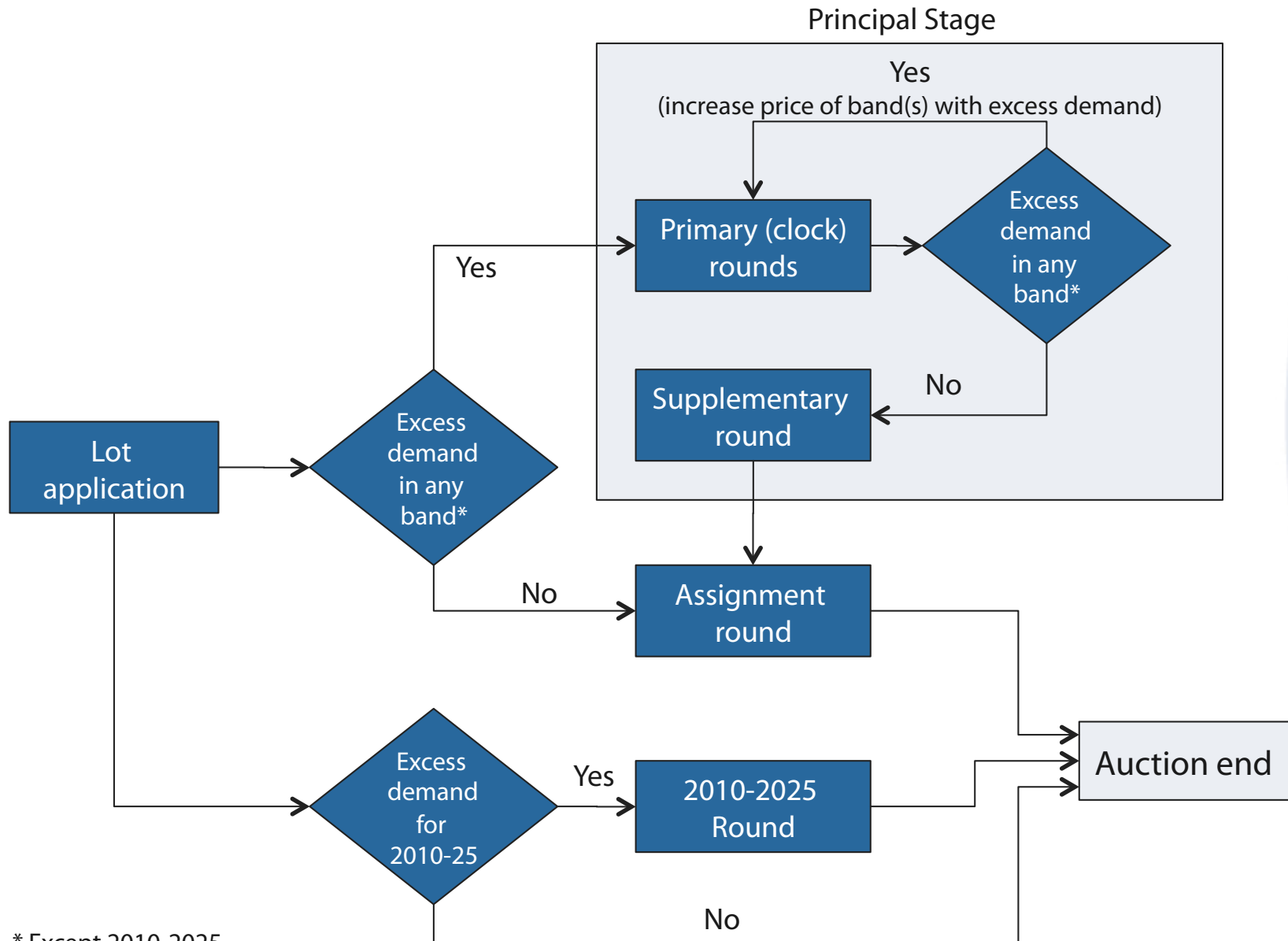


Award of mobile radio frequencies

Briefing Session

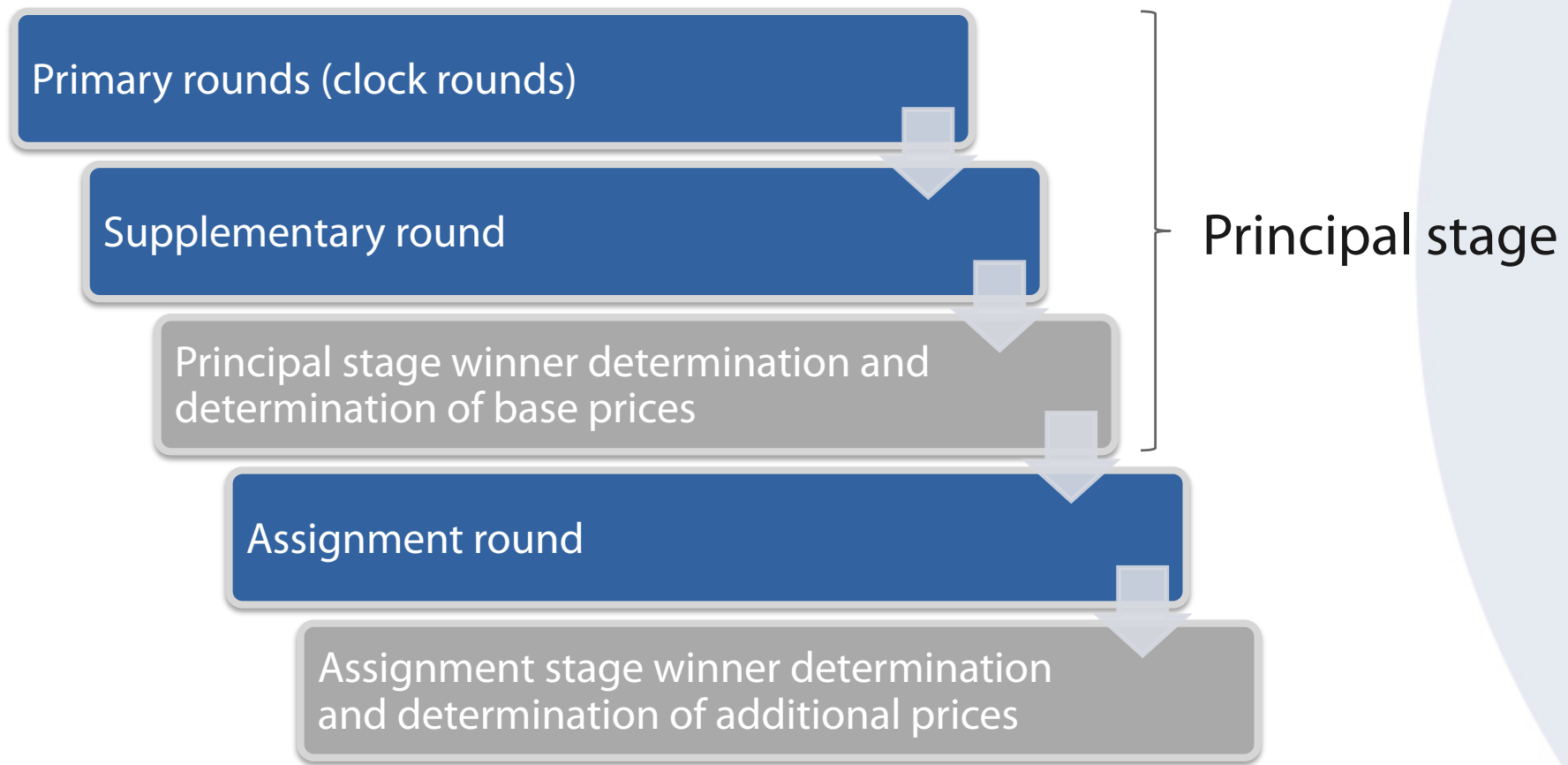
Biel, 8 December 2010

Auction overview



* Except 2010-2025

The CCA



Reasons for choosing a CCA

- Large number of bands
- Flexible spectrum packaging to support potentially very different business models

Practical combinatorial format

- Bidders can bid for packages of lots – no aggregation risks
- Open elements to aid price discovery
- Pricing rule that removes strategic complexity

Supports small generic lots

- Small lots can be offered to provide flexibility and efficient outcomes without exposing bidders to aggregation and substitution risks
- Use of generic lots ensures contiguity of final assignment

General rules

Bank guarantee

- initially needs to cover lots in the lot application at reserve price
- may have to be increased in the course of the auction as requested by OFCOM (max: 50% of highest bid)

Spectrum caps

- 2x30 MHz below 1GHz
- 2x20MHz in 900MHz
- 2x30MHz in 2.1GHz
- 2x15MHz or more in 900 => max. 2x30MHz in 1.8GHz

Bid submission

- Through Electronic Auction System
- Generally a two-stage process: submission for checking, confirmation of checked bid

Rules for the primary (clock) rounds

Bidding proceeds through a number of rounds

- Generally fixed duration, but will extend automatically up to a maximum duration for a bidder with unused extension rights who fails to submit a bid before the scheduled round end
- At round end, bidders will be informed about their own bids and the level of total demand for each category

Bidders make package bids for lots in different categories

- Nominate quantities in the various categories at given clock prices
- Subject to spectrum caps and eligibility constraint

Eligibility linked to activity

- In first round, eligibility is determined by lot application
- In any subsequent round, eligibility equals activity in previous round

Price increases for categories with excess demand, and clock stage ends when there is no excess demand in any category

- Increase set by auctioneer
- Not more than 100%

Rules for the supplementary round

Single bidding round

- Fixed duration, but will automatically be extended for bidders who fail to submit list of bids before the scheduled round end
- Throughout the round, bidders can add, delete or modify package bids

Bidder submit list of package bids

- Package bid consists of number of lots in each category, and a bid amount
- For all packages on which the bidder has submitted clock bids, the highest clock bid will automatically be carried over (this cannot be deleted)
- Bidder can increase primary bids, and submit supplementary bids for packages on which no primary bids were made

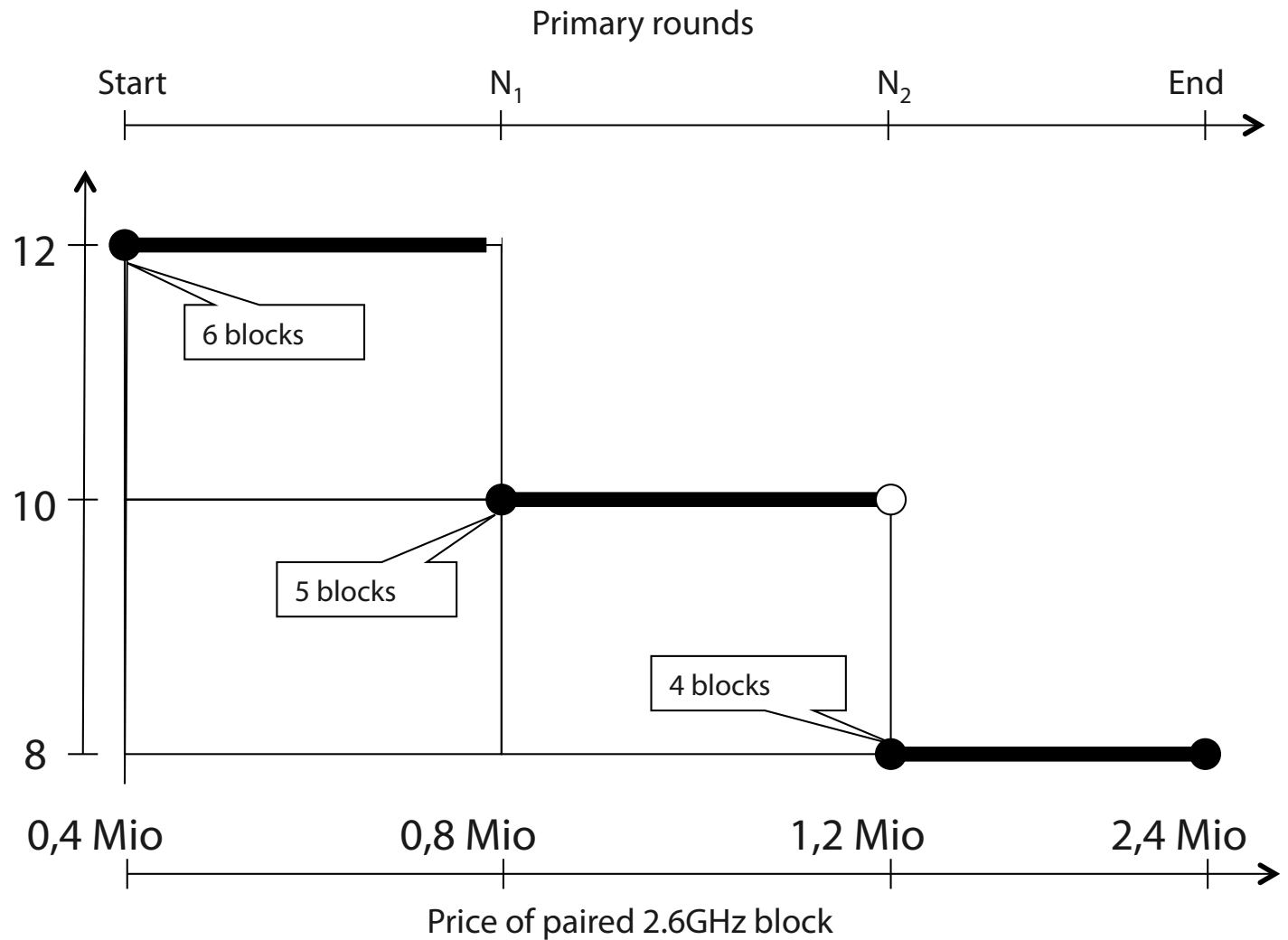
Supplementary bids are subject to constraints

- Number: maximum 1,000
- Bid amounts are capped relative to bid amount for the last non-zero package on which the bidder has bid in the clock stage, based on the prices in those primary rounds in which the bidder has reduced eligibility (i.e. relative preferences expressed in primary rounds constraint supplementary bids)

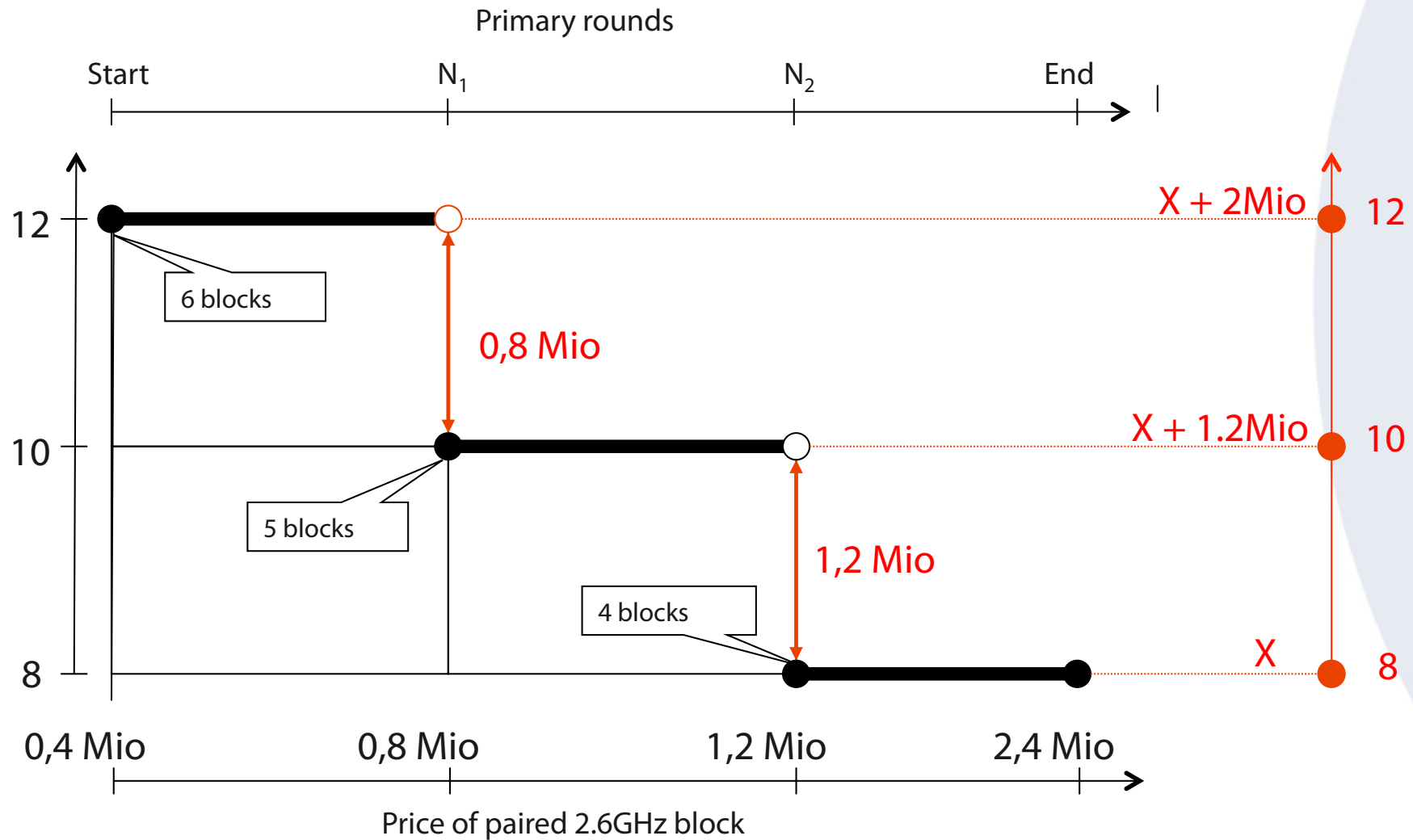
All bids will be taken into account when determining winners and prices

- Primary and supplementary bids will be used in establishing winning bidders and prices

Constraints on supplementary bids



Constraints on supplementary bids



Winner determination and pricing

Taking at most one bid from each bidder, identify combination of bids with the highest value that can be accommodated with the given supply (if there are two or more combinations with the same highest value, ties are broken by first selecting the combination with the larger number of winners, and then randomly)

Find the maximum amount by which the bids of the winning bidders (in total) can be reduced without changing the outcome of the winner determination process (subject to modified winning bids being above reserve price, and no individual winner paying more than her bid)

If the outcome of the previous step leads to a unique combination of prices, these are the base prices that winners have to pay – otherwise, find the combination of prices that is closest (in Euclidean distance) to the combination of individual winners' opportunity cost

Winner determination: example

- Single category with 5 Lots
- Three bidders, making the following bids

Lots	A	B	C
1	3	2	
2	4	4	5
3	6	6	

- Tables to the right show potential combinations of bids and total bid amounts , with infeasible combinations greyed out
- Feasible combination with highest value is indicated by red circle

Accept Bidder C's bid		Bidder A			
		0	1	2	3
Bidder B	0	5	8	9	11
	1	7	10	11	13
	2	9	12	13	15
	3	11	14	15	17

Do not accept Bidder C's bid		Bidder A			
		0	1	2	3
Bidder B	0	0	3	4	6
	1	2	5	6	8
	2	4	7	8	10
	3	6	9	10	12

Pricing example

The maximum amount by which we can reduce prices without changing the outcome of the winner determination is 4, made up of a reduction of:

1 for A
(from 3 to 2)

If we reduced the amount paid by A by more than 1, it would be better to give a third lot to B - i.e. A needs to pay at least 2 for its single lot

1 for B
(from 4 to 3)

If we reduced the amount paid by B by more than 1, it would be better to give the two lots won by B to A instead (so that A won 3 lots instead of 1) - i.e. B needs to pay at least 3 for its two lots

2 for C
(from 5 to 3)

If we reduced the amount paid by C by more than 2, it would be better to give one additional lot to B and one additional lot to A (or two additional lots to A) - i.e. C needs to pay at least 3 for its two lots

Assignment round

Only open to bidders having won spectrum in the principal stage

- Only determines assignment of specific frequencies
- Bidders express their preferences for different assignments through bids on specific options

Single bidding round

- Fixed duration, but with extension rights
- Single round for all bands

Bidders will be given all possible assignment options for each band

- Based on number of blocks won by different bidders within each band
- Requirement that assignment be contiguous (incl. not awarded spectrum)
- Certain options that would result in inappropriate assignment of preferred GSM channels may be ruled out

Bidders can express preference for specific assignments

- Assignment bids are not package bids, i.e. bids will be evaluated separately for each band
- No preference: zero bid (will be generated automatically by the system if no positive bid for an option is received)

Winner determination and pricing

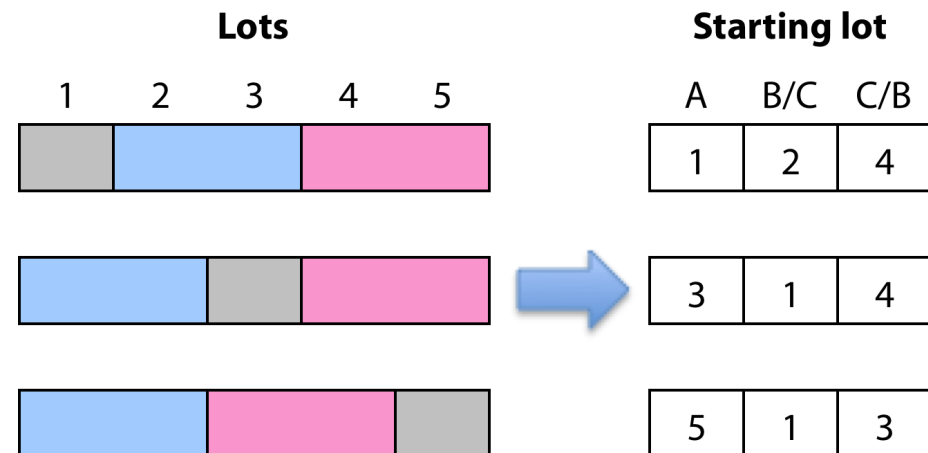
For each band, taking exactly one bid from each bidder, identify combination of bids with the highest value that are mutually consistent

Find the maximum amount by which the bids of the winning bidders (in total) can be reduced without changing the outcome of the winner determination process (subject to modified winning bids being greater than zero, and no individual winner paying more than her bid)

If the outcome of the previous step leads to a unique combination of prices, these are the additional prices that winners have to pay – otherwise, find the combination of prices that is closest (in Euclidean distance) to the combination of individual winners' opportunity cost

Assignment round example

- 3 winners
 - A wins 1 lot
 - B and C win two lots each
- Potential ways of allocating these winners in the band determine assignment options
- Mutually consistent bids:
 - (1, 2&3, 4&5), (1, 4&5, 3&2),
 - (3, 1&2, 4&5), (3, 4&5, 1&2),
 - (5, 1&2, 3&4), (5, 3&4, 1&2)



2010 – 2025 round

Only open to bidders who have nominated this lot in their application

- Only takes place if two or more bidders have indicated an interest in acquiring this lot at the reserve price

Single bidding round

- Fixed duration, but with extension rights

Bidders make a single bid

- Bidders submit a single bid for the lot
- Bid amount can be freely chosen by the bidder (though must not be below reserve price)

Winner determination and pricing

- Highest bidder wins and pays the higher of second highest bid and reserve price
- Random selection in case of two or more highest bids at the same amount

Electronic auction system: short overview

- Bidding over the internet, using a standard web browser (IE, Firefox, Safari)
- Authentication through digital certificates
- Strict single log-on
- Requirements:
 - Java needs to be installed
 - Bidders need to have installed their digital certificates on any machine they may want to use for bidding (note: only one connection at any point in time!)
- User-friendly interface
 - Screen updates automatically with changes in auction status
 - Bid submissions are checked, invalid submissions are rejected (with an explanation as to why they are invalid) and warnings are provided (e.g. if a bid were to result in a reduction in eligibility)
 - Upload facility for supplementary bids

The screenshot shows the DotEcon WebBidder interface in a browser window. The main heading is "Round 1 in progress." and it states "Round 1 will end on Thursday, December 02 at 16:42." Below this, it says "Your current position is:" followed by a table of Eligibility Point(s):

Lot	Eligibility Point(s)
Lot 1	5
Lot 2	5
Lot 3	5

Below the table is a "Bid Form:" section with instructions: "Please enter your decisions in the form below and click on the **Submit** button below to check whether your decisions are valid. If your decisions are valid, you will then be given the option to confirm your Bid. In the event that you do not meet the Activity Level requirement, you will be warned about this before you confirm your Bid." The form contains three sections for different frequency band categories:

- Frequency Band Category: Lot 1**
 - Bandwidth: 5 MHz (2x2.5 MHz) Paired
 - Units Available: 5
 - Eligibility Points: 3
 - Minimum Fee: GBP1,000
 - Round Price: GBP1,000
 - Your Demand:
- Frequency Band Category: Lot 2**
 - Bandwidth: 5 MHz (2x2.5 MHz) Paired
 - Units Available: 3
 - Eligibility Points: 4
 - Minimum Fee: GBP1,000
 - Round Price: GBP1,000
 - Your Demand:
- Frequency Band Category: Lot 3**
 - Bandwidth: 5 MHz (2x2.5 MHz) Paired
 - Units Available: 8
 - Eligibility Points: 2
 - Minimum Fee: GBP1,000
 - Round Price: GBP1,000
 - Your Demand:

At the bottom of the form is a "Submit" button. On the left side of the interface, there is a sidebar with "Auction time: Thu 02 Dec 16:20:09", "Within Round: No decision", "Left: 21m51s", "No unread messages", "Connected to server", "Demo", "Bidder1", "Results by round", "Logout", "Messages [Full screen]", and "No messages".