ComReg's Multi-Band Spectrum Release Workshop – 8 June 2012

Workshop Materials

Content

Section

1 Agenda

Time	Item	Speaker
10:00 – 10:05	Opening of Workshop	Jim Connolly, ComReg
10:05 – 10:15	Welcome Address	Alex Chisholm, ComReg
10:15 – 10:30	Overview of the Award Process	Jim Connolly, ComReg
10:30 – 11:15	Key Features of the Award Process	Dan Maldoom, DotEcon
11:15 – 11:30	15 Minute Break - Tea/Coffee	
11:30 – 13:00	Technical Features of the Award Process	Dan Maldoom, DotEcon
13:00 – 13:30	Demonstration of the Winner and Price Determination ("WPD") software	Dan Maldoom, DotEcon
13:30 – 13:40	Next Steps	Jim Connolly, ComReg

2 Opening Remarks From the Chairperson

Opening Remarks

Alex Chisholm, Chairperson, ComReg

On the occasion of an auction workshop held on Friday 8 June 2012, Clarion IFSC Hotel, Dublin

Good morning. There is not the brilliant sunshine we had hoped for today to usher in a 'New Dawn' for Irish spectrum, but no matter. It is very good of you all to make it through the rain, especially those of you who have travelled from other countries to be here.

You are all very welcome to this workshop, the purpose of which is to:

- give an overview of the award process;
- present the key features of the award process;
- explain a number of technical features which address a number of specific Irish circumstances; and
- demonstrate the beta Winner and Price Determination software which we intend to make available on Monday next, June 11th.

On 16 March this year, having given careful and due consideration to all the relevant facts and the many views received from interested parties during what has proven to be a drawn out and fairly arduous process, ComReg published its substantive decision on its multi-band spectrum award.

On 25 May ComReg published its final information memorandum which details the processes and procedures ComReg will employ to implement its substantive decision.

In the auction ComReg is offering spectrum rights of use across three critical bands, namely the 800 MHz, 900 MHz and 1800 MHz bands for the period 2013 to 2030.

This award process has already generated many thousands of pages of analysis and views, and now that we have published our decisions, I am certainly not proposing to take up any of your time with further justification or debate. The decisions 'are as they are', and the rationale for each of the decisions taken is set out in the published ComReg documents. We are here at this workshop today for 'How?', not 'Why?' (nor even 'Why Not?')

But as I know a number of you have spent a fair few months slogging away with our own spectrum experts during the extended consultation process on this award, I feel I should take this opportunity to make a few, very brief, remarks.

First, I want to say **thank you**. We do read very carefully every submission that is made to us by interested parties, whether operators, manufacturers, corporate users, or individual consumers and citizens. And we have genuinely learnt from the many representations we have received, and adapted our proposals accordingly. If you go back over the history of the whole consultation process that started in the latter part of 2008 – considering at that time the 900 MHz spectrum alone - you will see how the scope of the award, the design of the auction, the licence conditions, the benchmarks, indeed almost every facet of the whole award, have all evolved significantly in line with market developments and needs, and in response to the information and advice submitted.

Secondly, as a number of you have questioned whether we could not have come up with something a bit simpler; let me say a few words about **complexity**. Certainly we could have come up with something less complex if we had been prepared to compromise on any of our key regulatory objectives for this award. But when we reflected on our statutory requirements and the specifics of the Irish market today, we felt these regulatory objectives should not be compromised. We could also have kept things simpler if we had not worked so hard – with all of your input – to reflect the realities of the Irish

communications market and regulatory environment, not just re-applying without adaptation a model of intervention made elsewhere.

And do please recall that the relative complexity of the forthcoming auction itself stems in part from our desire to respect fully the existing licences issued to operators, albeit that they expired, or will expire, at different dates. Maintaining regulatory consistency and predictability here has brought us some complexity in terms of the two time periods for the licences being offered.

A further factor in complexity is our wish to give flexibility to operators to switch demand between bands in the auction, and to meet licence requirements using different bands; a more rigid approach here could have been simpler, but this would have been potentially costly in terms of efficiency.

Within the mechanics of the auction, a discretionary device such as 'relaxed primary bids' does add to complexity in the sense that it is an extra feature; but its purpose is to add desirable richness to the way in which demand can be expressed within the auction, given the defined regulatory objectives. Again, more simplicity would have come with less flexibility.

And, as you will see when I hand over shortly to the experts, the complexity is not so great. I do hope and expect that by the time you leave here at a quarter to two, you will see that the design of the auction does *make sense* and is *workable*, albeit that it may not be in every respect what your particular organisation most desired.

Thirdly, I wanted to recall why this collective slog is all **worthwhile**. Mobile access to communications is surely one of the most defining freedoms of modern life. Our expectations of what we can accomplish through our mobile devices, already high, continue to climb steeply. Our ability to work, to study, to save, to enjoy the modern consumer lifestyle – all of this is dependent on using services and applications which are accessed over radio spectrum suitable for advanced mobile services.

The three bands being included, in particular the rights of use in the 800 MHz and 900 MHz bands, are highly suitable for advanced mobile services, due to their excellent propagation properties which allow for high quality services and wide area coverage plus improved in-building reception.

In total ComReg is making available 280 MHz of sub-2 GHz spectrum (i.e. 140 MHz of paired spectrum), more than doubling the currently licensed assignments in these particular bands.
Clearly this award process is a vital step in allowing for the next generation of advanced mobile services to be made available in Ireland from next year, and ComReg looks forward to working with all interested parties through the remainder of the award process, and bringing it to a successful conclusion, so that Irish consumers and businesses can benefit from advanced mobile services over the next decades.

So let's get on with it.

3 Presentation Slides

Commission for
Communications Regulation

Multi-Band Spectrum Award for the 800 MHz, 900 MHz and 1800 MHz Bands

Presentation on the Award Process and the Auction Rules

8 June 2012

These slides are intended to be construed with the aid of the oral presentation. The binding version of the auction rules is that set out in the Information Memorandum (as may be amended in accordance with its terms). The terminology used in this presentation may not, at all times, necessarily be the precise technical or legal terminology as set out in the Information Memorandum, and reliance ought not to be placed on the particular terminology used in these presentation, as opposed to that contained in the Information Memorandum.

Commission for
Communications Regulation

Programme

Time	Item	Speaker
10:00 – 10:05	Opening of Workshop	Jim Connolly, ComReg
10:05 – 10:15	Welcome Address	Alex Chisholm, ComReg
10:15 – 10:30	Overview of the Award Process	Jim Connolly, ComReg
10:30 – 11:15	Key Features of the Award Process	Dan Maldoom, DotEcon
11:15 – 11:30	15 Minute Break - Tea/Coffee	
11:30 – 13:00	Technical Features of the Award Process	Dan Maldoom, DotEcon
13:00 – 13:30	Demonstration of the Winner and Price Determination ("WPD") software	Dan Maldoom, DotEcon
13:30 – 13:40	Next Steps	Jim Connolly, ComReg

www.comreg.ie

Commission for
Communications Regulation

Background – ComReg Documents

- ComReg's Decisions on this Multi-band Spectrum Award Process have been subject to public consultation and are set out in

  - **Document 12/25 and decision D04/12** - Response to Consultation and Decision on *"Multi-band Spectrum Release: Release of the 800 MHz, 900 MHz and 1800 MHz Radio Spectrum Bands"* - published 16 March 2012; and

  - **Document 12/52** – *"Multi-band Spectrum Release - Information Memorandum"* - published 25 May 2012

- ComReg's rationale for its Decisions is set out in these Documents and their supporting materials.

- Relevant documents are available on ComReg's website at:
  http://www.comreg.ie/gsmlib

www.comreg.ie

Commission for
Communications Regulation

Introduction to this Workshop (1)

As per ComReg Document 12/54:

- the objective of this Workshop is to:
  - o give an overview of this Award Process
  - o present its key features;
  - o explain technical features such as Activity Rules, etc.
  - o demonstrate the auction software.

- it is also an opportunity to raise <u>points of clarification</u> in relation to today's presentations.

- however the process for submitting <u>questions</u> on the Award Process and Auctions Rules is set out in Document 12/52 (see section 3.3.1 of Document 12/52).

www.comreg.ie

Commission for
Communications Regulation

Introduction to this workshop (2)

- An audio recording of the proceedings is being made for ComReg for the purpose of transcribing any points of clarification raised by participants and the clarification given by the presenters.

- After this workshop the following will be made available on ComReg's website
  - The presentation materials and
  - Any substantive clarifications provided as a result of this workshop.

- ComReg reserves the right to amend, vary or withdraw any clarification provided today, if it considers, on a review of the audio recording, that any of these is inappropriate, given, for example, the inadvertent inaccuracy, incompleteness or misleading nature of any clarification provided today.

5

www.comreg.ie

Commission for
Communications Regulation

OVERVIEW OF THE AWARD PROCESS

www.comreg.ie

Commission for
Communications Regulation

Overview

- Three Spectrum Bands in the Award Process:

  o 800 MHz band – 6 Lots

  o 900 MHz band – 7 Lots

  o 1800 MHz band – 15 Lots

- Spectrum rights in these bands will be made available in two Time Slices.

	Commencement Date	Expiry Date
Time Slice 1	1 February 2013 (or such other date as may be specified by ComReg)	12 July 2015 (or such other date as may be specified by ComReg)
Time Slice 2	13 July 2015 (or such other date as may be specified by ComReg)	12 July 2030

- Two Licence types available:

  - Liberalised Use Licence

  - Preparatory Licence

www.comreg.ie

Commission for
Communications Regulation

Overview - Liberalised Use Licence

- Allows Licensee to <u>use</u> the spectrum (i.e. provide services)
- Contains licence conditions such as technical conditions to facilitate co-existence, coverage, quality of service, etc.
- Spectrum Fees consists of an Upfront Fee and an ongoing Spectrum Usage Fee ('SUF')
  - Upfront Fee – set by the Auction (subject to a reserve price per Lot)

Frequency Band	Reserve Price per Lot in Time Slice 1	Reserve Price per Lot in Time Slice 2
800 MHz band	€2.55 Million	€8.26 Million
900 MHz band	€2.55 Million	€8.26 Million
1800 MHz band	€1.27 Million	€4.13 Million

  - SUF
    - €1.08 Million per Lot per annum in the 800 MHz and/or 900 MHz band plus the "CPI Adjustment"; and
    - €0.54 Million per Lot per annum in the 1800 MHz band plus the "CPI Adjustment".

Overview – Preparatory Licence

- Preparatory Licence
  - Only available to winners of Liberalised Use Licences
  - Allows Licensee to keep and have possession of apparatus designed to operate on the spectrum which it will be entitled to use pursuant to its Liberalised Use Licence (i.e. make preparations)
  - Administrative fee of €100
  - Can apply for a test licence

Overview of the Award Process

- Application Stage
- Qualification Stage
- Main Stage
  - Primary Bid Rounds
  - Supplementary Bids Round
- Assignment Stage
  - Assignment Round
  - Negotiation Phase
- Notification & Grant Stage
- Transition Phase

Auction stages

www.comreg.ie

Commission for Communications Regulation

Timeline – Application Stage

Application Stage Milestones	Timeline (as per Table 9 of 12/52)
Publication of Final **Information Memorandum (Document 12/52)** on ComReg's website	Friday 25 May 2012
Presentation to Interested Parties on the Award Process and the Auction Rules	Friday 8 June 2012
Deadline for submission of **Questions** regarding the Award Process	16:00 (local time) on Friday 22 June 2012
Final date for **Responses to Questions** on the Award Process to be published on ComReg's website	Friday 6 July 2012
Deadline date for **submission of Application Forms** Application Forms - Annex 5 to Document 12/52 or Document 12/52a (PDF editable format)	From 10:00 (local time) on Monday 16 July 2012 to 16:00 (local time) on Friday 20 July 2012
Deadline date for **submission of Deposits**	23:59 (local time) on Friday 20 July 2012
Restrictions on auction-related communications come into effect	On submission of first Application to ComReg

Commission for
Communications Regulation

Details on the Application Form

- The **Application Form** consists of three Parts.
  - All Parts must be completed and Parts 2 and 3 must be signed as appropriate.

- **Part 1: Administrative Information**
  - Requests administrative information (see Table 11 of 12/52), including
    - Appropriate evidence for signatory of Application (as per paragraph 3.29 of 12/52)
    - Ownership Structure Document (as per paragraph 3.32 of 12/52)
- **Part 2: Applicant Declaration**
  - Request the Applicant to agree to be bound by the Auction Rules
- **Part 3: Lot Application Form**
  - Requests the Applicant to specify the Lots that it is applying to buy in the Award Process.

- Additionally a monetary **Deposit must be submitted** with its Application Form.
  - Sum of the Reserve Prices of Lots requested in its Lot Application Form

Timeline - Qualification Stage

Qualification Stage Milestones	Timeline (as per Table 9 of 12/52)
Circulation of Bidder Materials for accessing and using the Electronic Auction Software ("EAS") to the Applicants	Week beginning Monday 23 July 2012
Mock Auction for each Applicant	Monday 30 July 2012 to Friday 3 August 2012
Deadline for withdrawal of Application	Friday 17 August
Each Applicant to be informed by ComReg about whether it has become a Bidder or not. Confirmation of the requirement for a Main Stage of the Auction and notification to Bidders of scheduled start date of the first Primary Bid Round; or Confirmation that there is no requirement for a Main Stage and notification to Winning Bidders of Winning Bids and start date for the Assignment Stage; or Confirmation that that there is no requirement for a Main Stage or an Assignment Stage and notification to Winning Bidders of Winning Bids and progression to Notification & Grant Stage	Friday 24 August 2012
Return of Deposits to Applicants that have not become Qualified Bidders	Friday 31 August 2012

Timeline – later stages

- The **later stages of the Award Process** include

  - Main Stage,

  - Assignment Stage,

    Auction stages

  - Notification and Grant Stage (see section 3.7 of 12/52) and

  - Transition Phase (see section 3.8 of 12/52).

- ComReg will provide further information on the timings of the later stages to the appropriate parties (e.g. Qualified Bidders, Winning Bidders etc.)

- The timelines to be set out in these notifications will be in accordance with Document 12/52

dot·econ

The Irish Multi-Band Spectrum Award Process

Key features of the award process

These slides are intended to be construed with the aid of the oral presentation. The binding version of the auction rules is that set out in the Information Memorandum (as may be amended in accordance with its terms). The terminology used in this presentation may not, at all times, necessarily be the precise technical or legal terminology as set out in the Information Memorandum, and reliance ought not to be placed on the particular terminology used in these presentation, as opposed to that contained in the Information Memorandum. The views in these slides are those of DotEcon and do not necessarily reflect the views of ComReg.

Lot Categories and associated Eligibility

Generic Lots – Lot Categories 1 – 6 – open to all bidders

Lot Category number and name	Frequency band	Time Slice	Number of Lots available	Eligibility points per Lot
(1) 800/1	791-821MHz paired with 832-862MHz	1	6	2
(2) 800/2		2	6	2
(3) 900/1	880-915MHz paired with 925-960MHz	1	5	2
(4) 900/2		2	7	2
(5) 1800/1	1710-1785MHz paired with 1805-1880MHz	1	6	1
(6) 1800/2		2	15	1

Lot Categories and associated Eligibility

Party-Specific Lots – Lot Categories 7-10

Lot Category number and name	Frequency band	Party permitted to bid for Lots in this Category	Time Slice	Number of Lots available	Eligibility Points per Lot
(7) 900/1/MET	880-915MHz paired with 925-960MHz	Meteor	1	2	2
(8) 1800/1/MET	1710-1785MHz paired with 1805-1880MHz	Meteor	1	3	1
(9) 1800/1/TO2	1710-1785MHz paired with 1805-1880MHz	O2	1	3	1
(10) 1800/1/VOD	1710-1785MHz paired with 1805-1880MHz	Vodafone	1	3	1

Spectrum caps

- ## For **each Time Slice** separately:

  - ### Overall cap of 2x50MHz of paired spectrum across all three bands (800MHz, 900MHz and 1800MHz)

  - ### Cap of 2x20MHz of paired sub-1GHz spectrum (800MHz and 900MHz bands)

- ## For **Time Slice 1** only:

  - ### Cap of 2x10MHz of paired spectrum in the 900MHz band

  - ### Existing 900MHz and 1800MHz holdings count towards the cap

dot·econ

Auction stages

- Application stage ('Round 0' for Qualified Bidders)
- Qualification Stage
- Main Stage
  - Primary Bid Rounds
  - Supplementary Bids Round
- Assignment Stage
  - Assignment Round
  - Negotiation Phase
- Notification & Grant Stage

dot·econ

Application Stage

- Submission of a completed Lot Application Form (amongst other material listed in the IM)

- Specifies an initial 'Round 0' bid

  - Treated as a package bid just like any other when eventually determining Winning Bidders and Base Prices

  - Determines **Initial Eligibility**

  - Determines **deposit requirement**

  - Appears within the EAS as a bid

Lot Application Form

- Unconditional offer to buy the number of Lots specified in an Applicant's Lot Application Form, at the reserve prices, and to discharge the related SUFs over the term of the licence

Lot Category	Reserve price (€m)	Annual SUF (before indexation) (€m p.a.)
800/1	2.55	1.08
800/2	8.26	1.08
900/1 (900/1/MET)	2.55	1.08
900/2	8.26	1.08
1800/1 (1800/1/MET, 1800/1/TO2, 1800/1/VOD)	1.27	0.54
1800/2	4.13	0.54

When is the Main Stage needed?

- Main Stage determines the number of lots won in each Lot Category by each bidder

- Main Stage required only if total demand across all Qualified Bidders' Lot Application Forms exceeds the number of lots available in <u>at least one</u> of the Generic Lot Categories 1-6

- If Main Stage is not required then each Qualified Bidder will win the Lots applied for on its Lot Application Form at reserve price

Main Stage CCA

- **If a Main Stage auction is required, it will follow a combinatorial clock format**
    - Pioneered by Ofcom in the UK
    - Used already in Netherlands, Denmark, Switzerland etc.
    - Close similarities to the Irish 26GHz auction (a combinatorial sealed bid) but this auction run over multiple open rounds to allow price discovery

- **Bids are made for <u>packages</u> of lots that are never broken up**

- **All bids made <u>at any point</u> in the auction are committing and might potentially win (depending on rival bids)**

- **Bids can be made for more than one package, but a bidder can win <u>at most one</u> of its package bids**

- **A Winning Bidder pays a price no greater than its highest bid for the package it wins**

Rounds within the Main Stage CCA

- **Primary Bid Rounds**
  - Bid for at most one package with lot prices specified by the auctioneer
  - Prices increase to reflect excess demand
- **Supplementary Bids Round**
  - Can bid for multiple packages at prices chosen by the bidder (subject to constraints)
- Entirety of bids received considered when determining the Winning Bids and Base Prices

dot·econ

Activity rules

- ## Main Stage auction is subject to a number of **activity rules**:

    - ### Previous primary rounds determine constraints on primary bids possible in the following rounds

    - ### Primary round bids determine constraints on bid amounts for supplementary bids

(Discussed in detail in following session)

dot·econ

What do activity rules achieve?

- **Primary Bid Rounds are progressive**
  - Cannot hide demand without risk
  - Reveal information about aggregate demand at different prices and likely market value
  - Allow some updating of valuations in light of information received (subject to constraints)

- **Primary Bid Rounds can provide information to a bidder about what package it is likely to win eventually**

Primary Bid Rounds:
Activity rules

- Eligibility computed separately for each Time Slice

- Eligibility-point based rule for primary bids
  - Initial Eligibility based on Lot Application Form
  - Can bid for <u>any package</u> within current eligibility
  - Eligibility to bid in the following Primary Bid Round is equal to the <u>smaller</u> of:
    - current eligibility; and
    - bidding activity

    in the most recently completed round

- Additional flexibility for bidders to bid for packages in excess of current eligibility (but within initial eligibility) provided by **relaxed primary bids**

dot·econ

Primary Bid Rounds:
Round Prices

- Set separately for Lot Categories 1 to 6 based on excess demand in the previous round

- Round prices for Party-Specific Lots equal to those of Generic Lots relating to the same band and Time Slice

- Price increment applicable to Lot Categories 1 to 6 will be set based on the amount of excess demand in the previous Primary Bid Round:
  - Strictly positive increment for Lot Category 1 to 6 if excess demand
  - No increment for Lot Category 1 to 6 if no excess demand

- Price increases will be no more than 20% in one round

Primary Bid Rounds:
Information available & scheduling

- At the end of a Primary Bid Round, bidders will be told:
  - Aggregate demand for Generic Lots in the most recently completed round;
  - The bidder's own bid in the last round
  - The bidder's own eligibility for the next round
  - How many extension rights the bidder has remaining

- Upon scheduling of a further Primary Bid Round, the EAS will display:
  - Start time, duration and end time of the next Primary Bid Round
  - The round price in each Lot Category that will apply in the next round

- The round schedule will be released through the EAS at least 15 minutes before the scheduled start time

- Minimum interval of 30 minutes between Primary Bid Rounds

Primary Bid Rounds: *Submitting Bids*

- Bidder's will select the lots they wish to bid for at current round prices

- Bidders select lots using the drop down boxes on the electronic bid form in the EAS

- Bidders must then:

  - **Check** their bid to make sure their bid is consistent with the activity rules and spectrum caps; and

  - **Submit** their bid to confirm their bid which then becomes binding

- The EAS will not allow bidders to submit bids for packages for which they are not eligible to bid

Primary Bid Rounds:
Extension rights

- Bidders start the Primary Bid Rounds with 2 extension rights
- An extension right allows a bidder to extend the round deadline by 30 minutes
- Failure to submit a bid by the original deadline will automatically trigger an extension for that bidder provided it has at least one unused extension right
- Other bidders will be informed that an extension has been triggered, but the original submission deadline applies
- Failure to submit a bid by the revised deadline will be treated as a bid for zero lots in any category
- ComReg <u>will not</u> issue further extension rights while a round is running

End of the Primary Bid Rounds

- The Primary Bid Rounds will end when total demand in Lot Categories 1 to 6 can be met from available lots

- Bidders will be informed through the EAS that the Primary Bid Rounds have finished

- At this point, the EAS will provide information to <u>all bidders</u> about:
    - aggregate demand in each of the Generic Lot Categories 1 to 6 in the final Primary Bid Round
    - the demand for Party-Specific Lot Categories 7 to 10 in the final Primary Bid Round

- Main Stage proceeds to the Supplementary Bids Round

dot·econ

Supplementary Bids Round: *Scheduling*

- Minimum of **three working days** between the final Primary Bid Round and the start of the Supplementary Bids Round

- The Supplementary Bids Round will last for at least 6 hours

- Bidders will have a single extension right of 30 minutes (regardless of extension rights remaining from Primary Bid Rounds)

Supplementary Bids Round: *Activity rules*

- Bidders can choose the bid amount for supplementary bids (in units of €1000)

- Bid amount must be at least the reserve price

- Can only increase previous bids made in primary rounds

- Any bid for a package X that a bidder is not eligible to bid for in the final primary round is subject to a **relative cap**

  - Constrains bid amount relative to the Constraining Package chosen in the Primary Bid Round when bidder last eligible to bid for X

- Any package X subject to a **final price cap** relative to the Final Primary Package

  - Cannot exceed bid for the Final Primary Package plus the difference in price of X and the Final Primary Package in the last round

Supplementary Bids Round: *Supplementary bids editor within EAS*

- The supplementary bids editor within the EAS will be available for bidder's convenience throughout the primary bid rounds

- This bids editor allows bidders to:

  - Edit a list of packages that could be subject to supplementary bids (which will include by default all packages that have been subject to bids during the Primary Bid Rounds at their highest bid amount);

  - View the minimum and maximum bid amounts for supplementary bids for lots based on the primary bids entered so far in the EAS;

  - Observe the change in caps of other SBs as a result of changing the SB of a Constraining Package; and

  - Download/upload a set of provisional supplementary bids.

Supplementary Bids Round: *Bid form*

- A bidder can submit one bid form during the Supplementary Bids Round which may contain bids for multiple packages (up to 3,000)

- The bid amount associated with each supplementary bid is discretionary though must be in units of €1,000 and satisfy activity rules

- To complete the Bid form, a Bidder will need to:
    - Select the package of lots it wishes to bid for; and
    - Enter a bid amount

- Data already entered in supplementary bids editor forms starting point

- During the Supplementary Bids Round, the EAS will allow bidders to:
    - Edit a list of packages the could be subject to supplementary bids
    - View minimum and maximum bid amounts for supplementary bids of lots
    - Observe the change in caps of other SBs as a result of changing the SB of a particular package
    - Download a set of provisional supplementary bids
    - Upload a set of provisional supplementary bids

Supplementary Bids Round: *Submitting the bid form*

- Once bidders have entered all of their supplementary bids they will be required to **check** their bids

  - The EAS will check that all bids are valid and consistent with the spectrum caps, activity rules and do not exceed the bidders initial eligibility

  - If any bids are invalid the EAS will inform the bidder and the bidder will be able to return to the bid form the revise its set of bids

- Once the bid form has been checked and all bids are valid, bidders must **submit** their bid form

- The EAS will not permit bidders to submit a further or replacement bid form

End of the Supplementary Bids Round

- Following the end of the Supplementary Bids Round, the combination of Winning Bids will be determined
    - Number of lots won by Winning Bidders; and
    - Base Prices to be paid for these packages
- At this point, the outcome of the Main Stage will be announced to bidders
- The following information will be provided:
    - Released to <u>all bidders</u>: Number of lots won by each bidder in each Lot Category
    - Released to <u>each Winning Bidder</u>: The Base Price that applies to its own Winning Bid
- The auction will then progress to the Assignment Stage

dot·econ

Deposit calls

- During Primary Bid Rounds, ComReg may require a deposit increase where deposit has fallen to less than 50% of the highest bid so far

- After the Supplementary Bids Round (and before the determination of Winning Bidders) ComReg may require an increase in deposit up to 100% of the highest bid made

- At least three working days allowed for deposit top up to be made from notice being given

dot·econ

Assignment Stage

- **Determines the specific frequencies to be assigned to:**
  - Winning Bidders from the Main Stage
  - any existing GSM Licensees retaining some or all spectrum in the 900MHz and 1800MHz bands in time slice 1 under unliberalised GSM licence

- **There will be at least one clear working day between the end of the Main Stage and the beginning of the Assignment Stage**

- **Assignment Stage will consist of:**
  - an assignment round
  - a negotiation phase

- **Upon scheduling of the assignment round, the EAS will display for each bidder its frequency assignment options within each spectrum band**

Assignment Stage:
Assignment round

- Each bidder and any remaining GSM licensee may submit bids for assignment options in each of the bands in which it holds spectrum rights

- Each band considered separately, but both time slice considered simultaneously

- Assignment options are determined based on three constraints:
  - All Winning Bidders will be awarded contiguous frequencies within a Time Slice
  - In the case where a bidder wins the same number of lots in a band in both Time Slices, they will be assigned continuous frequencies
  - Unassigned lots will be contiguous

- A bidder may submit bids for multiple assignment options within a band, but will win exactly one option

- The bid amount associated for each assignment bid is discretionary (units of €1)

- No compulsion to submit assignment bids with options not bid for treated as if bid for at zero bid amount

Assignment stage:
End of assignment round

- Winning assignment bids and the additional prices will be determined for each band separately

- Outcome of the assignment round will be notified to the Winning Bidders (and existing GSM Licensees if applicable):

  - Identity of winning bidders in each spectrum band in the assignment round
  - Specific frequency ranges assigned to each bidder
  - Additional prices applying to winning assignment bids

dot·econ

Assignment Stage:
Negotiation phase

■ Winning Bidders (and existing GSM Licensees where relevant) will be allowed a two-week period in which they will have an opportunity to agree amongst themselves an alternative configuration of frequency assignments

■ Bidders have the opportunity to re-organise the band to facilitate contiguity of spectrum holdings won in order to encourage efficient use of spectrum

■ Bilateral (or multilateral) deals not subject to veto by uninvolved parties

■ Bidders must notify ComReg of any revised frequency assignments

■ If no alternative assignment plan is agreed upon, ComReg will progress to the Notification and Grant Stage based on the outcome of the Assignment Round

■ In any case, the Additional Prices payable will be those Additional Prices determined by the assignment round

End of Auction

- At the end of the Assignment Stage the following information will be released:

    - Each bidder notified about the specific frequency ranges assigned to each bidder in each band and in each time slice in which it has won lots

    - Each Winning Bidder will be informed about the Additional Price that will apply to its winning assignment round bid

- This will signify the end of the auction and ComReg will notify the results of the auction to all bidders:

    - Identity of Winning Bidders

    - Frequency ranges awarded to each Winning Bidder

    - The frequency ranged retained as GSM spectrum rights in Time Slice 1

    - The upfront fee to be paid by each Winning Bidder including a break-down of the Base Price and Additional Prices for specific frequency assignments

dot·econ

The Irish Multi-Band Spectrum Award Process

Technical features of the award process

These slides are intended to be construed with the aid of the oral presentation. The binding version of the auction rules is that set out in the Information Memorandum (as may be amended in accordance with its terms). The terminology used in this presentation may not, at all times, necessarily be the precise technical or legal terminology as set out in the Information Memorandum, and reliance ought not to be placed on the particular terminology used in these presentation, as opposed to that contained in the Information Memorandum. The views in these slides are those of DotEcon and do not necessarily reflect the views of ComReg.

1

dot·econ

Part I:
Winner and price determination

General principles
for winner determination

- **Determine outcome that maximises the total value of winning bids subject to the availability of lots**

- **Winners of Party-Specific Lots must win these through <u>open competition</u>**

- **Similar to procedure used for Irish 26GHz auction (and other CCAs) except for features related to Party-specific lots**

General approach to Party-Specific Lots

- Imagine that existing GSM licensees released their spectrum…

- …which was added to the lots already available in the corresponding Generic Category (according to band and Time Slice) …

- …which could then be won back, treating bids for Party-Specific Lots as bids for corresponding Generic Lots.

- However, no notional release of spectrum should fail to result in corresponding spectrum being won back

Schematic of winner determination

Analysis for one scenario

Generic Lots available

Released lots

+

Supply

Notional release scenario for GSM spectrum (Party-Specific Lots)

WD

Demand

Winning combo of bids

Do releasers win back?

Yes

Feasible scenario with some total value of winning bids

No

Infeasible scenario

Bids compatible with hypothetical release scenario
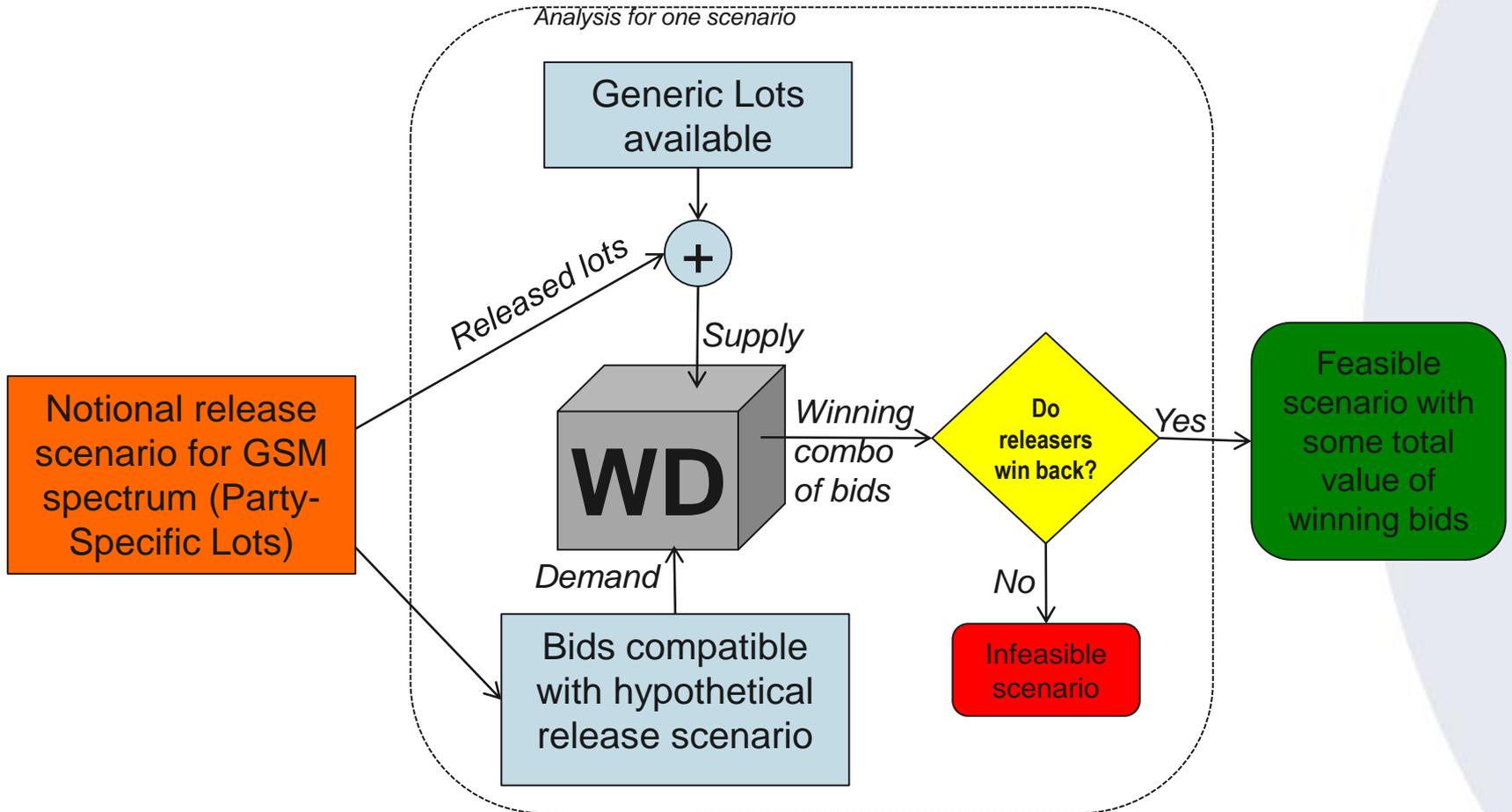
What is a notional release scenario?

- A <u>notional release scenario</u> (NRS) is simply a certain number of Party-Specific Lots specified
  - for each GSM Licensee (Meteor, O2, Vodafone)
  - for each relevant band (900MHz and 1800MHz)
- It represents the spectrum that GSM Licensees are presumed to release and then potentially win in open competition
- 192 possible notional release scenarios

Notional supply for a NRS

- Each Party-Specific Lot Category has a <u>corresponding Generic Lot Category</u> with the same frequency band and Time Slice

- For a given NRS, **notional supply** is determined by:

  - Treating notionally released lots as being available in the corresponding Generic Lot Category

  - Adding these notionally released lots to the lots already available in that Generic Lot Category

dot·econ

Compatible bids for a NRS

- Given an NRS, the **compatible bids** for a party entitled to bid for Party-Specific lot categories are:

  - Any bid for a package with the same number of lots in each Party-Specific Category as specified by the NRS

  - A zero bid for no lots at all at zero price

- For bidders who are not entitled to bid for party-specific lot categories, all bids are compatible with that NRS

8

Winner determination for a particular NRS

- **For a given NRS**, find a **Winning Combination** of bids by

    - selecting <u>one compatible bid</u> for each bidder (which might be a zero bid for no lots) …

    - … subject to allocating <u>no more lots than available</u> given the notional supply for this NRS

    - … in order to <u>maximise the total value of winning bids</u>

- There must be a winning combination in which every bidder notionally releasing lots wins them back, otherwise this NRS is **infeasible**

dot·econ

Selection of the Winning Scenario

- Each feasible NRS has an associated total value for its Winning Combination of bids

- There is always at least one feasible NRS (e.g. releasing no GSM spectrum)

- Find a feasible NRS that maximises this total value

- This is the **Winning Scenario**

- The overall Main Stage outcome is a Winning Combination of bids for the Winning Scenario in which all bidders notionally releasing spectrum win it back

Schematic of winner determination

Analysis for one scenario

Generic Lots available

Notional release scenario for GSM spectrum (Party-Specific Lots)

Released lots

+

Supply

WD

Demand

Bids compatible with hypothetical release scenario

Winning combo of bids

Do releasers win back?

Yes

No

Infeasible scenario

Feasible scenario with some total value of winning bids

Choose Winning Scenario to maximise value of winning bids

Resolution of any ties

- **Ties amongst multiple Winning Scenarios of equal total value broken by**
    - First, maximising the total MHz of allocated as Party-Specific lots
    - Second, by randomisation amongst remaining tied outcomes
- **Ties amongst multiple Winning Combinations of bids of equal total value (in which releasers in the Winning Scenario win back lots) broken by**
    - First, maximising the number of bidders winning packages containing at least as many lots as their Final Primary Packages in every category
    - Second, by randomisation amongst remaining tied outcomes

dot·econ

Price determination

- Base Prices subject to requirement that winners, *both individually and collectively*, pay at least their opportunity cost

- <u>Opportunity cost</u> is the value that allocating lots to a winner (or group of winners) denies to other bidders

- Subject to this requirement, the total payment by winners is minimised ("core pricing")

- Very similar to approach pricing approach in Irish 26GHz auction and other CCAs (e.g. Ofcom)

Definition of opportunity cost (simple case without notional release)

Ignoring the issue of notionally released lots…

- The opportunity cost for some group C of winners would be:

    - The total value of winning bids if all the bids of bidders in group C are excluded and the winning outcome re-determined (the "<u>counterfactual value</u>")

    - **Minus** the total value of all (original) winning bids of bidders <u>not</u> in group C

General principles for defining opportunity cost with Party-Specific Lots

- Any winner of Party-Specific Lots should pay a price determined by open competition with other bidders

- Therefore, in the <u>counterfactual</u> that Party-Specific Lots are not awarded to a particular winner (or winners) they are supposed to be available as corresponding Generic Lots for <u>any</u> bidder to win

- Any release of existing spectrum by other winners is governed by the principle that releasers win back what they release in open competition

Definition of opportunity cost with notional release scenarios

- To find the counterfactual value where a bidder or group of bidders C is excluded…

- … maximise value over every <u>feasible</u> NRS …

- where value for a particular NRS is calculating by

    - Excluding bidders from the group C

    - For bidders not in C, taking compatible bids for that NRS

    - Find the winning combination of bids of maximum value

    - … subject to allocating no more lots than available in the notional supply for that NRS (*which may include lots released by excluded bidders in the group C*)

    - … and subject to every releaser <u>not</u> in C winning back the released lots specified by the NRS

dot·econ

Determining Base Prices

- **Base prices**
  - Are at least reserve prices
  - Are no more than winning bids
  - For every group of winners C require the winners in C to pay in total at least the group's opportunity cost
  - Subject to the previous requirements, minimise total revenue

- **Bidders pay the least amount necessary for other bidders not to prefer to have won instead, not the amount of their winning bid**

- **If these conditions do not determine a unique price for each winner, then the sum-of-squares distance from individual opportunity costs is minimised**

Assignment round: WD and pricing (by band)

- **Similar principles apply for winner determination**
  - Select one assignment option for each winner to maximise value of winning bids…
  - …subject to requirement that assignment is feasible (each frequency block assigned at most once)
- **Similar principles for pricing**
  - Additional prices must be at least opportunity cost for every winner and group of winners, subject to which revenue is minimised
  - Opportunity cost is defined by a counterfactual in which the excluded bidders make bids at zero for all their assignment options (i.e. no frequency preference)

dot·econ

Part II:
Activity rules

Eligibility rules for Primary Bids Rounds

- ***Safe harbour****:* Can always bid for a package within available eligibility regardless of round prices or prior primary bids

- Eligibility to bid is calculated separately for the two time slices (no transferability)

- ***Minimum rule***: eligibility in each time slice for the following round is the smaller of:

    - Eligibility to bid at the start of the current round

    - Bidding activity in the current round

Relaxed Primary Bids (RPBs)

■ May be able to bid for package exceeding current eligibility (but not initial eligibility) in certain circumstances depending on evolution of round prices

■ Provides greater opportunity for bidders to bid for their most preferred lots than the eligibility rule alone

■ Based on the idea of 'revealed preference'

■ Similar proposals for UK multiband auction and Australian 800MHz and Canadian 700MHz auctions

dot·econ

Revealed preference – basic concept

- Suppose package A costs 10 and package B costs 20. The bidder chooses package A.

- Can infer that value of B to that bidder is no more than 10 greater than the value of A.

- Suppose that at a later round package A costs 20 and package B costs 35. If the bidder were to choose package B now, this would be inconsistent with its previous revealed preference.

- Suppose instead that package A costs 20 and package B costs 25. Bidding for package B could now be consistent with previous choice, as the price difference has narrowed.

When are relaxed primary bids possible?

■ RPBs can only be made if round prices have evolved such that the bid is compatible with revealed preferences expressed in previous rounds in which eligibility was reduced (in one or both Time Slices)

■ Any round in which eligibility is reduced (in one or both Time Slices) results in a **relative cap**

■ No constraints arise from bids made in rounds where eligibility is maintained

dot·econ

Relative caps and RPBs

- Suppose that package X is subject to an RPB

- The bidder is not currently eligible to bid for X, but must have been eligible in some previous round

- Let R be the round in which the bidder was <u>last</u> eligible to bid for package X, but bid for some <u>constraining package</u> Y with smaller eligibility

- There is a **relative cap** on any bid for package X, which may not exceed:

    - The current highest bid for package Y; **plus**

    - The price of X less the price of Y at round R's prices

RPBs and chain bids

- A RPB may be made for package X at current round prices if it is permissible to make bids on all relevant constraining packages that
    - Conform to the relative caps; and
    - Do not exceed current round prices
- Bids required on constraining packages at minimum levels necessary to satisfy the relative caps are termed **chain bids**
- Example:
    - RPB for package X at current round prices
    - Constraining package Y that the bidder is currently eligible to bid for (so Y is not subject to a further relative cap)
    - Relative cap sets floor on bid for package Y, which will result in a chain bid if the current highest bid for Y is not sufficiently high
    - If floor above current price of Y, RPB not currently possible

Mechanics of making RPBs

- EAS will assist in identifying packages for which RPBs may be possible in the current round

- On checking an RPB any associated chain bids will be notified to the bidder

- The rules on RPBs are formulated such that bidders are not penalised if they fail to make an RPB and the Primary Bid Rounds continue

- However, if the Primary Bid Rounds stop, then constraints arise on supplementary bids

- If a bidder is not bidding on its most preferred package in the final primary round, it may find itself unable to make supplementary bids at its valuations

Eligibility following a relaxed primary bid

- **Eligibility in the following round governed by the minimum rule…**

- **…so eligibility does <u>not</u> increase following a relaxed primary bid**

- **A relaxed primary bid exceeding eligibility in one Time Slice, but with activity strictly less than eligibility in the other Time Slice, will result in a reduction of eligibility**

dot·econ

Dropping to zero eligibility

- Where a bidder drops to zero eligibility, no further bids are possible in the Primary Bid Rounds

- In particular, RPBs are not possible for a zero eligibility bidder

Activity rules for supplementary bids

- ## Relative caps
  - Arise as bidders drop eligibility
  - As eligibility dropped, packages that the bidder now can no longer bid for become constrained relative to package chosen

- ## Final price cap
  - Applies to all packages
  - Limits bids relative to Final Primary Package
  - Creates opportunities for bidders to win final primary packages if they bid enough

dot·econ

Structure of relative caps

Package bid for
at first eligibility
reduction

Packages within
initial eligibility

Final primary
Package

Packages within
final eligibility

Package bid for
at subsequent eligibility
reductions

Picture assumes final package and eligibility reducing packages not RPBs
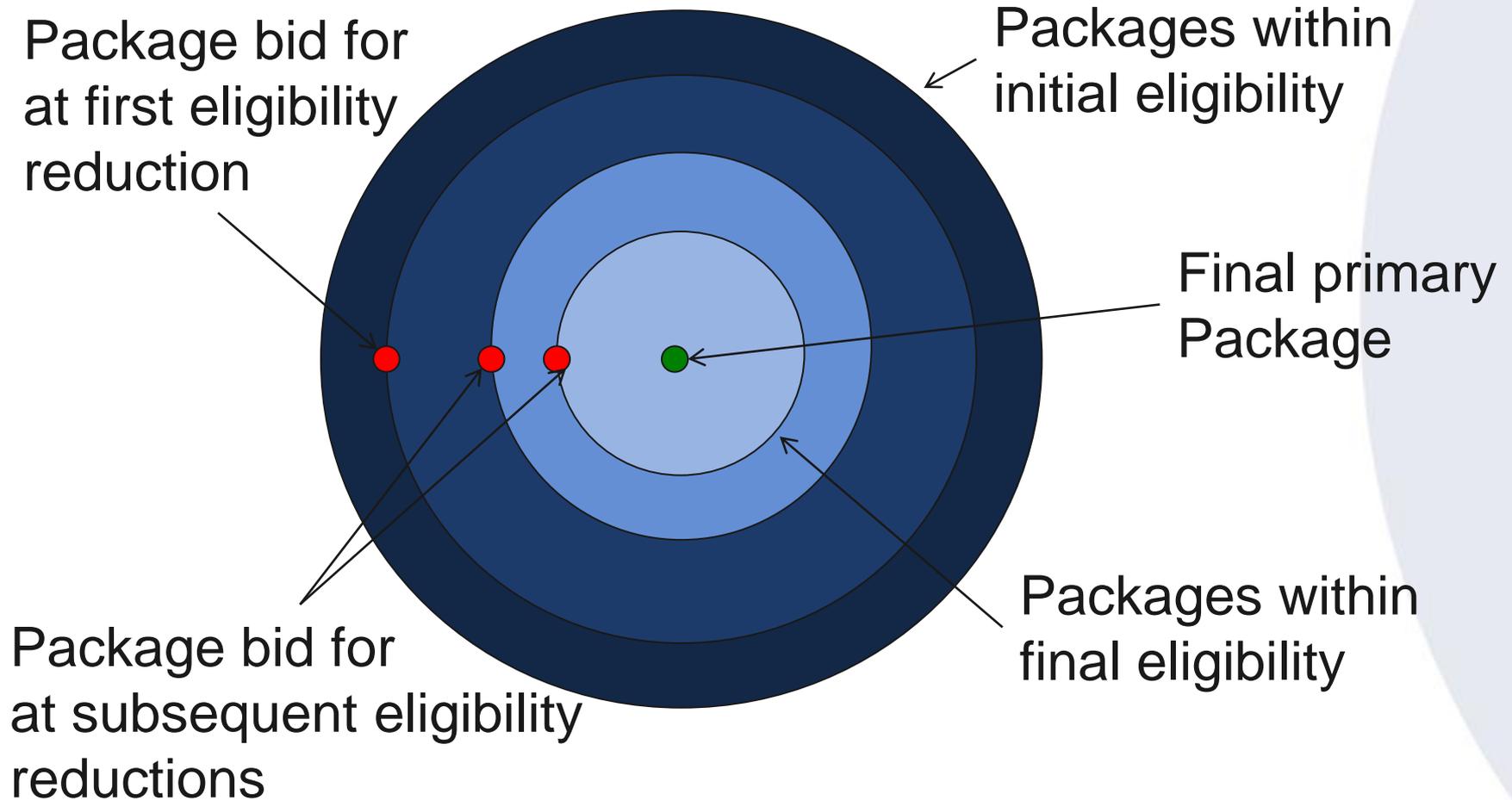
Final Price Cap

- Revealed preference constraint will always be applied based on the choice made in the final Primary Bid Round

- For any package X, other than the Final Primary Package, there is a cap on the amount of any supplementary bid equal to:
  - The highest bid made for the Final Primary Package **plus**
  - The price of X less the price of the Final Primary Package at the final Round Prices

- Notice that the Final Price Cap does not limit the bid that can be made for the Final Primary Package

Consequences of Final Price Cap

- Risk of Primary Rounds finishing creates incentive to bid for most preferred package
- Limits the differentials that can be bid for packages other than the Final Primary Package
- Implies that a supplementary bid round strategy which …
  - raises the bid for the Final Primary Package by at least the value of any provisionally unallocated lots at the end of the final Primary Bid Round (taking into account any subsequent deposit default)…
  - … and does not increase the bid amount for any other package to above its price in the final Primary Round …
- … will secure the Final Primary Package

dot·econ

Part III:
Activity rules in action

Example – based on Annex 7 of Final IM

- The bidder has the following valuations for different packages of lots across lot categories 800/1 and 800/2:

Package name	Number of 800/1 Lots	Number of 800/2 Lots	Bidder's valuation	Activity of package
1	2	1	€64m	(4,2)
2	1	3	€88m	(2,6)
3	2	3	€92m	(4,6)
4	1	1	€45m	(2,2)

- The bidder has selected **package 3** in its Lot Application Form.
- Therefore:
    - the bidder will have an initial eligibility of **4 eligibility points in time slice 1** and **6 eligibility points in time slice 2,** represented here as **(4,6)**
    - This is a binding bid for **package 3** at reserve prices of **€29.88m**

        2 x €2.55 (reserve price of an 800/1 lot) plus 3 x €8.26m (reserve price of a 800/2 lot)

Primary Bid Rounds – Round 1

Round	Round price of 800/1 Lots (€m)	Round Price of 800/2 Lots (€m)	Package 1 [2,1]		Package 2 [1,3]		Package 3 [2,3]		Package 4 [1,1]		Eligibility (Time Slice 1, Time Slice 2)	Activity (Time Slice 1, Time Slice 2)	Type of Bid
			Price	Payoff	Price	Payoff	Price	Payoff	Price	Payoff			
1	2.55	8.26	13.36	50.64	27.33	60.67	29.88	62.12	10.81	34.19	(4,6)	(4,6)	Standard

- The bidder's preferred package at round 1 prices is **package 3**, which has an activity of (4,6).

- The bidder is eligible to bid for this package.

- Bidding activity is equal to eligibility

- Eligibility for the next round is maintained at (4,6)

Primary Bid Rounds – Round 2

Round	Round price of 800/1 Lots (€m)	Round Price of 800/2 Lots (€m)	Package 1 [2,1]		Package 2 [1,3]		Package 3 [2,3]		Package 4 [1,1]		Eligibility (Time Slice 1, Time Slice 2)	Activity (Time Slice 1, Time Slice 2)	Type of Bid
			Price	Payoff	Price	Payoff	Price	Payoff	Price	Payoff			
1	2.55	8.26	13.36	50.64	27.33	60.67	29.88	62.12	10.81	34.19	(4,6)	(4,6)	Standard
2	5	9	19	45	32	56	37	55	14	31	(4,6)	(2,6)	Standard

- The bidder's preferred package at round 2 prices is **package 2**, which has an activity of (2,6).

- The bidder is eligible to bid for this package.

- Activity of (2,6) is less than current eligibility of (4,6)

- Eligibility for the round 3 falls to (2,6)

Primary Bid Rounds – Round 3

Round	Round price of 800/1 Lots (€m)	Round Price of 800/2 Lots (€m)	Package 1 [2,1]		Package 2 [1,3]		Package 3 [2,3]		Package 4 [1,1]		Eligibility (Time Slice 1, Time Slice 2)	Activity (Time Slice 1, Time Slice 2)	Type of Bid
			Price	Payoff	Price	Payoff	Price	Payoff	Price	Payoff			
1	2.55	8.26	13.36	50.64	27.33	60.67	29.88	62.12	10.81	34.19	(4,6)	(4,6)	Standard
2	5	9	19	45	32	56	37	55	14	31	(4,6)	(2,6)	Standard
3	10	10	30	34	40	48	50	42	20	25	(2,6)	(2,6)	Standard

- The bidder's preferred package at round 3 prices is again **package 2**.

- The bidder is eligible to bid for this package, and maintains its eligibility by continuing to bid on the same package.

- The eligibility for round 4 is (2,6) again.

Primary Bid Rounds – Round 4

Round	Round price of 800/1 Lots (€m)	Round Price of 800/2 Lots (€m)	Package 1 [2,1]		Package 2 [1,3]		Package 3 [2,3]		Package 4 [1,1]		Eligibility (Time Slice 1, Time Slice 2)	Activity (Time Slice 1, Time Slice 2)	Type of Bid
			Price	Payoff	Price	Payoff	Price	Payoff	Price	Payoff			
1	2.55	8.26	13.36	50.64	27.33	60.67	29.88	62.12	10.81	34.19	(4,6)	(4,6)	Standard
2	5	9	19	45	32	56	37	55	14	31	(4,6)	(2,6)	Standard
3	10	10	30	34	40	48	50	42	20	25	(2,6)	(2,6)	Standard
4	14	20	48	16	74	14	88	4	34	11	(2,6)		

- The bidder's preferred package at round 4 prices is **package 1**
- The eligibility of the preferred package <u>exceeds</u> the eligibility of the bidder in time slice 1
- However, given the round prices in round 4, the bidder may submit a **Relaxed Primary Bid**

The Relative Cap applying to the RBP

- The last round the bidder was eligible to bid for package 1 was round 2

- In round 2 the bidder bid for package 2, which is the <u>constraining package</u> for package 1

- The prices in the constraining round were €19m for package 1 and €32m for package 2.

- Therefore the Revealed Value Differential is €19m - €32m = - €13m

- The highest bid that the bidder may submit for package 1 cannot exceed the highest bid that the bidder submits for package 2 **minus** €13m:

$$b(x_1) \pounds\ b(x_2) + p_{R2}(x_1 - x_2)$$

$$b(x_1) \pounds\ b(x_2) + (€\ 19m - €\ 32m)$$

$$b(x_1) \pounds\ b(x_2) - €\ 13m$$

Chain Bid

- In round 4 the bid amount for package 1 at round prices is €48m.

- The relative cap requires that the bid amount cannot exceed the highest bid for package 2 <u>minus €13m</u>.

- Therefore, to be able to make an RPB for package 1 in round 4, the bidder must increase its bid for package 2 to at least €61m

- Required bid amount for package 2 is less than current prices (and not subject to any other caps) so RPB is possible

- The minimum bid amount for package 2 is higher than the highest bid the bidder has submitted so far for package 2

- Therefore the bidder must submit a chain bid of €61m for package 2 to make a RPB for package 1 in round 4

$$b(x_1) \pounds\ b(x_2) + p_{R2}(x_1 - x_2)$$
$$b(x_1) \pounds\ b(x_2) + (\text{€}\,19m - \text{€}\,32m)$$
$$b(x_1) \pounds\ b(x_2) - \text{€}\,13m$$
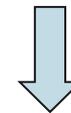
$$\text{€}\,48m\ \pounds\ b(x_2) - \text{€}\,13m$$
$$\text{€}\,48m + \text{€}\,13m\ \pounds\ b(x_2)$$
$$b(x_2)\ ^3\ \text{€}\,61m$$

Calculation of eligibility for round 5

- Eligibility at the start of round 4 is (2, 6)

- Activity in round 4 is (4, 2) due to RPB for package 1 which exceeds eligibility in Time Slice 1

- Eligibility for round 5 will be (2, 2)

Primary Bid Rounds – Round 5

Round	Round price of 800/1 Lots (€m)	Round Price of 800/2 Lots (€m)	Package 1 [2,1]		Package 2 [1,3]		Package 3 [2,3]		Package 4 [1,1]		Eligibility (Time Slice 1, Time Slice 2)	Activity (Time Slice 1, Time Slice 2)	Type of Bid
			Price	Payoff	Price	Payoff	Price	Payoff	Price	Payoff			
1	2.55	8.26	13.36	50.64	27.33	60.67	29.88	62.12	10.81	34.19	(4,6)	(4,6)	Standard
2	5	9	19	45	32	56	37	55	14	31	(4,6)	(2,6)	Standard
3	10	10	30	34	40	48	50	42	20	25	(2,6)	(2,6)	Standard
4	14	20	48	16	74	14	88	4	34	11	(2,6)	(4,2)	Relaxed
5	19	21	59	5	82	6	101	-9	40	5	(2,2)		

- The bidder's preferred package at the round prices for round 5 is package 2.

- The eligibility of this package exceeds the eligibility of the bidder in time slice 2.

- However, given the round prices in round 5, the bidder may submit a RPB.

Establishing the Relative Cap

- The last round in which the bidder was eligible to bid for package 2 was round 4, which is the **constraining round**.

- In round 4, the bidder bid on <u>package 1</u> which is the **constraining package**

- The price of these packages in the constraining round were €74m for package 2 and €48m for package 1.

- Therefore, the revealed value differential is €74m – €48m = €26m.

- Thus, the highest Bid that the bidder could submit for package 2 cannot exceed the highest bid that the bidder submits for package 1 *plus* €26m.

$$b(x_2) \pounds\ b(x_1) + p_{R4}(x_2 - x_1)$$
$$b(x_2) \pounds\ b(x_1) + (€\ 74m - €\ 48m)$$
$$b(x_2) \pounds\ b(x_1) + €\ 26m$$

Chain Bid

- In round 5 the bid amount for package 2 at round prices is €82m.

- The relative cap requires that the bid amount cannot exceed the highest bid for package 1 plus €26m.

- Therefore, to be able to make an RPB for package 2 in round 5, the bidder must also increase its bid for package 1 to at least €56m

- The minimum bid amount for package 1 is higher than the highest bid the bidder has submitted so far for package 1.

- Therefore the bidder must submit a chain bid of €56m for package 1 in order to be able to make a RPB for package 2 in round 5

$$b(x_2) \pounds \ b(x_1) + p_{R4}(x_2 - x_1)$$

$$b(x_2) \pounds \ b(x_1) + (\text{€} \ 74m - \text{€} \ 48m)$$

$$b(x_2) \pounds \ b(x_1) + \text{€} \ 26m$$
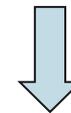
$$\text{€} \ 82m \ \pounds \ b(x_1) + \text{€} \ 26m$$

$$\text{€} \ 82m - \text{€} \ 26m \ \pounds \ b(x_1)$$

$$b(x_1) \ ^3 \ \text{€} \ 56m$$

dot·econ

Checks for RPB feasibility

- The required bid amount for the chain bid on package 1 is €56m does not exceed the price of this package in round 5 which is €59m

- The bidder is not currently eligible to bid for package 1, so this package is subject to a relative cap:

    The bid amount for package 1 cannot exceed the highest bid
for   *package 2 minus €13m*

- Relative cap for package 1 requires that bid amount package 2 must be at least €56m + €13m = €69m

- An RPB for package 2 at €82m will satisfy this relative cap

- Therefore, is it possible to submit an RPB of €82m for package 2 with a chain bid of €56m for package 1

dot·econ

Calculation of eligibility for round 6

- Eligibility at the start of round 5 was (2, 2)

- Activity in round 5 was (2,6), which exceeds eligibility for Time Slice 2

- Eligibility for round 6 will be maintained at (2,2)

Primary Bid Rounds – Round 6

Round	Round price of 800/1 Lots (€m)	Round Price of 800/2 Lots (€m)	Package 1 [2,1]		Package 2 [1,3]		Package 3 [2,3]		Package 4 [1,1]		Eligibility (Time Slice 1, Time Slice 2)	Activity (Time Slice 1, Time Slice 2)	Type of Bid
			Price	Payoff	Price	Payoff	Price	Payoff	Price	Payoff			
1	2.55	8.26	13.36	50.64	27.33	60.67	29.88	62.12	10.81	34.19	(4,6)	(4,6)	Standard
2	5	9	19	45	32	56	37	55	14	31	(4,6)	(2,6)	Standard
3	10	10	30	34	40	48	50	42	20	25	(2,6)	(2,6)	Standard
4	14	20	48	16	74	14	88	4	34	11	(2,6)	(4,2)	Relaxed
5	19	21	59	5	82	6	101	-9	40	5	(2,2)	(2,6)	Relaxed
6	20	23	63	1	89	-1	109	-17	43	2	(2,2)	(2,2)	Standard

- The bidder's preferred package at round 6 prices is **package 4**.
- Suppose that this is the final Primary Bid Round, as other bidders drop demand

End of Primary Bid Rounds

- In the primary bid rounds the bidder will have placed the following bids.

Rounds in which Bid was placed	Package Bid for	Amount of Bid (€m)	Type of Bid
1	3	29.88	Standard
2	2	32	Standard
3	2	40	Standard
4	1	48	Relaxed
4	2	61	Chain
5	2	82	Relaxed
5	1	56	Chain
6	4	43	Standard

- The highest bid for each package is highlighted

dot·econ

Relative caps on Supplementary Bids

- We have already seen the relative caps on **packages 1 and 2**

- For package 3:
    - Round 2 is the constraining round and package 2 the constraining package. The difference in price between package 3 and it constraining package (package 2) in the constraining round (round2) is €37m - €32m = €5m.
    - Thus the highest bid the bidder submits for package 3 cannot exceed the highest bid that the bidder submits for package 2 *plus* €5m.

- Package 4 was the final primary package. As the bidder was eligible to bid for this package, it is not subject to any relative cap

Final Price Caps on Supplementary Bids

- The final price cap limits the bid amount for any package X to be no greater than:
    - The highest bid that the bidder submits for package 4; plus
    - The difference in price between package X and the package 4 at round prices in the final primary bid round

- The price of package 4 in the final primary round (round 6) was €43m

- The price of package 1 in round 6 was €63m – bid for package 1 cannot exceed the highest bid for package 4 *plus* €20m (=€63m-€43m)

- The price of package 2 in round 6 was €89m - bid for package 2 cannot exceed the highest bid for package 4 *plus* €46m (=€89m - €43m)

- The price of package 3 in round 6 was €109m – bid for package 3 cannot exceed the highest bid for package 4 *plus* €66m (=€109m - €43m).

Restrictions on Supplementary Bids

- The following table provides an overview of the caps that would apply to the supplementary bids that the bidder can submit:

Package	Relative Cap	Final Price Cap	Valuation
1: [2,1]	HB(2) - €13m	HB(4) + €20m	€64m
2: [1,3]	HB(1) + €26m	HB(4) + €46m	€88m
3: [2,3]	HB(2) + €5m	HB(4) + €66m	€92m
4: [1,1]	NONE	NONE	€45m

- Bids at valuation can be made under these constraints

dot·econ

The Irish Multi-Band Spectrum Award Process

Electronic Auction System (EAS) Winner Determination and Pricing (WDP) software

These slides are intended to be construed with the aid of the oral presentation. The binding version of the auction rules is that set out in the Information Memorandum (as may be amended in accordance with its terms). The terminology used in this presentation may not, at all times, necessarily be the precise technical or legal terminology as set out in the Information Memorandum, and reliance ought not to be placed on the particular terminology used in these presentation, as opposed to that contained in the Information Memorandum.
The views in these slides are those of DotEcon and do not necessarily reflect the views of ComReg.

dot·econ

Accessing the EAS

- Auction will be accessed as a web application over the public Internet
    - Encrypted HTTPS connections
    - Digital certificates used to authenticate bidders and for users to verify the server identity
    - Further passwords required for access
- Full manuals and login credentials will be made available to Qualified Bidders only
- Mock auctions will be run

System requirements for using the EAS

- Modest bandwidth (512kb/s) but connection should be reliable with reasonably stable latency

- Bidding PC should have recent OS (Windows® 7, Linux, OS X®) with relevant service patches and be clear of malware

- Supported browsers are IE, Firefox, Chrome

- Recent version of Java is required

- Digital certificates need to be installed on bidding computer

- Recommend bidding computer is dedicated to task and kept securely

- Bidders should consider backup arrangements

- Only one session on the EAS can be active at a time, but sessions time-out automatically if inactive and can be picked up from a backup PC

Key features of EAS

- **Auction clock synced to server**

- **One-way messaging from auctioneer**

- **Notice of round schedule**

- **For Primary Bid Rounds:**
  - Interactive bid form for completing, checking and submitting
  - Feedback at end of rounds
  - Access to historic round information
  - Download/upload facilities

- **For Supplementary Bids:**
  - SB Editor, available from start of auction to assist preparation of bids
  - Explanations of caps
  - Interactive bid form for completing, checking and submitting
  - Download/upload facilities

- **Notice of assignment options and assignment bid form**

Beta EAS: Bid form

dot·econ

Powered by dot·econ WebBidder

ComReg Multi-band Spectrum Release Auction

Timer

Thu 07 Jun 2012
14:05:54

primary bid rounds

In round
Returned to bid form

Time left: 51m: 06s

No unread messages

Connected to server

You are logged in as:
Entrant

| Supplementary bids editor |
| Login history |
| Auction history |
| Bid history |
| Messages |
| View notices |
| Log out |

Messages:
No messages

Round 3 in progress

- **Please enter your decision for round 3**

Schedule summary

Round: 3
Start time: 07 June 2012 12:37 BST
Duration: 2 hours 20 minutes
End time: 07 June 2012 14:57 BST

Bidder eligibility

Lot group	Eligibility for round 3	Elibility assoc. with bid in round 3
All time slice 1 lots	2	2
All time slice 2 lots	6	4

Spectrum caps (MHz):

Lot group	Value	Assoc. with bid
All time slice 1 lots	2x50MHz	2x5MHz
All time slice 2 lots	2x50MHz	2x10MHz
Sub 1GHz lots in time slice 1	2x20MHz	2x5MHz
Sub 1GHz lots in time slice 2	2x20MHz	2x10MHz
900MHz lots in time slice 1	2x10MHz	2x0MHz

Summary of extensions

Extensions for the primary bid rounds	Maximum extension time for round 3
5 x 10 minutes	10 minutes

Category	Lot bandwidth	Lot Eligibility	Lots available	Annual SUF	Frequency band	Licence duration	Time slice	Reserve price	Round price in round 3	Your demand in round 3	Assoc. Eligibility	Expenditure
800/1	2x5MHz	2	6	€ 1.08m	791-821MHz paired with 832-862MHz	01/02/13 to 12/07/15	1	€2,550,000	€10,000,000	1 ⌄	2	€10,000,000
800/2	2x5MHz	2	6	€ 1.08m	791-821MHz paired with 832-862MHz	13/07/15 to 12/07/30	2	€8,260,000	€10,000,000	2 ⌄	4	€20,000,000
900/1	2x5MHz	2	5	€ 1.08m	880-915MHz paired with 925-960MHz	01/02/13 to 12/07/15	1	€2,550,000	€2,550,000	0 ⌄	0	€0
900/2	2x5MHz	2	7	€ 1.08m	880-915MHz paired with 925-960MHz	13/07/15 to 12/07/30	2	€8,260,000	€8,260,000	0 ⌄	0	€0
1800/1	2x5MHz	1	6	€ 0.54m	1710-1785MHz paired with 1805-1880MHz	01/02/13 to 12/07/15	1	€1,270,000	€1,270,000	0 ⌄	0	€0
1800/2	2x5MHz	1	15	€ 0.54m	1710-1785MHz paired with 1805-1880MHz	13/07/15 to 12/07/30	2	€4,130,000	€4,130,000	0 ⌄	0	€0

Bid amount: €30,000,000

- **The capped primary bid you have entered does not require any chain bids.**

Check

Zero bid

Reset

ComReg 12/61A

dot·econ

Powered by
dot·econ
WebBidder

ComReg Multi-band Spectrum Release Auction

Timer

Thu 07 Jun 2012
14:07:36

primary bid rounds

In round
Valid decision checked

Time left: 49m: 24s

No unread messages

Connected to server

You are logged in as:
Entrant

| Supplementary bids editor |
| Login history |
| Auction history |
| Bid history |
| Messages |
| View notices |
| Log out |

Messages:
No messages

Round 3 in progress

- **You have checked a decision for round 3**

Schedule summary

Round: 3
Start time: 07 June 2012 12:37 BST
Duration: 2 hours 20 minutes
End time: 07 June 2012 14:57 BST

Bidder eligibility

Lot group	Eligibility for round 3	Elibility assoc. with bid in round 3	Eligibility for round 4
All time slice 1 lots	2	2	2
All time slice 2 lots	6	6	6

Spectrum caps (MHz):

Lot group	Value	Assoc. with bid
All time slice 1 lots	2x50MHz	2x5MHz
All time slice 2 lots	2x50MHz	2x15MHz
Sub 1GHz lots in time slice 1	2x20MHz	2x5MHz
Sub 1GHz lots in time slice 2	2x20MHz	2x15MHz
900MHz lots in time slice 1	2x10MHz	2x0MHz

Summary of extensions

Extensions for the primary bid rounds	Maximum extension time for round 3
5 x 10 minutes	10 minutes

Category	Lot bandwidth	Lot Eligibility	Lots available	Annual SUF	Frequency band	Licence duration	Time slice	Reserve price	Round price in round 3	Your demand in round 3	Assoc. Eligibility	Expenditure
800/1	2x5MHz	2	6	€ 1.08m	791-821MHz paired with 832-862MHz	01/02/13 to 12/07/15	1	€2,550,000	€10,000,000	1	2	€10,000,000
800/2	2x5MHz	2	6	€ 1.08m	791-821MHz paired with 832-862MHz	13/07/15 to 12/07/30	2	€8,260,000	€10,000,000	3	6	€30,000,000
900/1	2x5MHz	2	5	€ 1.08m	880-915MHz paired with 925-960MHz	01/02/13 to 12/07/15	1	€2,550,000	€2,550,000	0	0	€0
900/2	2x5MHz	2	7	€ 1.08m	880-915MHz paired with 925-960MHz	13/07/15 to 12/07/30	2	€8,260,000	€8,260,000	0	0	€0
1800/1	2x5MHz	1	6	€ 0.54m	1710-1785MHz paired with 1805-1880MHz	01/02/13 to 12/07/15	1	€1,270,000	€1,270,000	0	0	€0
1800/2	2x5MHz	1	15	€ 0.54m	1710-1785MHz paired with 1805-1880MHz	13/07/15 to 12/07/30	2	€4,130,000	€4,130,000	0	0	€0

Bid amount: €40,000,000

| Submit |

| Return |

Beta EAS: Checking an invalid bid

ComReg Multi-band Spectrum Release Auction

Timer

Thu 07 Jun 2012
14:08:38

primary bid rounds

In round
Invalid decision checked

Time left: 48m: 22s

No unread messages

Connected to server

You are logged in as:
Entrant

| Supplementary bids editor |
| Login history |
| Auction history |
| Bid history |
| Messages |
| View notices |
| Log out |

Messages:
No messages

Round 3 in progress

- The eligibility associated with your bid is below your current eligibility If you submit a primary bid for this package, this will be a constraining primary bid. This will result in a reduction of eligibility to bid on "All time slice 1 lots" for the next round to 0.
- Please enter your decision for round 3

There are errors

- The spectrum associated with your bid to bid on "Sub 1GHz lots in time slice 2" exceeds the spectrum cap.

Schedule summary

Round: 3
Start time: 07 June 2012 12:37 BST
Duration: 2 hours 20 minutes
End time: 07 June 2012 14:57 BST

Bidder eligibility

Lot group	Eligibility for round 3	Elibility assoc. with bid in round 3
All time slice 1 lots	2	0
All time slice 2 lots	6	10

Spectrum caps (MHz):

Lot group	Value	Assoc. with bid
All time slice 1 lots	2x50MHz	2x0MHz
All time slice 2 lots	2x50MHz	2x25MHz
Sub 1GHz lots in time slice 1	2x20MHz	2x0MHz
Sub 1GHz lots in time slice 2	2x20MHz	2x25MHz
900MHz lots in time slice 1	2x10MHz	2x0MHz

Summary of extensions

Extensions for the primary bid rounds	Maximum extension time for round 3
5 x 10 minutes	10 minutes

Category	Lot bandwidth	Lot Eligibility	Lots available	Annual SUF	Frequency band	Licence duration	Time slice	Reserve price	Round price in round 3	Your demand in round 3	Assoc. Eligibility	Expenditure
800/1	2x5MHz	2	6	€ 1.08m	791-821MHz paired with 832-862MHz	01/02/13 to 12/07/15	1	€2,550,000	€10,000,000	0	0	€0
800/2	2x5MHz	2	6	€ 1.08m	791-821MHz paired with 832-862MHz	13/07/15 to 12/07/30	2	€8,260,000	€10,000,000	5	10	€50,000,000
900/1	2x5MHz	2	5	€ 1.08m	880-915MHz paired with 925-960MHz	01/02/13 to 12/07/15	1	€2,550,000	€2,550,000	0	0	€0
900/2	2x5MHz	2	7	€ 1.08m	880-915MHz paired with 925-960MHz	13/07/15 to 12/07/30	2	€8,260,000	€8,260,000	0	0	€0
1800/1	2x5MHz	1	6	€ 0.54m	1710-1785MHz paired with 1805-1880MHz	01/02/13 to 12/07/15	1	€1,270,000	€1,270,000	0	0	€0
1800/2	2x5MHz	1	15	€ 0.54m	1710-1785MHz paired with 1805-1880MHz	13/07/15 to 12/07/30	2	€4,130,000	€4,130,000	0	0	€0

Bid amount: €50,000,000

- You have selected a capped primary bid, the chain bids required are summarised below. In order to submit a capped primary bid for this package, the following chain bids are required:

Summary of chain bids

| Unique package identifier | 800/1 | 800/2 | 900/2 | 1800/2 | Eligibility assoc. with package | Highest bid amount | Price of package in current round | Required chain bid amount | Required eligibility |

Beta EAS: Confirming bid

Powered by dot·econ WebBidder

ComReg Multi-band Spectrum Release Auction

Timer
Thu 07 Jun 2012
14:09:00

primary bid rounds

In round
Decision confirmed

Time left: 48m: 00s

No unread messages

Connected to server

You are logged in as:
Entrant

- Supplementary bids editor
- Login history
- Auction history
- Bid history
- Messages
- View notices
- Log out

Messages:
No messages

Round 3 in progress

- **You have submitted your decision for round 3**

Schedule summary

Round: 3
Start time: 07 June 2012 12:37 BST
Duration: 2 hours 20 minutes
End time: 07 June 2012 14:57 BST

Bidder eligibility

Lot group	Eligibility for round 3	Elibility assoc. with bid in round 3	Eligibility for round 4
All time slice 1 lots	2	2	2
All time slice 2 lots	6	6	6

Spectrum caps (MHz):

Lot group	Value	Assoc. with bid
All time slice 1 lots	2x50MHz	2x5MHz
All time slice 2 lots	2x50MHz	2x15MHz
Sub 1GHz lots in time slice 1	2x20MHz	2x5MHz
Sub 1GHz lots in time slice 2	2x20MHz	2x15MHz
900MHz lots in time slice 1	2x10MHz	2x0MHz

Summary of extensions

Extensions for the primary bid rounds	Maximum extension time for round 3
5 x 10 minutes	10 minutes

Category	Lot bandwidth	Lot Eligibility	Lots available	Annual SUF	Frequency band	Licence duration	Time slice	Reserve price	Round price in round 3	Your demand in round 3	Assoc. Eligibility	Expenditure
800/1	2x5MHz	2	6	€ 1.08m	791-821MHz paired with 832-862MHz	01/02/13 to 12/07/15	1	€2,550,000	€10,000,000	1	2	€10,000,000
800/2	2x5MHz	2	6	€ 1.08m	791-821MHz paired with 832-862MHz	13/07/15 to 12/07/30	2	€8,260,000	€10,000,000	3	6	€30,000,000
900/1	2x5MHz	2	5	€ 1.08m	880-915MHz paired with 925-960MHz	01/02/13 to 12/07/15	1	€2,550,000	€2,550,000	0	0	€0
900/2	2x5MHz	2	7	€ 1.08m	880-915MHz paired with 925-960MHz	13/07/15 to 12/07/30	2	€8,260,000	€8,260,000	0	0	€0
1800/1	2x5MHz	1	6	€ 0.54m	1710-1785MHz paired with 1805-1880MHz	01/02/13 to 12/07/15	1	€1,270,000	€1,270,000	0	0	€0
1800/2	2x5MHz	1	15	€ 0.54m	1710-1785MHz paired with 1805-1880MHz	13/07/15 to 12/07/30	2	€4,130,000	€4,130,000	0	0	€0

Bid amount: €40,000,000

Supplementary bids editor - Mozilla Firefox

brian https://brian/comreg_dev/Entrant/ProvisionalBid.wb?serial=11&random=3882533

Supplementary bids editor

You can use the supplementary bids editor to enter and submit your supplementary bids. The supplementary bids editor will assist you by providing you with details on the constraints on the bids you may submit. To enter a supplementary bid, please add the package you wish to bid for to your list of provisional supplementary bids. You can later edit the bid amounts in your provisional supplementary bids. Alternatively, you can upload a number of supplementary bids from a file, which can then still be amended using the supplementary bids editor.

You can use the supplementary bids editor before the start of the supplementary round, including during the primary bid rounds, to maintain a list of provisional supplementary bids that will be available during the supplementary round. You will then be able to amend and submit (if all the bids in the list are valid) these bids during the supplementary round.

All bids in your list of provisional supplementary bids need to be validated before you can submit your supplementary bids. If any of the bids in the list is invalid, you will not be allowed to submit your list until you amend the invalid supplementary bids so they are valid, or delete them from the list.

For further details on how to use the supplementary bids editor, please refer to the manual.

Unique package identifier	800/1	800/2	900/1	900/2	1800/1	1800/2	Package reserve	Highest bid amount	Relative cap	Constraining package UID	Capped primary bid allowed	Explain	Modify	Bid amount	Delete
11	1	3	0	0	0	0	€27,330,000	€32,000,000	Not capped	N/A	N/A	N/A	☐	€32,000,000	N/A
10	2	3	0	0	0	0	€29,880,000	€32,120,000	€37,000,000	11	Yes	explain	☐	€32,120,000	N/A

Export options: CSV | Excel | XML | Bids File

Update edits

Add package

Clear edits

Upload a supplementary bids file

Select the file you wish to upload, then upload the file by clicking "Upload bids". The file can be either tab separated (tsv) or comma separated (csv), all other formats will be rejected by the system.

Bids file to upload: [   ] Browse…

☐ Clear existing bids in your list of provisional supplementary bids before uploading

Upload bids

dot·econ

Backup bidding procedures

- ComReg will provide telephone number for a support hotline

- Calls may be recorded and subject to authentication procedures

- <u>Prior</u> permission must be obtained from ComReg <u>before</u> submitting a bid by a means other than the EAS

- Alternative bid submission must conform to the instructions issued by ComReg

- Extensions provide basic safeguard against technical failures

- In the event of wide-spread technical problems, ComReg has a range of powers, including issuing additional extensions and a temporary suspension of further rounds

WDP software

- Beta software for computing Winning Bids and Base Prices for the Main Stage will be made available from Monday next week

- This is provided solely for the purposes of understanding the auction rules

- This is the same software as used within the EAS for computing results, but provided in a 'standalone' version

dot·econ

System requirements for WDP software

- Computational load can be intensive
- System requirements are:
  - 64bit version of Ubuntu Linux 10.04 LTS
  - Minimum of 4 cores and 16GB RAM
  - Recommended 8 cores and 32GB RAM
- Data input/output through text files
- Extensive diagnostic output to console

dot·econ

Procedures for getting WDP software

- Send request by email to IrishMultiBand2012@dotecon.com

- You will be sent the licence conditions

- Sign up to licence by return of email

- You will be sent a download link and access password

- Potential problems must be brought to the attention of ComReg

  - In writing to Dr Samuel Ritchie at ComReg in line with Q&A procedures (Doc 12/52)

- Updates of WDP software may be issued

Multi-Band Spectrum Award for the 800 MHz, 900 MHz and 1800 MHz Bands

Next Steps

These slides are intended to be construed with the aid of the oral presentation. The binding version of the auction rules is that set out in the Information Memorandum (as may be amended in accordance with its terms). The terminology used in this presentation may not, at all times, necessarily be the precise technical or legal terminology as set out in the Information Memorandum, and reliance ought not to be placed on the particular terminology used in these presentation, as opposed to that contained in the Information Memorandum.

www.comreg.ie

Commission for Communications Regulation

Next Steps

- The presentation materials and any substantive clarifications will be made available on the ComReg website in due course.

- The process for submitting <u>questions</u> on the Award Process and Auction Rules is set out in Document 12/52 (see section 3.3.1 of Document 12/52).

Application Stage - Milestones	Timeline (as per Table 9 of 12/52)
Deadline for submission of **Questions** regarding the Award Process	16:00 (local time) on Friday 22 June 2012
Final date for **Responses to Questions** on the Award Process to be published on ComReg's website	Friday 6 July 2012
Deadline date for **submission of Application Forms** Application Forms - Annex 5 to Document 12/52 or Document 12/52a (PDF editable format)	From 10:00 (local time) on Monday 16 July 2012 to 16:00 (local time) on Friday 20 July 2012
Deadline date for **submission of Deposits**	23:59 (local time) on Friday 20 July 2012
Restrictions on auction-related communications come into effect	On submission of first Application to ComReg

Commission for
Communications Regulation

Thank You

www.comreg.ie