of these bid types and how the bidding system will process them.

4.1 Simple Bids

In Round 1, bidders will submit simple bids to indicate their initial demands for blocks in a category in a geographic area in which they are qualified to bid. In subsequent rounds, they may wish to maintain, reduce, or increase those demands using simple bids.

A *simple bid to maintain a quantity* equal to the bidder's processed demand for a product r at the round's clock price indicates that the bidder is willing to purchase a quantity equal to the previous round's

[9] Bids requesting a reduction in demand may not be fully applied if the reduction would cause the demand for blocks in the product to fall below the supply. Simple bids requesting an increase in demand may not be fully applied if that would cause the bidder's processed activity to exceed its eligibility or if that would cause the bidder's processed demands to exceed the aggregation limit.

processed demand at all prices in this round up to and including this round's clock price. Intra-round bids to maintain demand are not permitted.[10]

A *simple bid requesting to reduce demand* to a quantity q for a product r at price p in a round indicates that:

(1) At all prices above p and less than or equal to the clock price (or the next price at which the bidder submitted a bid, if the bidder submitted multiple bids for the product), the bidder is willing to purchase an exact quantity equal to q; and

(2) At price p, the bidder is willing to purchase any quantity between q and its previous demand for product r.[11]

If the bidder has submitted a single bid to reduce demand for product *r* in the round, the bidder is willing to purchase a quantity equal to its processed demand at all prices greater than or equal to the start-of-round price and less than that bid price. More generally, the bidder is willing to purchase a quantity equal to its processed demand at all prices greater than or equal to the start-of-round price and less than the lowest bid price among all of the bidder's bids to reduce demand for product r in the round.

By submitting one (or more) *simple bid(s) requesting to increase demand* for a product r at one (or more) price(s) in a round, the bidder indicates that at all prices associated with this round (*i.e.*, prices that are greater than or equal to the start-of-round price and less than or equal to the clock price) it is willing to purchase any quantity of product r that is greater than or equal to its processed demand and less than or equal to the maximum quantity that it specifies in a bid.[12]

Example 4: Bidder Submits a Simple Bid Requesting to Reduce Demand to 0 Blocks at $5,500

Suppose that after the bids of the previous round are processed, the bidder's processed demand for a product is 2 blocks and the posted price is $5,000. In the current round, the clock price is $6,000, and the bidder submits a single simple bid for the product requesting to reduce its demand to 0 blocks at price $5,500.

To the bidding system, this bid means the following:

- If the price is below $5,500, the bidder is willing to purchase 2 blocks.
- If the price is exactly $5,500, the bidder is willing to purchase 0, 1, or 2 blocks.

[10] A bidder cannot submit a bid to maintain its demand at a price below the round's clock price. Bids made at intra-round prices are used to indicate the price at which the bidder's requested demand changes from its processed demand from the previous round, or if the bidder requested a change at a lower intra-round price in the round, from its requested demand at the next lowest price.

[11] The bidder's previous demand for product r is either equal to its processed demand from the previous round or, if the bidder has submitted a simple bid at a price below p for product r, the quantity in the bid for product r with the highest price below p.

[12] The bidding system will not process the requested increase until bid processing reaches the price at which the bid was made, but depending upon demand for the product relative to its supply and depending upon which bids to reduce demand for the product are applied, the posted price for the current round may be above or below the bid price of the requested increase. The posted price may be lower if applying the increase allows another bidder's requested decrease at a lower price point to be applied.

- If the price is above $5,500, the bidder is not willing to purchase any blocks.

The graph below illustrates how the bidding system interprets this simple bid:

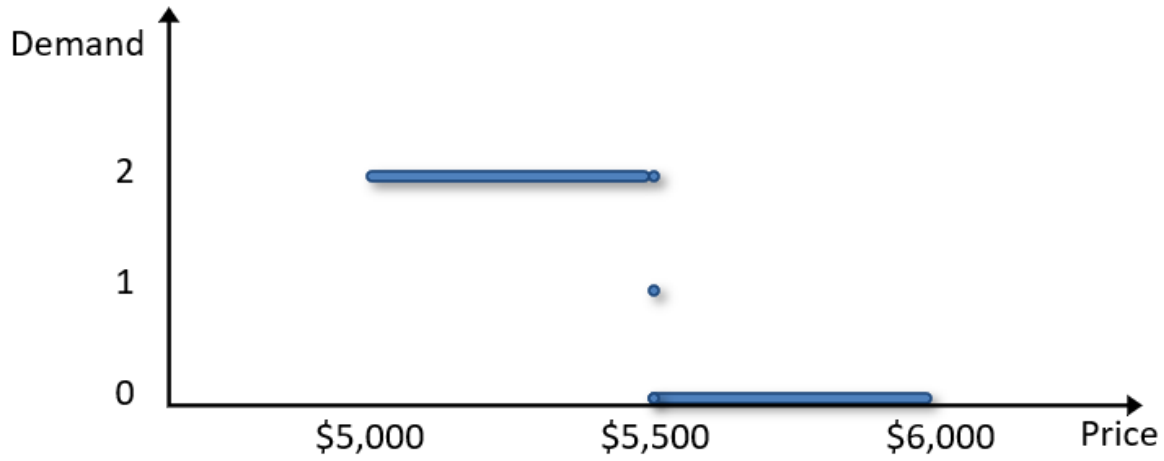

Figure 1: Simple bid to reduce demand to 0 blocks at $5,500

If a simple bid is partially applied, then the processed demand of the bidder is a quantity that is strictly between the bidder's processed demand before the simple bid was applied and the quantity that the bidder specified in the bid.

When the bidding system processes the bids at price $5,500, the simple bid will be applied fully, partially, or not at all depending on the level of excess demand at that point in the bid processing.

(a) If aggregate demand exceeds supply by more than 2 blocks, the bid is fully applied. The bidder will have processed demand for 0 blocks.

(b) If aggregate demand exceeds supply by exactly 2 blocks, the bid is also fully applied. The bidder will have processed demand for 0 blocks.

(c) If aggregate demand exceeds supply by only 1 block, the bid is partially applied. The bidder will have processed demand for 1 block.

(d) If aggregate demand does not exceed supply, the bid is not applied. The bidder will continue to have processed demand for 2 blocks.

Using the same bid, if no other bidder has submitted a bid requesting to change its demand for this product, then:

- In case (a), the posted price will be equal to $6,000.
- In cases (b) and (c), the posted price will be equal to $5,500.
- In case (d), the posted price will be equal to $5,000.

Example 5: Bidder Submits a Simple Bid Requesting to Increase Demand to 2 Blocks at $5,500

Suppose that, after the bids of the previous round are processed, the bidder's processed demand for a product is 0 blocks and the posted price is $5,000. In the current round, the clock price is $6,000, and the bidder submits a single simple bid for the product requesting to increase its demand to 2 blocks at price $5,500. This means that for all prices p such that $\$5{,}000 \leq p \leq \$6{,}000$, the bidder is willing to purchase 0, 1, or 2 blocks. The corresponding demand graph is shown in the following figure:

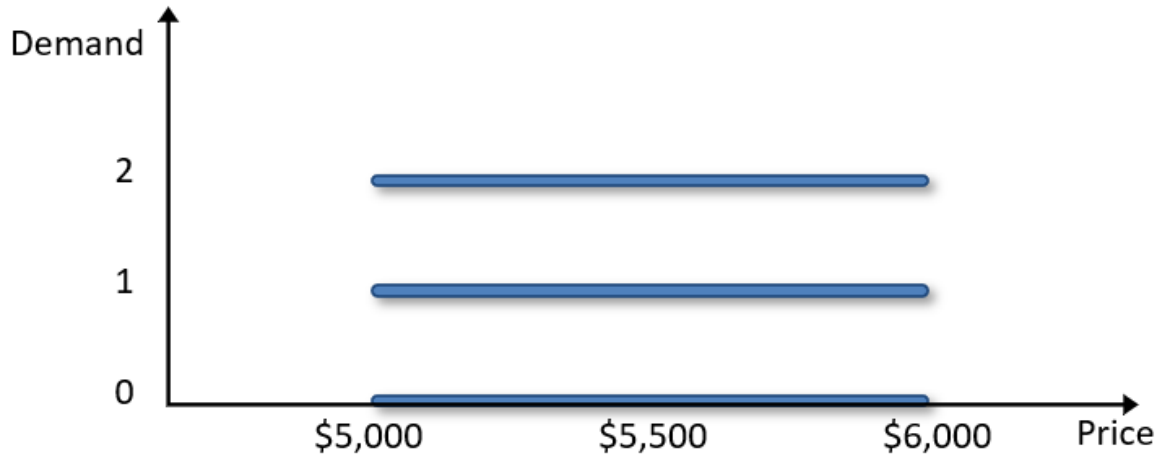

Figure 2: Simple bid to increase demand to 2 blocks at $5,500

4.2 Switch Bids

A *switch bid* is a request to move demand for up to n blocks in a given PEA from one category to another category. Thus, switch bids are possible only in the 75 PEAs with two categories (the remaining 331 PEAs have only one category in Auction 110). For instance, a bidder can request to switch 2 blocks from Cat1 to Cat2 in a given PEA. Switch bids may be applied partially or in full.

For each switch bid, the bidder specifies the "from" product as well as a price p and a quantity q for the "from" product. If the "from" product is the Cat1 product in a PEA, then the "to" product is the Cat2 product in that PEA, and vice versa. The bidder does not specify a quantity or a price for the "to" product. In processing the switch bid, the bidding system will determine the maximum number of blocks by which demand in the "from" product can be reduced (such that aggregate demand does not fall below supply) and will then switch an equal number of blocks to the "to" product.

Such a bid indicates that:

(1) At all prices that are strictly greater than p and less than or equal to the clock price (or the next price at which the bidder submitted a switch bid involving the "from" product), the bidder is willing to purchase an exact quantity of q of the "from" product;

(2) At price p, the bidder is willing to purchase any quantity between q and its previous demand for the "from" product;[13] and

(3) The bidder is willing to purchase up to a quantity of $d_t + (d_f - q)$ of the "to" product at the clock price, where d_t and d_f denote the bidder's previous demand for the "to" and "from" products respectively before the switch bid is applied.[14]

Regardless of whether a bid to switch n blocks from one product to another is fully or partially applied, if the processed demand of the bidder for the "from" product is reduced by m blocks, then the processed demand of the bidder for the "to" product is increased by m blocks, where $1 \leq m \leq n$. A switch bid for 1 block cannot be partially applied.

Example 6: Bidder Submits a Switch Bid for 2 Blocks from Cat1 to Cat2 at $5,500

Suppose that after the bids of the previous round are processed, the bidder's processed demand is 2 blocks in Cat1 and 0 blocks in Cat2 in a given PEA, and the posted price of Cat1 in that PEA is $5,000. In the current round, the clock price for Cat1 in that PEA is $6,000, and the bidder submits a single switch bid involving that PEA requesting to switch 2 blocks from Cat1 to Cat2 at price $5,500.

To the bidding system, this bid means the following:

- If the price of Cat1 is below $5,500, the bidder is willing to purchase 2 Cat1 blocks.
- If the price of Cat1 is exactly $5,500, the bidder wishes to switch demand from Cat1 to Cat2 by up to 2 blocks.
- If the price of Cat1 exceeds $5,500, the bidder is willing to purchase 2 Cat2 blocks.

Note that the bidder does not specify a quantity or a price for Cat2 in its bid. By submitting the bid, the bidder indicates a willingness to purchase up to 2 blocks of Cat2 at the current clock price.

When the bidding system processes the bids at price $5,500, this switch bid will be applied fully, partially, or not at all depending on the level of excess demand at that point in the bid processing:

- If aggregate demand exceeds supply by 2 or more blocks in Cat1, the bid is fully applied. The bidder will then have processed demand for 0 blocks in Cat1 and 2 blocks in Cat2.
- If aggregate demand exceeds supply by only 1 block in Cat1, the bid is partially applied. The bidder then will have processed demand for 1 block in Cat1 and 1 block in Cat2.
- If aggregate demand does not exceed supply, the bid is not applied at all. The bidder will continue to have processed demand for 2 blocks in Cat1 and none in Cat2.

In all cases, the bidder's total processed demand across the two categories is still 2. However, a switch bid may be applied partially in the sense that the number of blocks that are switched from Cat1 to Cat2

[13] The bidder's previous demand for the "from" product is either equal to its processed demand from the previous round or, if the bidder has submitted a switch bid at a price below p involving that product, the quantity in the bid involving that product with the highest price below p.

[14] The bidder's previous demand for the "to" product is either equal to its processed demand from the previous round or, if the bidder has submitted another switch bid involving that product, the quantity that has already been applied for this product during bid processing at the point this switch bid is considered.

may be smaller than the maximum number of blocks that the bidder was willing to switch, depending on whether it is possible to reduce the bidder's demand for Cat1.

5 Processing Bids for a Clock Round

This section describes bid processing in the clock rounds. The purpose of bid processing is to determine, at the conclusion of a round of bidding, the processed demands for all bidders and the posted prices for all the products.

5.1 Missing Bids

For each product for which the bidder had processed demand in the previous round, if the bidder did not submit a bid for that product during the current round, it will be deemed to have submitted a simple bid for that product with a quantity of 0 at the start-of-round price. For example, if the start-of-round price for a particular product is $6,000 and the bidder did not submit a bid in this round for that product, it will be deemed to have bid a quantity of 0 at $6,000. Note that this does not necessarily mean that a bidder will have processed demand for 0 blocks at $6,000. The missing bid will be processed just as if the bidder submitted a simple bid for 0 blocks at $6,000.

5.2 Price Points

The *price point* indicates the percentage of the distance between the start-of-round price and the clock price. Specifically, the price point of a bid is calculated as the following ratio:

$$\text{price point} = \frac{\text{bid price} - \text{start-of-round price}}{\text{clock price} - \text{start-of-round price}}$$

The result of the calculation is rounded to 10 decimal places.

For example, the 0% price point refers to the start-of-round price, the 100% price point refers to the clock price, and the 50% price point refers to the average of the start-of-round price and the clock price. As another example, if the start-of-round price is $5,000 and the clock price is $6,000, the price $5,100 corresponds to the 10% price point, and the price $5,400 corresponds to the 40% price point.

5.3 Processed Demands

Bids to maintain demand are always applied during bid processing, whereas bids to change demand are applied to the maximum extent possible.

Bids to change demand are prioritized for processing in the following order: by price point (from lowest to highest) across all bids, and then by bid-specific pseudorandom number (from lowest to highest). The priority ordering of bids remains the same throughout the bid processing of a round (that is, only one pseudorandom number is associated with a given bid in a round).[15]

[15] Each pseudorandom number is drawn uniformly at random from the set $\{0,1,2,\ldots,2^{40}-1\}$.

A simple bid to increase demand is applied to the maximum extent possible while ensuring that:

(1) the bidder's processed activity does not exceed its eligibility for the round; and

(2) in the case of a PEA with two categories, the bidder's processed demand across the two categories does not exceed 4.

A simple bid to reduce demand is applied to the maximum extent possible while ensuring that it does not create (or further increase) excess supply for the product.

A switch bid is applied to the maximum extent possible while ensuring that it does not create (or further increase) excess supply in the "from" product.

The bid processing algorithm maintains a queue of all bids to change demand from the round that have not been applied in their entirety. Whenever a bid is applied either partially or in its entirety, the queue is re-tested to determine whether any bids in the queue can be applied. When a bid has been applied in its entirety, it is removed from the queue; otherwise, it is kept in the queue so that the remaining part may be applied later. The re-testing of the queue is repeated until no bids remaining in the queue can be further applied. Then the next bid from the round is processed until (1) all bids from the round have been processed, and (2) no bids in the queue can be further applied. At that point, all bids remaining in the queue are discarded.

The demands of a bidder following the processing of the bids for the round are referred to as its processed demands.

5.4 Posted Prices

Once processed demands have been determined, the posted price for a product is set based on that product's aggregate demand. The aggregate demand is evaluated using the processed demands.

The posted price of each product is determined as follows:

- If aggregate demand exceeds supply, the posted price equals the clock price for the round.
- If aggregate demand equals supply and at least one bid to reduce demand for the product was applied (either entirely or partially), the posted price equals the highest bid price among all bids to reduce demand for the product that were applied (either entirely or partially). That is, the posted price is the price at which a reduction caused aggregate demand to equal supply.
- In all other cases, the posted price equals the start-of-round price (*i.e.,* the posted price of the previous round).

Note that the last condition implies that if aggregate demand is equal to supply at the start of the round, and all bidders with processed demand maintain their demand at the clock price and there are no other bids for the product in the round, the posted price will equal the start-of-round price.

These rules ensure that the posted price of a product will not be higher than the price of any bid that requested a reduction for that product but was not applied (either entirely or in part) *and* will not be lower than the price of any bid that requested a reduction for that product and was applied.

5.5 Bid Processing Examples

This section provides two examples to illustrate how processed demands and posted prices are calculated.

Example 7: A bidder with processed demand of 4 blocks for a product has submitted a simple bid for 0 blocks for that product. If applying the bid in its entirety would lead to excess supply for the product, but it is possible to apply up to 3 blocks of the reduction without creating excess supply for the product, then 3 blocks of the reduction will be applied. The bid for a quantity of 0 blocks for the product will be placed in the queue, so that the reduction of the remaining one block may be applied later, if conditions permit after other bids have been processed.

Example 8: Consider the Cat2 product with a supply of 6 blocks. Suppose that the start-of-round price is $10,000 and the clock price is $11,000. The following table shows, for each of four bidders, the bidder's processed demand after the previous round and the bid it submitted in this round for the product. All bids are simple bids.

Bidder	Previous Round Processed Demand	Submitted Bid Quantity@Price (Price Point)	Results of Bid Processing	
			Bid Applied?	Current Round Processed Demand
1	3	0 @ $10,500 (50%)	Partially	1
2	2	1 @ $10,600 (60%)	No	2
3	0	1 @ $10,800 (80%)	Yes	1
4	2	2 @ $11,000 (100%)	Yes	2

Based on the table above, the aggregate demand after the previous round is 7.

We assume that, for all other products, bidders have bid to maintain their demands at the clock prices.

The bid processing works as follows:

- All bids to maintain demand (including the bid of bidder 4 for this product) are applied.
- The bid of bidder 1 is processed next, because it has the lowest price point among all bids to change demand. Bidder 1 has bid to reduce its demand in the product from 3 to 0 blocks. It is possible to apply at most one block of the reduction without creating excess supply for the product. Thus, one block of the reduction is applied, and the bid for a quantity of 0 blocks is placed in the queue.
- At this point there is no excess demand for the product, and the processed demand of bidder 1 is 2 blocks.
- The bid of bidder 2 is processed next. Bidder 2 has bid to reduce its demand in the product from 2 blocks to 1 block. Because there is no excess demand for the product, it is not possible to apply this reduction without creating excess supply. Thus, the bid of bidder 2 is not applied and it is placed in the queue.
- The bid of bidder 3 is processed next. Bidder 3 has bid to increase its demand in the product from 0 blocks to 1 block. We assume that applying this bid does not cause the processed activity of

bidder 3 to exceed its eligibility for the round. Thus, the bid is applied, creating 1 unit of excess demand for the product.

- The queue is re-tested to determine whether any bids in the queue bid can be applied. The queue currently contains two bids.
    - The bid of bidder 1 is considered first because it has a lower price point than the bid of bidder 2. A reduction of an additional block is applied, and bidder 1 now has a processed demand of 1 block. Bidder 1's bid for a quantity of 0 blocks remains in the queue.
    - The bid of bidder 2 is considered next, but cannot be applied at all because there is no excess demand. Thus, the bid of bidder 2 remains in the queue.
- Bid processing ends, and the bids in the queue are discarded. The bidders' processed demands for the product are shown in the last column of the table above.
- The posted price is $10,500 (the bid price of bidder 1), because aggregate demand equals supply and the bid of bidder 1 is the only reduction bid that was applied (either entirely or partially).

6 Checking Whether the Reserve Price Has Been Met

Once the bids for the round have been processed, if the reserve price has not been met in a previous round, the system will check whether the reserve has been met in this round. The reserve price is met if the auction proceeds, adjusted to take into account the discounts for bidding credits, equal at least 110% of the estimated relocation or sharing costs provided to the Commission by NTIA.

If, after a round, aggregate demand is less than or equal to supply for all products, then this round is the final clock round and, in the event that the reserve price is met, each bidder will win its processed demand for the round. The system will determine that the reserve has been met if the sum, over all bidders, of a bidder's commitment minus its commitment discount is greater than or equal to $14,775,354,330. Note that commitments are based on the posted prices of the round (see Section 3.5).

If, after a round, aggregate demand exceeds supply for at least one product, then this round is not the final clock round and thus winning bidders are not known when the reserve price requirement is evaluated. In this case, bidding credits are incorporated with a worst-case calculation.

The following notation is used in this section:

- $d_{t,i,r}$ is the processed demand of bidder i for product r after round t.
- $p_{t,r}$ is the posted price for product r after round t.
- S_r is the supply of product r.
- BC_i is the bidding credit percentage of bidder i.
- R is the set of all products.

The worst-case calculation considers each product separately and does not take into account bidding credit caps. For the purpose of calculating a lower bound on the net proceeds, the proceeds of a product will be calculated as the lowest possible proceeds that could be expected given the bidders that currently have positive processed demand for that product and their associated bidding credits. Thus, the

calculation will consider the proceeds that would result if, for products with excess demand, blocks are first assigned to bidders with larger bidding credit percentages.

Now consider product r and suppose that there are m bidders with processed demand for the product.

If aggregate demand for product r is less than or equal to the product's supply, then the proceeds for product r after round t are calculated as:

$$\delta_{t,r} = p_{t,r} \cdot \sum_{i=1}^{m} (1 - BC_i) \cdot d_{t,i,r}$$

If the aggregate demand for the product exceeds the product's supply, then the m bidders with positive processed demand for product r are ordered in decreasing order of bidding credit percentages. Let k be the minimum number such that $\sum_{i=1}^{k} d_{t,i,r} \geq S_r$. Then, each bidder from 1 through $k-1$ is assigned its processed demand, bidder k is assigned any remaining supply up to its processed demand, and each bidder $k+1$ through m is not assigned any blocks in the worst-case calculation.

The estimated worst-case proceeds from product r after round t are calculated as:

$$\delta_{t,r} = p_{t,r} \cdot \sum_{i=1}^{k-1} (1 - BC_i) \cdot d_{t,i,r} + p_{t,r} \cdot (1 - BC_k) \cdot \min\left(d_{t,k,r},\ S_r - \sum_{i=1}^{k-1} d_{t,i,r} \right)$$

The reserve price is met after round t if:

$$\sum_{r \in R} \delta_{t,r} \geq \$14{,}775{,}354{,}330$$

After each round, bidders will be informed about whether the reserve price has been met. If the reserve price has not been met, bidders will be informed about the shortfall, that is, $\$14{,}775{,}354{,}330 - \sum_{r \in R} \delta_{t,r}$, rounded up to the nearest $1 million. The Public Reporting System will announce whether the reserve price has been met after a round, but will not provide information about the shortfall in the case that the reserve price has not been met.

Example 9: Calculation of Worst-Case Proceeds from a Product with Excess Supply

The aggregate demand for product p after round t is $D_{t,r} = 6$, and the product's supply is $S_r = 10$. There is excess supply of 4 blocks. There are two bidders with positive processed demand for product r: Bidder 1 has processed demand $d_{t,1,r}$ = 4 and a bidding credit percentage of 25%, and Bidder 2 has processed demand $d_{t,2,r}$ = 2 and does not qualify for a bidding credit. The posted price of product r after round t is $p_{t,r} = 100$.

To compute the estimated worst-case proceeds from product r, assume that:

- Bidder 1 is assigned 4 blocks (its processed demand)
- Bidder 2 is assigned 2 blocks (its processed demand)

That is, $\delta_{t,r} = 100 \cdot (1 - 25\%) \cdot 4 + 100 \cdot 2 = 500$

Example 10: Calculation of Worst-Case Proceeds from a Product with Excess Demand

Consider a product with supply of 10 blocks. There are 4 bidders each with a processed demand of 4 for that product. Bidders 1 and 2 have a bidding credit percentage of 25%, Bidder 3 has a bidding credit percentage of 15%, and Bidder 4 does not qualify for a bidding credit. The posted price is $p_{t,r} = 100$.

To compute the estimated worst-case proceeds from product r after round t, assume that:[16]

- Bidder 1 is assigned 4 blocks (its processed demand)
- Bidder 2 is assigned 4 blocks (its processed demand)
- Bidder 3 is assigned 2 blocks (the minimum of its processed demand and the number of available blocks given the blocks assigned to Bidders 1 and 2)
- Bidder 4 is not assigned any blocks

That is,

$$\delta_{t,r} = 100 \cdot (1 - 25\%) \cdot 4 + 100 \cdot (1 - 25\%) \cdot 4 + 100 \cdot (1 - 15\%) \cdot 2 = 770$$

Note that in this example all 6 blocks are assigned, because there is no excess supply.

The calculations for the worst-case proceeds from a product will be rounded down at the bidder product level to the nearest $1. In particular, in computing $\delta_{t,r}$, the estimated worst-case proceeds from product r, the calculations will be done in following way. The quantity $p_{t,r} \cdot (1 - BC_i) \cdot d_{t,i,r}$ is computed for every bidder i and each of these numbers is rounded down to the nearest dollar.[17] The summation of these numbers (across all bidders with positive processed demand for the product) will give the worst-case net proceeds from the product.

7 Stopping Rule

After the bids of a round have been processed, the stopping rule is met if, for every product, aggregate demand is less than or equal to supply. If the stopping rule is met, the clock phase concludes. Otherwise, the auction proceeds with a new clock round.

If the reserve price has been met at the conclusion of the clock phase, a bidder with processed demand for a product at the time the stopping rule is met will win licenses corresponding to that number of blocks and will be assigned specific frequencies in the assignment phase. The final clock phase price of a product equals the product's posted price after the last clock round.

If the reserve price has not been met at the conclusion of the clock phase, then the auction will end without assigning any new licenses.

[16] Note that processed demand is assigned to bidders in decreasing order of bidding credit percentage.

[17] In the case of a product with excess demand, the quantity $p_{t,r} \cdot (1 - BC_k) \cdot \min\left(d_{t,i,r},\ S_r - \sum_{i=1}^{k-1} d_{t,i,r}\right)$ for bidder k will also be rounded down to the nearest dollar.

8 Information Policy

After each clock round, the following information will be publicly available on the Public Reporting System for each product: the supply, the aggregate demand, the posted price of the last completed round, and the clock price for the next round. The identities of bidders demanding blocks in a specific category or PEA will not be disclosed until after Auction 110 concludes.

The Public Reporting System will also announce whether the reserve price has been met after a round. If the reserve has not yet been met, each bidder will be informed about the shortfall between the reserve and the estimated total cash proceeds, rounded up to the nearest million. This shortfall information will not be publicly available during the auction.

Each bidder will have access to additional information related to its own bidding and bid eligibility. Specifically, after the bids of a round have been processed, the bidding system will inform each bidder of the number of blocks it holds after the round (its processed demand) for every product and its eligibility for the next round.

9 Setting Up the Next Round

If the bidding system determines that there is excess demand for at least one product, then the system sets up the next round. The system must calculate each bidder's eligibility for the next round based on the activity associated with the bidder's processed bids in the previous round. The clock prices for the new round must also be calculated. This section provides the details of these calculations.

9.1 Processed Activity, Next Round Eligibility, and the Contingent Bidding Limit

A bidder's *processed activity* for a round is equal to the total number of bidding units associated with the bidder's processed demand after the bid processing of the round. Specifically, the bidder's processed activity after round t is calculated as:

$$\sum_{r \in R} d_{t,i,r} \cdot b_r$$

Where:

- R denotes the set of all products.
- $d_{t,i,r}$ denotes the processed demand of bidder i for product r after round t.
- b_r denotes the number of bidding units associated with product r.

An activity rule is used to require bidders to participate in each round of the auction. A bidder's eligibility in Round 1 of the auction is determined by the bidding units associated with its upfront payment.

A bidder's eligibility in subsequent rounds is calculated based on its eligibility in the previous round, its required activity (see Section 3.2), its processed activity, and the activity requirement percentage.

If the processed activity of bidder i after round t is greater than or equal to its required activity, then bidder i maintains its eligibility in the following round, that is, the bidder's eligibility for round $t + 1$ will equal the bidder's eligibility for round t.

Otherwise, the eligibility of bidder i for the round $t + 1$ is reduced and is set equal to the ratio of the bidder's processed activity for round t over the activity requirement percentage. The result is rounded up to the nearest integer.

Example 11: In a given round $t > 1$, the activity requirement percentage is 95% and the contingent bidding percentage is 120%. Consider a bidder with eligibility of 10,000 bidding units in the round. The following table shows the bidding units, start-of-round prices, and clock prices for products W, X, Y, and Z, as well as the bidder's processed demands after the previous round and its submitted bids in this round.

Product	Bidding Units	Previous Round Processed Demand	Start-of-Round Price	Clock Price	Submitted Bids Quantity@Price (Price Point)
W	7,000	1	$80,000	$90,000	0 @ $81,000 (10%)
X	2,800	1	$30,000	$35,000	0 @ $31,000 (20%)
Y	10,000	0	$90,000	$100,000	1 @ $93,000 (30%)
Z	2,000	0	$20,000	$24,000	1 @ $22,000 (50%)

Based on the table above, the bidder had one block of processed demand in products W and X in the previous round. In this round, the bidder has submitted bids to reduce its demand in products W and X to 0, and to increase its demand in products Y and Z to 1 block. The bid to increase demand in product Y has higher priority than the bid to increase demand in product Z because it was submitted at a lower price point.

The bidder's processed activity in the previous round is 7,000 + 2,800 = 9,800. The bidder's submitted activity in the round is 10,000 + 2,000 = 12,000. The bidder will be allowed to submit these bids because the submitted activity does not exceed its contingent bidding limit for the round, which is 12,000 (that is, 120% of 10,000).

Bids to change demand are processed in increasing order of price point. This example assumes that no other bidder submitted a bid to change its demand in W, X, Y, or Z. The example considers two scenarios:

Scenario 1: There is excess demand in product W and in product X so that both of the bidder's bids to reduce demand are applied. The bid to reduce demand in W is considered first and is applied, because this scenario assumes that there is excess demand in W. As a result, the activity associated with the demand held by the bidder is 2,800. The bid to reduce demand in X is considered next and is applied, because this scenario assumes that there is excess demand in X. As a result, the activity associated with the demand held by the bidder is now 0. The bid processing algorithm will then consider the bid to increase demand in Y (because it has a lower price point than the bid to increase demand in Z). The bid to increase demand in Y is applied, because that does not cause the bidder's processed activity to exceed its eligibility. As a result, the activity associated with the demand held by the bidder is now 10,000. The bid to increase demand in Z is considered next but is not applied, because applying the bid would cause the bidder's processed activity to exceed its eligibility. Thus, the bidder's processed activity after the round is equal to 10,000. This means that the bidder maintains its eligibility at 10,000.

Scenario 2: There is excess demand in product X but not in product W so that the bid to reduce demand in X is applied but the bid to reduce demand in W is not. The bid to reduce demand in W is considered first but it is not applied, because this scenario assumes that there is no excess demand in W; thus, the bid is placed in the queue, and the activity associated with the demand held by the bidder continues to be 7,000 + 2,800 = 9,800. The bid to reduce demand in X is considered next and is applied, because this scenario assumes that there is excess demand in X. As a result, the activity associated with the demand held by the bidder is now 7,000. The bid processing algorithm will then consider the bid to increase demand in Y (because it has a lower price point than the bid to increase demand in Z). The bid to increase demand in Y is not applied, because applying it would cause the bidder's processed activity to become 7,000 + 10,000 = 17,000, which would exceed the bidder's eligibility of 10,000. The bid to increase demand in Z is considered next and is applied, because that does not cause the bidder's processed activity to exceed its eligibility (7,000 + 2,000 < 10,000). Then, the bidder's processed activity after the round is equal to 9,000 (less than its required activity of 9,500) and the bidder's eligibility in the next round is 9,474 bidding units (that is, 9,000/0.95 rounded up to the nearest integer).

As illustrated in this example, if a bidder submits activity that exceeds its eligibility, not all of its bids will be applied. Since bids are considered by the bidding system in order of price point, a bidder can prioritize its bids using price points, so that the bidding system applies any free eligibility first to the bidder's most preferred bids to increase demand. The highest priority bids should be associated with the lowest price points.

Example 11 illustrates a scenario where the contingent bidding limit is used properly to address the potential for loss of bidding eligibility under some circumstances: the bidder submits bids with activity that exceeds its eligibility and indicates price points that reflect its preferences for the order in which it wishes its bids to increase demand to be processed by the system.

Example 12 provides some case studies where the contingent bidding limit is not used properly.

Example 12 – Case Studies Where Contingent Bidding Limit Is Not Used Properly: For the purposes of this example, the contingent bidding percentage is 120% and the bidder's eligibility for the round is 10,000.

- Case study 1: All bids to increase demand are at the same price point. Consider a variation of Example 11 where both bids to increase demand (*i.e.*, the bids for products Y and Z) are at the corresponding clock prices (*i.e.*, at $100,000 and $24,000 respectively). Then, both bids have a price point of 100%, and the system will prioritize them based on random numbers. In Scenario 1 where both bids to reduce demand are applied, the bidding system might process the bid to increase demand for product Z first. If that bid is applied, then it is not possible to also apply the bid to increase demand for product Y. In that case, the bidder will only have processed demand for product Z, which perhaps was not the bidder's intention.
- Case study 2: Bid to increase demand cannot be applied under any circumstances. Consider a bidder that has processed activity for a single product (A) and submits a bid to maintain demand in A and another bid to increase demand in another product (B), as shown in the table below:

Product	Bidding Units	Previous Round Processed Demand	Start-of-Round Price	Clock Price	Submitted Bids Quantity@Price (Price Point)
A	10,000	1	$90,000	$100,000	1 @ $100,000 (100%)
B	2,000	0	$20,000	$24,000	1 @ $22,000 (50%)

The bidder will be allowed to submit these bids with submitted activity of 12,000 since that equals the bidder's contingent bidding limit for the round (*i.e.*, 120% of 10,000). However, the bid to increase demand for product B will not be applied under any circumstances. The reason is that, since bids to maintain demand are always applied, the bid to maintain demand for product A is applied first, and therefore applying the bid to increase demand for product B would cause the bidder's processed activity to exceed its eligibility. This case study illustrates a scenario where a bidder submits a bid that is irrelevant because it cannot be applied under any circumstances.

- Case study 3: The bidder attempts to move its demand to a product with more bidding units and for which the bidder does not have sufficient eligibility. Consider a bidder with processed activity for a single product (A). The bidder submits a bid to reduce its demand in A from 1 to 0 and another bid to increase its demand in another product (C) from 0 to 1, as shown in the table:

Product	Bidding Units	Previous Round Processed Demand	Start-of-Round Price	Clock Price	Submitted Bids Quantity@Price (Price Point)
A	10,000	1	$90,000	$100,000	0 @ $95,000 (50%)
C	11,000	0	$110,000	$120,000	1 @ $115,000 (50%)

In this case, the bidder wants to move its demand from product A to product C. However, the bidder does not have enough eligibility for a block of product C. The bidder will be allowed to submit these bids with submitted activity of 11,000 since that does not exceed the bidder's contingent bidding limit for the round (*i.e.*, 120% of 10,000). However, the bid to increase demand for product C will not be applied under any circumstances because the bidding units for one block of C exceed the bidder's eligibility for the round. Thus, if the bid to reduce demand in A is applied, then the bidder's processed activity will be 0 and the bidder's eligibility for the next round will also be 0.

9.2 Clock Prices for the Next Round

A product's clock price in the next round is calculated by incrementing the product's posted price from the previous round by a specified percentage.

Specifically, the clock price $P_{t,r}$ for product r in round t is calculated as:

$$P_{t,r} = \left(1 + y_{t,r}\right) \cdot p_{t-1,r}$$

Where:

- y_t denotes the increment percentage for round t. The increment percentage will be set within a range of 5% to 20% inclusive, and may change from round to round with advance notice. The initial increment percentage will be set at 10%.
- $p_{t-1,r}$ denotes the posted price of product r for round $t-1$.

Results above $10,000 will be rounded up to the nearest $1,000; results below $10,000 but above $1,000 will be rounded up to the nearest $100; and results below $1,000 will be rounded up to the nearest $10.

Finally, the clock price $P_{t,r}$ will be capped at $p_{t-1,r}$ plus the *increment cap*, so that the difference between the clock price and the start-of-round price for a product in a round does not exceed the increment cap. The increment cap will be set at $50 million initially, and may be adjusted as rounds continue.

Note that the clock price calculation for the next round applies to every product, regardless of whether there is excess demand for the product.