



Commission for
Communications Regulation

Information Memorandum

The Award of National Block Point to Point and Point to Multipoint Assignments in the 26 GHz band.

Document No:	07/93R
Date:	24 January 2008

Contents

1 Introduction 4

2 Objectives 5

3 Licence Framework 6

 3.1 SPECTRUM ASSIGNMENT 6

 3.1.1 Licence Duration and Renewal 7

 3.1.2 Guard Bands and efficient spectrum use 7

 3.1.3 Block Edge Mask 7

 3.1.4 Change of use 8

 3.1.5 Spectrum Review 8

 3.1.6 Ensuring the Effective Use of Spectrum 8

 3.1.7 Flexibility of Use 8

 3.1.8 Avoiding Anti-Competitive Behaviour 9

 3.1.9 Individual Point to Point Licences 9

 3.1.10 Spectrum availability in the 28 GHz band 9

 3.2 FEES 9

 3.2.1 Minimum Price 10

 3.2.2 Fee Payment Structure 11

4 Auction Rules 13

 4.1 APPLICATION STAGE 14

 4.2 QUALIFICATION STAGE 14

 4.3 SEALED BID STAGE 15

 4.3.1 Activity Rule 15

 4.3.2 Submitting Bids 16

 4.3.3 Winner determination 16

 4.3.4 Base Price Determination 17

 4.4 ASSIGNMENT STAGE 17

 4.4.1 Split between P2P and PMP and designation of guard blocks 17

 4.4.2 Procedure for assigning lots if no Assignment Bid Round is required 18

 4.4.3 Determining the bid options for the Assignment Bid Round 19

 4.4.4 Submitting assignment round bids 20

 4.4.5 Winner determination 21

 4.4.6 Determining additional prices from the Assignment Phase and the overall licence fee 22

 4.4.7 End of the Assignment Stage 22

 4.5 GRANT STAGE 22

 4.6 DEPOSIT 22

 4.7 APPLICANT BEHAVIOUR AND BIDDER ASSOCIATION 22

 4.8 UNASSIGNED LOTS 23

 4.9 EXPENSES 23

 4.10 PROVISION OF FURTHER INFORMATION 23

 4.11 TERMS FOR SUBMISSION OF APPLICATION 23

 4.12 CONCLUSION OF LICENSING PROCESS 23

 4.13 GENERAL 24

 4.14 BREACHES OF THE AUCTION RULES 24

5 Participation in the licensing process 27

 5.1 QUESTIONS AND ANSWERS 27

 5.2 APPROVAL OF APPLICATIONS 27

 5.3 RULES ON APPLICANT BEHAVIOUR 28

 5.4 BIDDER BRIEFING SESSIONS 28

 5.5 AUCTION WEBSITE 28

5.6	INDICATIVE TIMETABLE	28
6	Offer and Acceptance of the Licences	30
	Annex 1 Glossary of Terms	31
	Annex 2 Candidate Auction Formats	33
	A2.1 Sealed Bid Combinatorial Auction	34
	A.2.2 Combinatorial Clock Auction	35
	A .2.3 Sealed Bid Combinatorial vs. Combinatorial Clock	36
	A.2.4 Conclusion re Appropriate Auction Format	37
	A.2.5 Assignment Stage and Appropriate Pricing Rule	37
	Annex 3 Detailed Flowchart of Award Process	39
	Annex 4 Sample Application Form	43
	Annex 5 Sample Bid Form	49
	Annex 6 Base Price Determination	53
	A6.1 BASE PRICE DETERMINATION	53
	A6.2 DETERMINING ADDITIONAL PRICES AND THE LICENCE FEE	54
	Annex 7 Sample Bid Form for Assignment Stage	56
	Annex 8 Radio Regulations	57
	Annex 9 Winner Determination and pricing algorithms for combinatorial clock auctions	69

1 Introduction

This finalised memorandum provides information for interested parties considering bidding for national block licences in the 26 GHz band for Point-to-Point (P2P) and Point-to-Multipoint (PMP) applications.

In its Draft Information Memorandum, the Commission for Communications Regulation (ComReg) indicated that it would publish all respondents' submissions to that document with the finalised Information Memorandum, subject to the provisions of ComReg's guidelines on the treatment of confidential information as set out in ComReg Document 05/24.

As this spectrum is to be awarded via an auction process and, having regard to the possibility that publication of the number of respondents, their identity and/or submissions may influence the outcome of the proposed auction, ComReg has decided not to publish this information at this time. ComReg has however taken account of the issues raised by respondents in this finalised memorandum. ComReg will publish all respondents' submissions following conclusion of the auction process, subject to the provisions of ComReg's guidelines on the treatment of confidential information.

Regulation 9 (4) of the Authorisation Regulations¹ requires spectrum assignment procedures to be open, transparent and non-discriminatory.

In general, spectrum is assigned on a first-come, first-served basis. However, if the regulator expects that demand will exceed supply within a certain spectrum block or believes that it is an appropriate assignment method, spectrum is assigned on the basis of a comparative selection procedure, either an auction or a "beauty contest".

In such cases, prior public consultation is required under regulation 11 (1)(b) of the Authorisation Regulations to solicit the views of interested parties, including users and consumers, on the envisaged limitation of usage rights.

Moreover, the selection criteria used for the assignment of a limited number of usage rights must be objective, transparent, non-discriminatory and proportionate.

In August 2006 ComReg published an Information Memorandum (ComReg Document 06/37b) detailing proposals making available 18 lots of 2 x 28 MHz of spectrum via a Single Sealed Bid auction format. No applications were received for these licences.

Following discussion with interested parties it was decided to review the auction format, the auction reserve price and to make the spectrum available again.

¹ The European Communities (Electronic Communications Networks and Services)(Authorisation) Regulations, 2003 (S.I. No. 306 of 2003).

2 Objectives

ComReg is mindful of the need to ensure that spectrum is assigned in an open and transparent manner and has decided that the best method to assign this particular spectrum is via an auction process.

ComReg's objectives for this award are to:-

- i) Ensure an efficient outcome in which spectrum is assigned to undertakings that will generate the greatest value for Ireland – this is particularly important given that there is no secondary trading option which would allow winning bidders to address modest inefficiencies in assignments at a later stage;
- ii) Allow the market to determine the appropriate split between P2P and PMP use, while ensuring that these can be located in separate parts of the available spectrum;
- iii) Minimise aggregation risks for bidders seeking multiple 2 x 28 MHz lots of spectrum – this is important as bidders buying multiple lots for the same use are likely to place a strong premium on winning contiguous spectrum to minimise co-ordination/interference issues with their neighbours;
- iv) Avoid spectrum going unassigned in the event that there is demand from bidders with serious business cases for that spectrum;
- v) Encourage participation in the process, in particular by mitigating concerns about bidder asymmetries – ComReg is keen that all parties (irrespective of size) with viable business cases participate in this auction;
- vi) Be relatively fast, effective, reasonable and simple for bidders to understand; and
- vii) Minimise vulnerability to strategic manipulation and collusion.

3 Licence Framework

Licensee(s) will be granted the national right to use the spectrum, assigned as a result of this competition, for either Point-to-Point (P2P) or Point-to-Multipoint (PMP) links. The term of the licence is set at 10 years. The licensee(s) will be obliged to meet certain terms and conditions as contained in the Wireless Telegraphy (National Point-to-Point and Point-to-Multipoint Block Licences) Regulations, 2007 (S.I. No. 762 of 2007) attached to this document and in the ComReg Guidelines Document 06/37cR².

3.1 Spectrum Assignment

There is a total of 2 x 504 MHz of spectrum available in the frequency ranges 24.773 – 25.277 GHz paired with 25.781 – 26.285 GHz. This has been divided into 18 lots of 2 x 28 MHz as shown in Figure 1 below. The blocks can be used for either PMP or P2P applications.

ComReg will not be designating specific frequencies for particular technologies or applications (e.g. PMP or P2P). However on the basis of an extensive review of sharing studies undertaken by CEPT and other parties ComReg has concluded that it is spectrally efficient to separate PMP and P2P use within the band. This will minimise the need for guard bands to prevent interference between different access techniques and network topologies. ComReg is of the view that the auction process will determine the appropriate split between the lots allocated to PMP and P2P.

However, as a general rule, P2P lots will be allocated in the upper part of the band and PMP lots in the lower part of the band. In the event that all lots are assigned in this process then lot A18 is designated as a guard band to protect the adjacent existing point-to-point links. In addition, in order to ensure adequate separation between PMP and P2P, one of the other 17 lots will be designated as a guard block between PMP and P2P users. The position of this guard block will depend on the relative number of lots allocated to PMP and P2P in the auction.

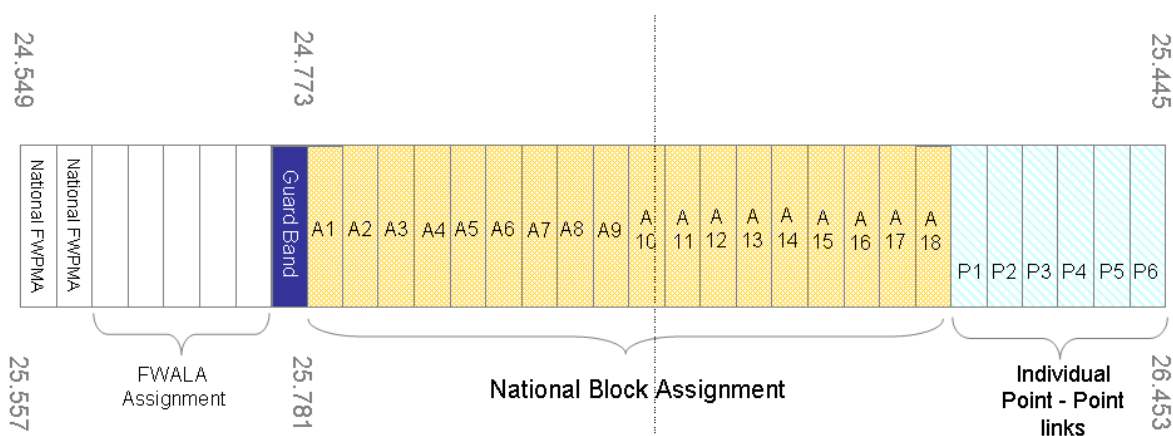


Figure 1 26 GHz band plan

² Commission for Communications Regulation (2006), Guidelines for National Point-to-Point and Point-to-Multipoint Block Licences in the National 26 GHz Band, Document No. 06/37c, August, http://www.comreg.ie/_fileupload/publications/ComReg0637c.pdf.

3.1.1 Licence Duration and Renewal

The licences will be issued for a period of 10 years. ComReg will carry out a review of the band prior to licence expiration with the emphasis being on the efficient management and use of spectrum. Due consideration will be given to existing allocations in this review.

3.1.2 Guard Bands and efficient spectrum use

This spectrum will be awarded on a technology neutral basis. In the interest of spectrum efficiency ComReg will not be assigning guard bands between adjacent operators. Bidders need to take account of any guard band requirements which their choice of technology may require and bid for sufficient spectrum to make provision for same.

Operators can maximise the use of their spectrum assignment and minimise the risk of any spectrum being under utilised through co-ordination with the adjacent operators and deployment of the block edge mask. This approach has been successfully adopted in other licensed frequency bands. For example, if two adjacent operators have acquired one block of spectrum each for the provision of guard bands, through co-ordination and mutual agreement each operator could agree to set aside half of their guard band assignment to minimise the risk of interference. This would free up an additional 14 MHz of spectrum for each operator and would not require detailed communications with regard to either operator's network.

One respondent suggested that the existing packaging approach may be spectrally inefficient because two adjacent users operating the same technology (i.e. both P2P or both PMP) may both have unilaterally bought an extra lot as a guard block, so as to avoid any requirement to coordinate with their neighbours. This would result in there being two adjacent lots used as guard blocks, even though a one-block separation would be sufficient to avoid coordination.

ComReg recognises that this is a possible outcome. However, ComReg believes that the alternative approach of mandating a guard block between the two parties would be even more inefficient, given that coordination is possible. ComReg also notes that adjacent parties should have strong incentives to coordinate with each other so as to avoid any potential for inefficient use of valuable spectrum.

The respondent further asserts that use of a simultaneous multiple round auction (SMRA) format could mitigate this problem, as bidders can see how much spectrum other parties are bidding for. This is incorrect, as (unless a bidder is bidding for just one block) it is not possible to determine, based on the number of blocks in its bid, whether or not that bidder intends to coordinate with neighbours or unilaterally use part of its spectrum as a guard block.

3.1.3 Block Edge Mask

Licensees are permitted to use any channelling arrangement within their licensed blocks of spectrum as long as the requirements of the block-edge mask are met (see ComReg Guidelines Document 06/37cR).

3.1.4 Change of use

The auction provides sufficient flexibility to licensees to efficiently match their choice of technology with their actual requirements. Therefore, ComReg does not believe that there would be significant advantage to be gained from allowing bidders to swap their assigned lots for unallocated lots (if there are any). ComReg appreciates that the demand profile of bidders may change during the licence period, leading them to require more or less P2P and PMP spectrum. In this case, licensees have the options to return underused spectrum to ComReg and/or request ComReg to allow a change of use (subject to protecting the rights of other users). Licensees and other parties may in the future approach ComReg to express an interest in buying any unallocated spectrum. However, ComReg will not award any unallocated spectrum in this band within 18 months of the current award and reserves the right to determine how and on what terms the unallocated spectrum will be awarded, e.g. via FWALA licences, individual licences or another auction.

3.1.5 Spectrum Review

It is ComReg's policy to conduct, at regular intervals, reviews of spectrum management and use and as a consequence of these reviews changes to licences may be required. If changes are required to licences as a result of a spectrum review, ComReg will consult with the licensees at the earliest possible stage in order to take account of their views.

3.1.6 Ensuring the Effective Use of Spectrum

The spectrum is a public resource which should be used in ways to serve the public interest and must not be hoarded. As such, licensees are required, as a condition of use, to demonstrate that their spectrum is being used for national P2P or PMP services within three years of the licence issue and on the fifth, seventh and ninth anniversaries of the licence issue.

Recognising that a variety of different business plans and technologies may be employed in the blocks across different markets and taking a technology neutral approach, ComReg does not intend to specify particular roll-out conditions.

In the event that spectrum obtained in this competition is not being used within three years of the issue of the licence and on the fifth, seventh and ninth anniversaries of the licence issue, ComReg may amend or revoke the licence accordingly.

The requirement on a licensee to demonstrate that their spectrum is being used applies to each contiguous block of spectrum assigned (including guard bands) to the licensee rather than to individual lots. ComReg does not consider deployment of guard bands within an operator's spectrum assignment as a breach of this requirement.

3.1.7 Flexibility of Use

To ensure that licensees can quickly and efficiently adapt their service offerings, they will be allowed the maximum possible flexibility in determining the use of the spectrum and the technologies they will employ.

Licensees are permitted to use any channelling arrangement within the licensed blocks of spectrum as long as the requirements of the block-edge mask and any cross-border agreements are met (see the guidelines document 06/37cR).

There is currently no spectrum liberalisation legislation in Ireland. In the event that such legislation is introduced, ComReg reserves the right to apply such legislation to these licences.

3.1.8 Avoiding Anti-Competitive Behaviour

In order to safeguard against anti-competitive behaviour and to avoid one operator dominating the whole band, ComReg believes that no one entity should be permitted to acquire the entire available national 26 GHz spectrum. Therefore a spectrum aggregation limit will be applied and each bidder will only be awarded a maximum of 6 blocks. This should provide adequate flexibility to the operator to provide the services they require.

This aggregation limit will be enforced in the case of licence transfer requests.

The limits on the aggregation of spectrum in this band will be reviewed periodically taking into account the degree to which use and/or competition has developed in the relevant market(s) as evidenced by factors such as the concentration of market share and the availability of choice in the provision of services.

3.1.9 Individual Point to Point Licences

Following the award process detailed in this document ComReg will open up the six upper channels for licensing, P1 – P6 (25.277 – 25.445 GHz paired with 26.285 – 26.453 GHz), under the current individual P2P link licence scheme

3.1.10 Spectrum availability in the 28 GHz band

The 28 GHz band is viewed as a good substitute for the 26 GHz band. Therefore ComReg is of the view that, in the interest of transparency and to aid the decision making process of prospective applicants, it is important to be aware of ComReg's proposals for this band. ComReg intends to make the 28 GHz band available for licensing in the future but has yet to finalise a date for commencement of this work which will not be within the next 24 months. ComReg has yet to determine on what basis this spectrum will be made available, i.e. either on an individual link basis or nationally in a similar manner as detailed in this document. Any such process would be likely to take time to complete and would be subject to a competitive process for assignment.

3.2 Fees

For the avoidance of uncertainty, the following definitions apply in the discussion of applicable fees for this award:-

- *Reserve price*: This refers only to the minimum upfront fee or payment for a given licence (which may contain one or more 2x28 MHz lots). For any given package of lots, the reserve price for that package is the sum of the reserve prices for the associated number of lots.

- *Annual fee:* This refers to the fixed annual payments associated with a licence, which apply over the licence term. The annual fee for a licence in any given year is proportional to the number of 2x28 MHz lots in the licence.
- *Minimum price:* This refers to the combined value of the upfront reserve price plus any fixed annual fees charged over the licence term.
- *Auction price:* This is the price for a licence as determined in the auction. The auction price must be greater than or equal to the aggregate reserve price for the number of lots in the licence.
- *Licence price:* The licence fee is the sum of the auction price and the annual fees. The licence price must be at least equal to the minimum price, but could be higher if the auction prices exceed the reserve prices.

3.2.1 Minimum Price

There is no exact methodology for setting minimum prices for a spectrum auction. However, a number of considerations arise in the context of the 26 GHz national block award process.

On the one hand, the minimum price must be high enough to:-

- deter frivolous bidders;
- reduce the gains from collusion or demand-reducing strategies; and,
- encourage bidders to return licences they are not using.

On the other hand, the minimum price must be low enough to:-

- stimulate participation in the auction; and
- avoid choking potential demand off inefficiently.

ComReg's key priority in this auction is to support the efficient use of spectrum. In that regard an important consideration is to set the minimum price at a level that facilitates participation by serious bidders such that the auction process can then determine the true 'market' or 'economic' value of the spectrum.

A number of methodologies for determining an appropriate minimum price for the 26GHz national block assignment were considered. A benchmarking-based approach, using evidence from comparable awards in other countries, was the preferred choice due to its practical, transparent and evidence-based nature. The results of the benchmarking approach indicated that a minimum price in the range of €350,000-€450,000 per lot would be appropriate for this award.

As ComReg considers it important that the value of the spectrum is determined by the auction itself and the minimum price should be at a level that promotes participation in the auction process, a minimum price of **€350,000 per 2x28MHz lot** was chosen. It is considered that this price would minimise the risks of demand being choked and spectrum going unused inefficiently, while also deterring frivolous bidding and/or strategic manipulation of the auction process.

3.2.2 Fee Payment Structure

In the absence of secondary spectrum trading, it is considered important to structure the payment of the minimum price in a manner that provides some incentive for the return of any underused licences. This could be achieved by allocating a proportion of the minimum price to an annual fee which would be spread over the term of the licence. If a reasonably significant fixed annual fee was applied, this would provide incentives for bidders to return underused licences early to avoid being liable for future annual charges. Paying a proportion of the minimum price in annual payments might also encourage participation by entrants who might otherwise find paying the total minimum price upfront a barrier to entry.

Conversely, some bidders may have a preference for paying all fees upfront to enable them to write these off after the first year. In addition, there may also be a case for having a relatively significant upfront reserve price to avoid undue payment risk and to deter frivolous bidding. In that regard, there is a balance to be struck between an upfront reserve price that deters frivolous bidding and annual payments that provide ongoing incentives for the return of unused spectrum, particularly in the later years of the licence.

It is considered that this balance is most appropriately achieved by structuring the minimum price of **€350,000 per lot** as follows:

- i) Setting **an upfront reserve price of €70,000** per lot;³ and
- ii) Paying the remainder of the minimum price (i.e., €350,000-€70,000 = **€280,000**) in fixed annual instalments, adjusted for the consumer price index ('CPI'),⁴ in two phases as follows:

Phase 1:

Pay €20,000 (+CPI) annually for years 2-5

Phase 2:

Pay €40,000 (+CPI) annually for years 6-10

³ Suppose that Bidder A wins a licence containing 2 lots (2x56MHz) and that its auction price is €200,000. Bidder A pays a one-off upfront fee of €200,000 (comprised of the €140,000 reserve price for two lots plus €60,000 which is the incremental amount bid above the reserve price in auction). Bidder A must also make ongoing annual payments as per bullet point ii).

⁴ The relevant CPI measure taken for each year would be the CPI for the preceding year. For example, if the annual payments were made every September then the relevant measure taken for September 2008 would be the CPI estimate for August 07-August 08. However, to provide bidders with some degree of certainty, it is proposed that the relevant CPI range be subject to a floor of 2% and a cap of 6%.

For illustrative purposes, some sample calculations of the annual payments that winners might be subject to are presented in the example below. These calculations assume a midpoint of 4% as the relevant CPI measure for the 9-year period, although in reality this will fluctuate from year to year (as noted above).

Example

Phase 1: Year 2: €20,800; Year 3: €21,632; Year 4: €22,497.28; Year 5: €23,397.17

Phase 2: Year 6: €41,600; Year 7: 43,264; Year 8: €44,994.5; Year 9: €46,794.34; Year 10: €48,666.11

Information Memorandum:

Note that the actual upfront fee due from a licensee will exceed the reserve price in the case that their auction price is higher than the aggregate sum of the reserve prices for the number of lots in their licence. The full auction price must be paid upfront before the licence is issued. A licensee may surrender a licence within the ten year term and will not be liable for the remaining annual payments thereafter.

4 Auction Rules

ComReg’s objectives in determining an appropriate auction format for this award are set out in Section 2 above. With these objectives in mind, a number of potential auction formats were explored for this award process. The Sealed Bid Combinatorial auction format is the preferred choice for this award (see Annex 2 for more on auction formats)

This section describes the rules for the award of 26GHz spectrum using a Sealed Bid Combinatorial auction format with a Second-Price rule. The auction will consist of a five-stage award process as illustrated in Figure 1.

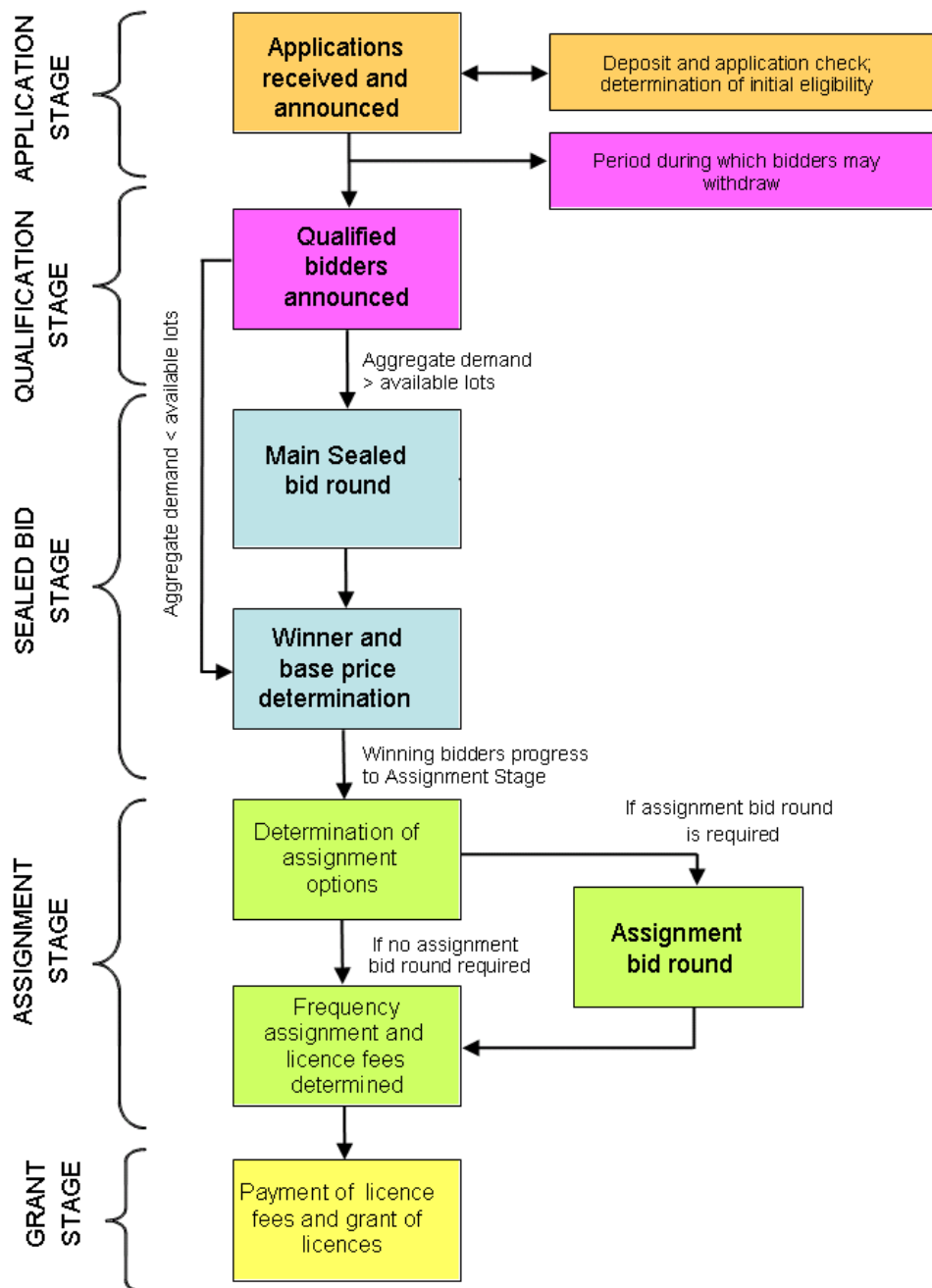


Figure 1: Flowchart of proposed auction format

A more detailed flowchart showing indicative timelines is given in Annex 3.

4.1 Application Stage

ComReg will announce on its website a time and day by which time all prospective participants in the 26GHz auction must have submitted an application and associated bid deposit.

An application shall consist of:

- A completed application form specifying the number of P2P lots and the number of PMP lots that the bidder is willing and committed to purchase at the minimum price per lot. The maximum number of lots that a bidder can apply for, combined across both P2P and PMP, is six.
- Administrative information, including contact information and details about ownership structure, to be defined by ComReg.
- A signed declaration stating that the bidder will abide by the auction rules and procedures, and has submitted the requisite deposit.
- Any other information required by ComReg.

The bid deposit must be transferred to a bank account, as nominated by ComReg, before midnight on the same day that applications are due. The total amount of the bid deposit must be at least equal to the upfront reserve price per lot (€70,000) multiplied by the combined number of P2P and PMP lots that the bidder has applied for. For example, if a bidder applied for the maximum six lots, it must submit a bid deposit of at least €420,000 (6 X €70,000).

For the avoidance of doubt, a valid application by a bidder for a specified number of P2P and/or PMP lots represents a binding bid at the minimum price for those lots in the event that the bidder is selected as a qualified bidder. In the event that there is excess demand for lots and a sealed bid stage is required, this bid (the amount of which may be increased in the sealed bid stage) will be included amongst the bids considered in the winner determination process. If there is no excess demand and the auction proceeds directly to the assignment stage, then this bid will be a winning bid (i.e. there will be no opportunity to modify the bid) and the bidder will pay the reserve price⁵.

Following the completion of the application process, ComReg will announce the identity of all applicants.⁶ It will not announce any information about the number of lots that they have bid for.

4.2 Qualification Stage

The qualification stage determines the participants in the auction and, if required, their initial eligibility to bid for lots in the Sealed Bid Stage.

⁵ Plus any additional price for specific P2P and/or PMP frequencies awarded in the assignment stage, if applicable (see section 5.4) plus any annual fees that comprise the minimum price..

⁶ A possible concern with revealing this information before the auction is that this might potentially facilitate collusion between bidders. However, as collusion is clearly prohibited by the rules of this auction, ComReg does not consider it necessary to restrict information on bidders' identities in this instance.

In order to qualify to participate in the auction, bidders:

- must have fulfilled the application and bid deposit requirements; and
- must not be associated with any other applicants that have not withdrawn their application.

There will be a gap of at least 10 working days between the announcement of the applicants and announcement of qualified bidders. During this period, any applicant may withdraw their application by submitting a written request to ComReg. In this case, the application will be annulled and the applicant will be refunded their deposit less an administrative fee (the amount to be determined by ComReg).

The gap between application and qualification provides an opportunity for prospective bidders to determine whether they are ‘associated’ with any other applicants (see discussion of rules on association in Section 4.7). It is the responsibility of bidders to ensure that they do not proceed with an application in the case that they are associated with another applicant that does not withdraw its application prior to the deadline for withdrawals. If at any point subsequent to the deadline for withdrawals and prior to the grant of licences, two or more bidders are determined by ComReg to be associates, then all such parties will be disqualified, will forfeit any deposit that they have submitted, and may be liable for any further bids that they have submitted.

After the deadline for withdrawals has passed, ComReg will announce the identity of the qualified applicants (‘bidders’) eligible to participate in the auction, and the identity of any applicants that have withdrawn or been excluded from the process. ComReg will not announce the aggregate eligibility of the qualified bidders or the eligibility of individual bidders, i.e., the number of lots that they are eligible to bid for.

ComReg will also announce whether or not the main Sealed Bid Stage is required. If the Sealed Bid Stage is not required (e.g., where demand for lots is less than or equal to the number of lots available) the award will progress directly to the Assignment Stage.

4.3 Sealed Bid Stage

The main auction phase, i.e., the Sealed Bid Stage, is only required if there is excess demand for lots. Excess demand is defined as there being:

- aggregate demand for P2P lots exceeding 17 lots; or
- aggregate demand for PMP lots exceeding 17 lots; or
- aggregate demand for P2P and PMP lots combined exceeding 16 lots.

4.3.1 Activity Rule

Each bidder starts the auction with an eligibility which is equal to the aggregate amount of P2P lots and PMP lots that they applied for. The aggregate eligibility across the two categories is capped at six lots.

Each bidder is allowed to submit a bid for every possible combination of P2P and PMP lots, subject to the cap determined by their eligibility (which cannot be greater than six lots)⁷. The minimum eligibility is one lot, in which case the bidder would have two bid options i.e. one PMP or one P2P. The maximum eligibility is six lots, in which the bidder would have 27 bid options.

4.3.2 Submitting Bids

The Sealed Bid Stage comprises a single round of bidding. All qualified bidders are obliged to submit a bidding form; and failure to do so may result in penalties being applied (see Section 4.14).

ComReg will notify qualified bidders of the start time and end time for the single round, and the place or places for submission of sealed bids, following the determination of the qualified bidders. ComReg has discretion over the time, place(s) and duration of the round. However, ComReg anticipates that the round will take place between 10am and 4pm on a single business day, with bids submitted to its office in Dublin. Bids submitted outside the specified round time will be rejected.

Bidders must submit their bids in writing to ComReg on the official bidding form supplied (See Annex 5 for a sample bid form). The bidding form provides a list of all possible packages of lots that a bidder may be able to bid for (there are 27 options). To make a bid, bidders specify an overall price (in whole euros) in words and numbers for a particular package. Bidders may submit multiple package bids on the bidding form (see above), but should not bid for options for which they do not have eligibility. Each bid is 'exclusive' meaning that it is either accepted or rejected in its entirety.

The completed bidding form must be submitted within a sealed envelope. The sealed envelope should be marked with the words: "ComReg – 26GHz auction – sealed bid". There should be no other markings on the envelope and no means of identifying the party that submitted the bid without opening the envelope. The envelopes will not be opened until after the close of the bid round.

4.3.3 Winner determination

Following the close of the Sealed Bid Round, the auctioneer will proceed to open all the sealed bids received and determine the winning bids.

The winning bids are the combination of bids of greatest total value amongst all valid bids submitted, subject to the conditions that:

- At most 17 lots are allocated in the case that all winning bids are for P2P lots or all winning bids are for PMP lots;
- At most 16 lots are allocated in all other cases;
- No bidder wins more lots than their eligibility, as determined by their application;

⁷ For example, assume that Bidder A submits an application for 2 P2P lots and 1 PMP lot. His initial eligibility is 3 lots. He can therefore submit up to nine mutually exclusive bids in the sealed bid stage, one each for the following combinations: 1 P2P lot; 1 PMP lot; 2 P2P; 2 PMP; 1 P2P & 1 PMP; 3 P2P; 3 PMP; 2 P2P & 1 PMP; and/or 1 P2P & 2 PMP.

- No bidder wins more than six lots; and
- At most one bid for a package of lots is accepted from each bidder.

An algorithm will be used to determine the combination of bids that meets these criteria. It is possible that there could be more than one set of bids having the equal highest value. In this case, the tie will be resolved in the following way:

- The set of bids that results in the largest number of lots being allocated will be selected.
- If there is still a tie, the set of bids that results in the largest number of winning bidders will be selected.
- If there is still a tie, with a number of possible sets of bids having the same total value and the same number of winning bidders, then a random process will be used to select the winning set of bids.

4.3.4 Base Price Determination

An algorithm will also determine the base price to be paid by each winning bidder for the number of lots they have won. The base prices are determined using a ‘second price’ rule (See Annex 6 and Annex 9 for more details).

4.4 Assignment Stage

The purpose of the Assignment Stage is to determine how the available frequencies in the 26GHz band are distributed amongst the winning bidders from the Sealed Bid Stage, and the final price to be paid by each winning bidder. The main Sealed Bid Stage (or Qualification Stage if no Sealed Bid Stage was required) will have already determined the split between P2P and PMP lots, and how many P2P and PMP lots each winning bidder will receive, but not the assignment of specific frequency ranges.

4.4.1 Split between P2P and PMP and designation of guard blocks

The outcome of the main Sealed Bid Stage determines the number of P2P lots and PMP lots. P2P lots are always assigned to spectrum at the upper end of the band and PMP lots are always assigned to spectrum at the lower end of the band.

In the event that all available lots are sold, lot A18 is always designated as a ‘guard block’ and will not be allocated in this award. In addition, if required, one further lot between the P2P and PMP allocations will also be designated as a guard block and will not be allocated in this award. However, ComReg reserves the right to assign these guard bands in the future, subject to safe guarding the interference rights of adjacent users.

For example, suppose that, at the end of the Sealed Bid Stage, 12 lots are allocated to PMP and 4 lots to P2P. In this case:

- PMP will occupy the frequencies 24.773-25.109 GHz paired with 25.781-26.117 GHz (lots A1 to A12);
- there will be a guard block at 25.109-25.137 GHz paired with 26.117-26.145 GHz (lot A13);

- P2P will occupy the frequencies 25.137-25.249 GHz paired with 26.145-26.257 GHz (lots A14-A17); and
- there will be a guard block at 25.249-25.277 GHz paired with 26.257-26.285 GHz (lot A18).

In the event that all available lots are allocated to either P2P or PMP, then these lots will occupy the frequencies 24.773-25.249 paired with 25.781-26.257 GHz (lots A1-A17) and only 25.249-25.277 GHz paired with 26.257-26.285 GHz (lot A18) will be designated as a guard block.

It is possible that not all available lots will be sold, owing to deficient or incompatible demand from bidders. Any unallocated lots will be located evenly on either side of the PMP and P2P allocations and retained by ComReg for possible future award.⁸ There would be no requirement to have a guard band at lot 18. This gives ComReg maximum flexibility in terms of future use of the unassigned lots, e.g., an auction at a future date for further national block licences may be deemed appropriate or the frequencies may be used for individual link use. For example, if there are only 5 P2P lots and 6 PMP lots sold then they will be assigned as shown in Figure 2 below. Lot A10 is the guard band between P2P and PMP assignments and lots A16 and A3 are the guard bands at the upper and lower ends of the national block assignments respectively.

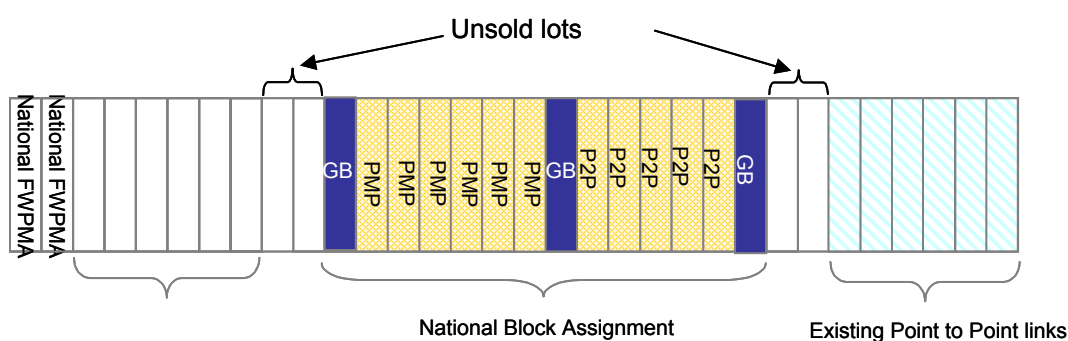


Figure 2 Illustration of a possible band plan outcome in the event that not all lots are sold.

In the case that some lots are unallocated and all the remaining lots are allocated to PMP, then all PMP lots will be assigned to frequencies at the lower end of the band.

In the case that some lots are unallocated and all the remaining lots are allocated to P2P, then all P2P lots will be assigned to frequencies at the upper end of the band. In this case, lot A18 will be designated as a guard block.

4.4.2 Procedure for assigning lots if no Assignment Bid Round is required

No Assignment Bid Round is required in the case that:

- there is only one winning bidder; or
- there is only one winner of PMP lots and only one winner of P2P lots.

⁸ There may be an odd number of unallocated lots, in which an exactly even split will not be possible. In this case, ComReg will have discretion to position the extra block at either end of the available spectrum.

In either of these cases, the location of that bidder within the band plan will be pre-determined according to the rules described in section 4.4.1. Therefore, no further bidding is required. The bidder will be assigned the frequencies corresponding to the appropriate lots.

If there is only one winner of PMP lots and some lots are unallocated, then the location of that bidder within the band plan will be pre-determined according to the rules described in section 4.4.1. Therefore, this bidder is not required to participate in the Assignment Bid Round. The bidder will be assigned the frequencies corresponding to the appropriate lots.

Similarly, if there is only one winner of P2P lots and some lots are unallocated, then the location of that bidder within the band plan will be pre-determined according to the rules described in section 4.4.1. Therefore, this bidder is not required to participate in the Assignment Bid Round. The bidder will be assigned the frequencies corresponding to the appropriate lots.

4.4.3 Determining the bid options for the Assignment Bid Round

For all categories where there is more than one winning bidder, an Assignment Bid Round is required. A separate bidding process is required for each category, i.e. P2P and PMP, but these will be conducted simultaneously.

Winning a certain number of lots in the main Sealed Bid Stage (see section 4.3 above) entails both a right and an obligation to purchase one of the frequency range options presented to that bidder in the Assignment Bid Round. For example, if a bidder won four P2P lots in the main Sealed Bid Stage, this entails a commitment in the Assignment Stage to bid for all available contiguous packages of four lots (2x112MHz) within the frequency range allocated to P2P lots. Such a bidder would not be permitted to bid for larger or smaller packages of lots.

For each category where there are winning bidders that are required to participate in the Assignment Bid Round, the auctioneer will determine a set of frequency range options available to them. For each bidder in each category, the auctioneer will identify an exhaustive list of packages of contiguous frequencies that:

- have the same number and type (P2P or PMP) of lots that the bidder won in the main Sealed Bid Stage; and
- may also allow all other winners to receive contiguous assignments.

Bids in the Assignment Stage are limited to those frequency range options that are compatible with contiguous blocks being awarded. For example, suppose in the first stage that 10 lots were allocated to PMP and 6 lots to P2P. Further suppose that there were three PMP winners: Carl (6 lots), Dave (3 lots) and Eric (1 lot); and two P2P winners: Alan (4 lots) and Beth (2 lots). The bidding options available to PMP winners are illustrated in Figure 3; in this case, there are six possible outcomes and four bidding options each. The bidding options available to the P2P winners are illustrated in Figure 4; there are two possible outcomes and two bid options each.

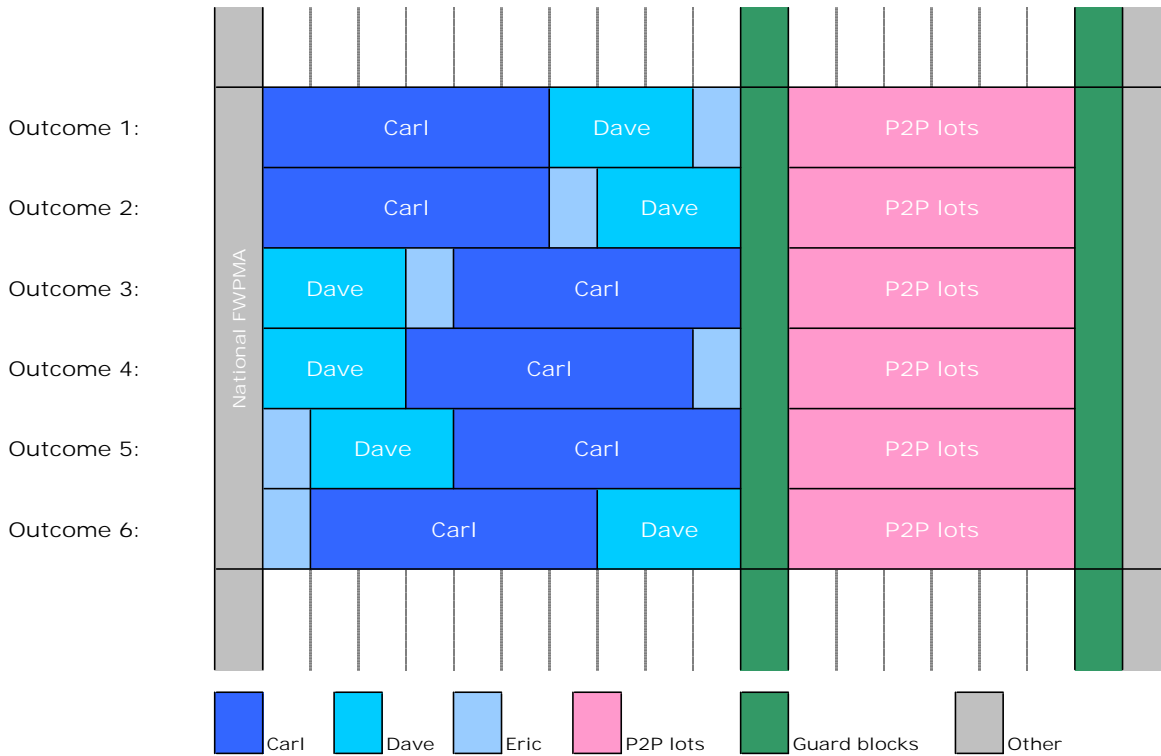


Figure 3: Example of possible assignment outcomes for PMP bidders

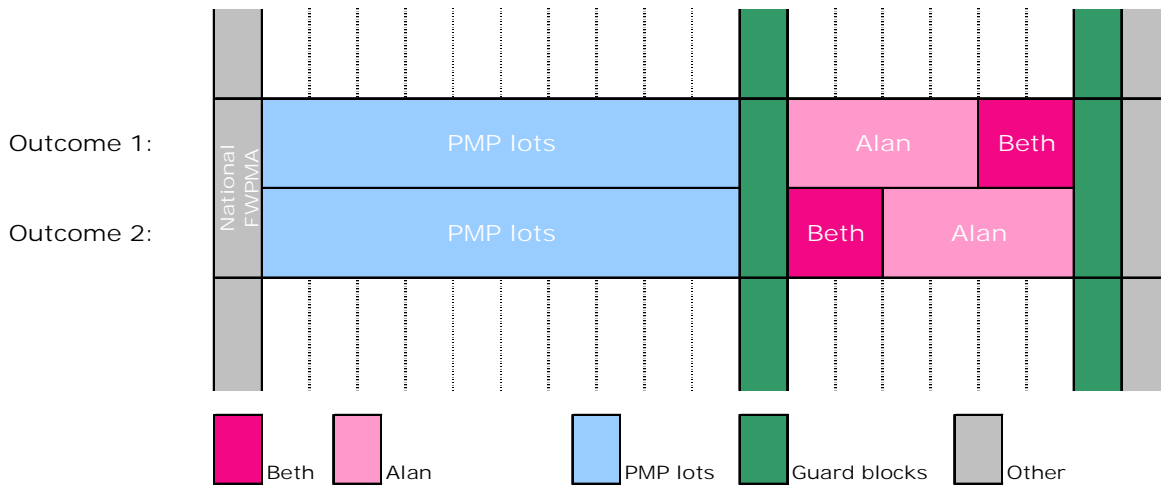


Figure 4: Example of possible assignment outcomes for P2P bidders

4.4.4 Submitting assignment round bids

Similar to the Sealed Bid Stage, the Assignment Stage comprises a further single sealed bid round where bids are submitted in writing during the specified round time.

The start time and duration of the Assignment Bid Round will be announced by the auctioneer after the completion of the Sealed Bid Stage. ComReg has discretion over the time, place(s) and duration of the round. However, ComReg anticipates that the round will take place between 10am and 4pm on a single business day, with bids submitted to its office in Dublin.

Each winning bidder will be provided with a bespoke bidding form that specifies all their bid options, as determined according to section 4.4.3 (an example bid form for Carl based on the example above is provided in Annex 7). A bidder may bid for all or some of the available bid options. Assignment round bids must be in whole euros. The default minimum bid for each option is zero. There is no upper bound limit.

Unlike the Sealed Bid Stage, bidders are not obliged to submit a bidding form. If a bidder fails to submit a bidding form in the Assignment Bid Round, then it will be deemed to have made a valid bid of zero for every option in every category where it was eligible to bid. Similarly, if a bidder does not submit a bid for an individual bid option, or its bid is illegible or unclear, then it will be deemed to have made a valid bid of zero for that individual bid option.

Note that all winning bidders from the main Sealed Bid Stage who are eligible to participate in the Assignment Bid Round are guaranteed to win at least the same amount of (contiguous) spectrum in each category that they won in the main Sealed Bid Stage. Only the relative bids made for different bid options will affect the final frequency assignment outcome and the additional prices to be paid. Therefore, it is recommended (but not obligatory) that bidders submit a bid of zero for their least favoured option in every category where they are eligible to bid.

The completed bidding form must be submitted within a sealed envelope. The sealed envelope should be marked with the words: “ComReg – 26GHz auction – Assignment Round bid”. There should be no other markings on the envelope and no means of identifying the party that submitted the bid without opening the envelope. The envelopes will not be opened until after the close of the bid round.

4.4.5 Winner determination

Following the close of the Assignment Bid Round, the auctioneer will proceed to open all the sealed bids received and determine the assignment of frequencies.

The winning bids are the combination of Assignment Round bids of greatest total value amongst all valid bids submitted, subject to the conditions that:

- at most one P2P bid and one PMP bid is accepted from each bidder;
- each bidder receives contiguous frequencies;
- each bidder is assigned the same amount of spectrum in each band as they won in the Sealed Bid Stage; and
- the conditions for the positioning of guard blocks and any other unallocated lots described in Section 4.4.1 are respected.

An algorithm will be used to determine the combination of bids that meets these criteria. It is possible that there could be more than one set of bids having equal highest value. In this case, the tie will be resolved using a random process. All such tied sets of bids will have an equal chance of winning.

4.4.6 Determining additional prices from the Assignment Phase and the overall licence fee

In each category where there were two or more winning bidders, additional prices, deriving from any preferences for specific frequencies expressed via bids in the Assignment Stage, will be determined. These additional prices are determined using a second-price rule in an analogous manner to the main Sealed Bid Stage (see Annex 6).

The auction price to be paid by each winner will therefore be the sum of the base price calculated at the end of the main Sealed Bid Stage (see Section 4.3.4) and any additional/incremental amounts deriving from bids made in the Assignment Stage for specific P2P and/or PMP frequency ranges (See Annex 6 for more details).

4.4.7 End of the Assignment Stage

Once the auctioneer has determined the winning bids and the additional prices for the Assignment Stage, the results of the auction will be announced to all bidders. The following information will be released to all bidders:

- the identity of the winning bidders;
- the number of P2P lots and PMP lots awarded to each winning bidder;
- the frequency ranges awarded to each winning bidders; and
- the fees to be paid by each winning bidder, including a breakdown of the base price and any additional prices applicable to that winning bidder.

4.5 Grant Stage

Following the completion of the Assignment Stage, the award process will proceed to the Grant Stage. In the Grant Stage:

- winning bidders are offered a licence and required to pay their upfront licence fees, less any deposit; and
- licences are awarded to the winners.

4.6 Deposit

Applicants wishing to participate in the auction will, at the Applications Stage, have to provide ComReg with a deposit of €70,000 for each lot that they include in their application. For example, a bidder that submits an application for a bid of 2 P2P lots and 1 PMP lot must submit a deposit of $3 \times €70,000 = €210,000$. Failure to submit an adequate deposit will result in the bidder being disqualified.

Following the completion of the Assignment Stage, winning bidders that fail to pay their full upfront licence fee less any deposit will not be granted their licences and forfeit their deposit in its entirety.

4.7 Applicant behaviour and bidder association

Connected persons of an applicant or applicant group may not be connected persons of another applicant or applicant group as defined in Part 2 of the sample application form (see Annex 4 below). Applicants and applicant groups may not be connected to each other. Applicants which are found to have such relationships

will not be approved to participate in the auction (For more information, please see section 4.14 below). Applicants must abide by the Competition Act 2002.

4.8 Unassigned lots

The Sealed Bid Combinatorial auction is designed to prevent lots going unassigned inefficiently. However, it is still possible that some lots could go unassigned either because there is deficient demand, or because aggregate demand across the winning bidders is less than the number of lots available, and there are no bidders willing to buy the residual. In addition, one or two lots may be designated a guard block.

Following the auction, ComReg reserves the right to make any unassigned lots (including guard blocks) available for future award. However, it will not make these lots available for national P2P or PMP licensing for a period of at least 18 months but reserves the right to make it available for other services within that 18 month period if it wishes. Following this 18 month period, ComReg reserves the right to determine how and on what terms any unassigned lots will be awarded, e.g. via FWALA licences, individual licences or another auction. When considering the scope for release of such lots, ComReg will take into account the need to protect existing licencees from undue uncertainty over their interference environment.

Unallocated lots at the end of the auction will be distributed evenly on a contiguous basis on either side of the P2P and PMP allocations, as shown in the example in Section 4.4.1. This gives ComReg maximum flexibility for assigning these blocks at a future date.

4.9 Expenses

All expenses incurred by applicants or potential applicants shall be borne by themselves exclusively.

4.10 Provision of further information

ComReg reserves the right to request an applicant to submit further material and documents in addition to the information already provided within such time and in such format as ComReg may stipulate.

4.11 Terms for Submission of Application

Requests by applicants for an extension to the time period allowed for the preparation of applications and bidding forms will not be considered.

Multiple applications from an applicant are not permitted.

4.12 Conclusion of licensing process

It is the intention of ComReg to conclude the licensing process as quickly as possible after the announcement of the results of the auction process.

4.13 General

ComReg will engage DotEcon Limited to process the bids (if required) and determine prices.

ComReg reserves the right to supplement, vary, suspend, terminate or otherwise alter this licensing process at any stage.

If there is evidence of collusion, ComReg reserves the right to pass this on to the appropriate authorities and take whatever procedural steps are necessary as a consequence.

There is no guarantee that a licence will be issued as a result of this auction.

The holding of this auction process does not warrant or imply that any licence will be awarded, or that the terms on which it may be granted may not be altered from those described.

By participating in this auction, the applicant undertakes that it accepts the terms of this auction, will abide by the rules of the auction and that its application and bidding form are irrevocable and unconditional offers that will remain valid and binding on the applicant until such time as the applicant has been awarded or declined a licence, or ComReg has otherwise terminated the competition.

ComReg reserves the right to alter any of the deadlines or conditions during the licensing process.

Although every care has been taken in preparing this document and conducting this process, no representation, warranty or undertaking, expressed or implied, in respect of any error or misstatement is or will be made or given, and no responsibility or liability will be accepted by ComReg or by any of its officers, employees, servants, agents or advisers as to the accuracy or completeness of this document or any other written or oral information made available to any interested party or its advisers concerning this document and any liability howsoever arising (including in respect of this tender process) is expressly disclaimed. No information contained in this document shall form the basis for any warranty or representation by or term of any contract with ComReg.

ComReg makes no representations and warranties in respect of the viability of the market(s) or accuracy of the contents of this document so that applicants and potential applicants are responsible for their own verification and due diligence.

The applicant agrees by accepting any licence which it may be offered that the licensee is responsible for all costs, liabilities and losses derived from the operation or non-operation of the licence for whatever cause.

4.14 Breaches of the Auction Rules

In the event that an individual bidder breaches the auction rules, the bidder will either be fined but permitted to continue in the auction, or be expelled from the auction (in which case all its bids would become void), depending on the severity of the breach. ComReg's ruling in such instances will be final.

The following will apply;

<p>Insufficient/incorrect information on the application form</p>	<p>The applicant will be given 5 working days to provide the correct information after which failure to do so will result in expulsion from the process. The applicant's deposit will not be forfeited.</p>
<p>Failure to specify a bid for lots on the application form or failure to submit adequate deposit with the application</p>	<p>Expulsion from the award process. The applicant's deposit will not be forfeited.</p>
<p>Collusion</p>	<p>Expulsion and forfeit of all deposit monies. In addition, ComReg reserves the right to take further action against the transgressor.</p>
<p>Association between two or more applicants identified before determination of qualified bidders</p>	<p>All but one applicant must withdraw. If this condition is not met, all such applicants will be expelled from the process. The applicants deposit will not be forfeited.</p>
<p>Association between two or more qualified bidders identified</p>	<p>Expulsion from process and forfeiture of deposit.</p>
<p>Failure to submit a bidding form in the Sealed Bid Stage</p>	<p>€10,000.00 of the applicant's deposit will be forfeited. The applicant must replenish its deposit within 5 working days. In the event that the applicant does not replenish its deposit within 5 working days, its entire deposit will be forfeited and it will be expelled from the process. The applicant's application form will substitute as a bidding form.</p>
<p>One or more individual bids on the bidding form for the Sealed Bid Stage are illegible or unclear or below the minimum</p>	<p>These individual bids will be rejected. Other bids remain valid. The applicant's deposit will not be forfeited.</p>
<p>One or more individual bids on the bidding form for the Assignment Stage are illegible or unclear</p>	<p>These individual bids will be rejected and the bidder is deemed to have made a valid bid of zero for these options. Other bids remain valid. The applicant's deposit will</p>

Information Memorandum:

	not be forfeited.
Failure to pay upfront licence fee in full	Licence will not be awarded and deposit will be forfeited.

5 Participation in the licensing process

Any legal entity, by which is meant a company, partnership or other legal person, can apply to take part in the licensing process.

There are no restrictions on the applicant's country of domicile.

5.1 Questions and Answers

Any interested party may submit written questions concerning the licensing process. All questions received in due time (see below) will be replied to on an ongoing basis and as far as possible within 8 working days. All questions and answers will be made available by ComReg in writing to all parties who have submitted questions. ComReg will not disclose the identity of the party posing a question, except where it may be legally obliged to do so.

Questions shall be marked for the attention of Ms. Tara Kavanagh and shall be clearly labelled "**QUESTIONS: 26GHz Licence Process**". Questions addressed in any other way will not be answered. Questions forwarded by letter, e-mail or fax will be accepted.

All questions should be sent to:

Commission for Communications Regulation,
Abbey Court, Irish Life Centre
Lower Abbey Street
Dublin 1
IRELAND
ATT: Ms. Tara Kavanagh

Phone +353 (01) 804 9623; Fax +353 (01) 804 9665
E-mail: 26ghzcompetition@comreg.ie

The latest time for receipt of questions is **14.00 hours (local time) on 20 March 2008**. Questions received after this time will not be answered.

Applicants should note that ComReg is subject to Irish and EU rules on treatment and handling of confidential information (see ComReg document 05/24 "Guidelines on the Treatment of Confidential Information").

5.2 Approval of applications

All applications will be subject to an approval procedure. As part of the approval process, ComReg may require further information from applicants in addition to that provided in their application. Any such additional information must be submitted to ComReg within 5 working days from the date of the request. ComReg will inform each applicant, in writing, whether or not their application has been approved.

Notification that an applicant's application has been approved should not be taken to mean that the bidding form entered as part of that application is valid – since this cannot be ascertained until the envelopes that contain the bidding forms are opened.

5.3 Rules on Applicant behaviour

An applicant must, until the issue of the licences, refrain from

- disclosing confidential information⁹;
- entering into material agreements with other applicants; and
- undertaking any action that might adversely affect the auction prior to, and after, the application and until the date of the issue of the licences.

As part of the application, each applicant will be required to declare that it will abide by these rules. If at any point it becomes apparent that an applicant has failed to comply with these rules the applicant will be excluded from the auction and will forfeit its deposit.

5.4 Bidder briefing sessions

As part of the auction process ComReg is proposing to hold a briefing session for interested parties. These will consist of a detailed discussion of the proposed auction format and will enable prospective bidders to ask any questions that they may have on the proposed format. This briefing session is scheduled to take place on March 6 in the ComReg offices from 10.30 a.m. to 12.30 a.m..

5.5 Auction Website

ComReg is developing a section on its website that will contain all information relating to this 26 GHz spectrum award process. All announcements relating to this auction will be posted onto this section of the website. See the ComReg website for more information http://www.comreg.ie/radio_spectrum/radio_spectrum.496.html .

5.6 Indicative Timetable

There is no pre-set timetable for the auction. However, in order to assist potential applicants in the preparation of applications and bids, the table below provides an indication of the intended timeframe. ComReg reserves the right to alter the application date subject to a notice period of 72 hours.

The timetable for key events is set out below.

Indicative Timetable	
Bidder Briefing Session	March 6 2008

⁹ Confidential information refers to information concerning an applicant's application or a part thereof that, if it were to be made available to other bidders, may affect the amount that they would bid. Such information would include (but is not limited to) any information regarding the applicants strategy such as its business case and the contents of its application and bidding form.

Information Memorandum:

Closing date for receipt of written questions	March 20 2008
Application date	April 2008
Auction	May 2008
Announce winners	June 2008

Table 1: Timetable of events.

6 Offer and Acceptance of the Licences

Once the spectrum has been specifically allocated, ComReg will notify each applicant in writing whether they have been successful in its bid, offer the applicant a licence and specify the licence fees that are payable by the applicant. The notification will specify: (i) a due date (no more than 30 days from the date of notification) by which the successful applicant shall pay any monies due; and (ii) a due date (5 working days) for acceptance of the offer. ComReg may at its sole discretion extend the time limit in order for applicants to fulfil this obligation. If a successful applicant declines to accept a licence offered it will forfeit its deposit.

Once the successful applicants have been issued with their licences ComReg will make a public announcement comprising:

- The names of all applicants and the number of blocks bid for by each applicant;
- The name of the applicants¹⁰ who have been awarded a licence and the number of blocks awarded to that licensee; and
- The price paid for each block by each successful applicant.

ComReg will not announce the amount of money bid by any unsuccessful applicant.

¹⁰ The name as given in part 1 of the application form

Annex 1 Glossary of Terms

Term	Meaning
Aggregation risk	A situation where lots are complements and the bidder risks acquiring only a subset of lots it wants, with the result that synergy values are unrealised
Annual fee	The yearly fixed charge that an NRA levies on a licence holder for the use of the component lots of spectrum
Auction price	This is the price for a licence as determined in the auction. The auction price must be greater than or equal to the aggregate reserve price for the number of lots in the licence.
Base price	The price to be paid for the package of lots won by the winning bidder in the main Sealed Bid Stage (determined using a second price rule)
Beauty contest	A competitive tender where bids submitted are evaluated on the basis of pre-selected criteria
Clock auction	A variant of the SMRA format in which bidders compete for a number of generic lots and all lots are awarded at a uniform price
Combinatorial clock auction	A variant of the SMRA format that uses both a clock auction (for price discovery) and combinatorial bidding (to eliminate aggregation risk). Unlike the simple clock auction, there is no uniform price for similar lots
Common value uncertainty	Where bidders participating in an auction (or other type of award process) have related values but are uncertain about the value of the lots available
ComReg	Commission for Communications Regulation
First come, first served (FCFS)	A tender where licences are awarded to bidders in the order that they submit their applications
Guard block	A block of spectrum located between two adjacent users of spectrum to prevent undue interference. Such spectrum is left fallow or subject to restricted use
Licence	A usage right to use radio spectrum subject to defined conditions. A licence may consist of one or more lots of radio spectrum assigned in an award process
Licence price	The total price to be paid for a licence (consisting of a lot or group of lots) including both any upfront fees (such as the 'reserve price' and 'auction price') and the discounted stream of any annual fees over the minimum term of the licence. In the absence of competition, the licence price will equal the 'minimum price'
Minimum price	The lowest amount at which a lot (or group of lots) will be sold in an award process. The minimum price comprises both the reserve price of the component lots and the discounted stream of annual fees over the minimum term of the licence
MNOs	Mobile network operators
NRA	National regulatory authority
Primary bid	A bid made for a package of lots during the relevant

Term	Meaning
	auction round
Reserve price	This refers only to the minimum upfront fee or payment for a given licence. This is distinct from the minimum price (defined above) because the reserve price excludes any fixed annual fees charged over the term of the licence
Sealed bid auction	An auction where bidders do not know the value of bids submitted by other bidders and bidders have a one-off opportunity to express their value for the spectrum
Second price rule	In a single lot auction, a second price rule means that the winning bidder pays the amount of the next highest bid. With multiple lots and combinatorial bidding, determining the 'second price' is more complicated, but the basic principle is that winning bidders should pay a price related to the opportunity cost of denying the strongest alternative use
SMRA	Simultaneous multiple round auction – generic name for an open, ascending price auction with multiple lots
Spectrum auction	Public sale in which an NRA sells lots of radio spectrum to the highest bidder(s)
Stranded lots	A situation where a bidder may be left with unwanted lots because it may have only succeeded in winning a sub-set of the lots that it originally wanted/bid for (see Aggregation risk above)
Winner's curse	A situation where the winning bidder in an auction overpays for the lots it wins because it has over-estimated their value relative to other bidders with common values

Annex 2 Candidate Auction Formats

In considering potential auction formats for this award process, ComReg commissioned DotEcon Limited to consider the pros and cons of various auction types taking account of ComReg's objectives and the particular characteristics of supply and demand for this spectrum.

The analysis demonstrated that neither a standard Simultaneous Multiple Round Auction (SMRA) format nor a SMRA with Augmented Switching could be relied upon to deliver an efficient outcome for this particular award process.¹¹ Both approaches involve participants bidding on and winning 'specific' lots based on actual frequencies. As such, neither could guarantee an efficient split between Point-to-Point (P2P) and Point-to-Multipoint (PMP) applications.¹² Furthermore, although there may be some (limited) flexibility to switch demand across lots and to make certain withdrawals, bidders may still – to varying extents – be exposed to the risk of winning stranded lots or non-contiguous spectrum. This may occur where, for example, near the end of the auction the bidders are overbid on part of a contiguous group of lots that they wanted. These uncertainties may affect bidders' willingness to participate and accordingly the efficiency of the overall auction process.

By contrast, auction formats involving 'combinatorial' or 'package' bidding mechanisms - such as the Combinatorial Clock¹³ and Sealed Bid Combinatorial auctions - were considered more appropriate for this auction. The reasons for this include the following:-

- Bidders submit package bids for a specified number of *generic lots*¹⁴ which means it is possible to eliminate any aggregation risks for bidders. Winning bidders can be guaranteed contiguous assignments of spectrum;
- The risk of stranded lots is eliminated, as bidders' package *bids are accepted or rejected in their entirety*. Therefore, it is impossible for bidders to win an unwanted subset of their demand; and
- They also guarantee appropriate separation between P2P and PMP uses which can be achieved by following the main auction phase with *an assignment round* and limiting the frequency options available to bidders in the assignment stage to ones that are compatible with all bidders receiving contiguous spectrum.

¹¹ Under the standard SMRA, bidders make multiple bids over consecutive rounds for specific lots and have limited flexibility to shift demand between lots. The SMRA with augmented switching gives bidders greater flexibility to switch demand across lots thus easing aggregation risks somewhat.

¹² This is because the relevant split between P2P and PMP would rely on bidders attempting to position themselves (via their bids) in spectrum adjacent to other bidders deploying compatible systems.

¹³ The Combinatorial Clock is a variant of the standard (Uniform-Price) clock auction, which is used for selling multiple generic/identical lots. In a standard clock auction, the auctioneer raises the price steadily over consecutive rounds and bidders indicate how many lots they want in each round at the prevailing round price. The auction continues until the price reaches a level where demand for lots is less than or equal to supply and all remaining (winning) bidders pay the same uniform clearing price per lot. The key difference with the combinatorial clock auction is that all bids submitted during clock rounds remain live and are potential winning bidders and bidders also get a chance to express their willingness to pay for various combinations of lots at various prices with the result that bidders may pay different prices per lot. The winning bids are the set or combination of bids across all rounds and price points that maximise revenues.

¹⁴ Generic lots can be used where spectrum is sufficiently similar in value such that bidders have no strong preferences between frequencies. A follow-up assignment phase can then be used to reflect any small valuation differences that potentially arise between bidders in their choice of frequencies.

The Uniform-Price Clock auction also appears, at first glance, to be an attractive option, given that it is relatively simple to implement and understand with all winners paying a uniform price¹⁵. However, it has a very significant disadvantage - there is a risk of ‘overshoot’ where demand falls suddenly below supply resulting in lots going unassigned unnecessarily. This can be inefficient where there are bidders who would have been prepared to purchase the unassigned lots, albeit at a lower price, but are unable to do so because they have already reduced their demand or exited the auction and are no longer eligible to win the residual lots.¹⁶

As noted in Section 2 above, a key objective of this auction is to promote efficient use of the spectrum. On that basis, the Combinatorial Clock and the Sealed Bid Combinatorial auction formats were considered the best potential auction types for this award.

A2.1 Sealed Bid Combinatorial Auction

The main features of the Sealed Bid Combinatorial auction format are as follows:-

- Winning bidders are determined on the basis of just one round of bidding where bidders have a one-off opportunity to submit a set of ‘best and final offers’ for packages (combinations) of generic lots within each category (i.e. P2P or PMP) that they would like to win. Each bid is exclusive meaning that, at most, one bid from any one bidder will be accepted i.e. bidders cannot combine their bids.
- The winning bids are determined according to the set of packages or combinations amongst all bids received that maximises revenues.
- In a follow-up assignment round the winners submit additional bids for specific frequencies, corresponding to the number of P2P or PMP lots that they won in the main auction. The frequency options available in this round are limited to those consistent with the winners receiving contiguous spectrum.

The Sealed Bid Combinatorial auction format fulfils many of ComReg’s key objectives highlighted in section 2 above, in that:-

- It supports an efficient division of P2P and PMP uses which it achieves by using generic lots in the main auction and assigning specific frequencies to winners in a follow-up assignment stage.
- Bidders do not face any risk of stranded lots and aggregation risks are eliminated. This is because bidders effectively submit package bids that are accepted or rejected in their entirety. As such, winners are guaranteed contiguous spectrum.
- Overshoot risks are eliminated as bidders can express their demand for various combinations of lots. As noted above, the winning bids are then determined according to the set of packages or combinations amongst all bids received that maximises revenues (with the result that bidders may pay

¹⁵ See supra note **Error! Bookmark not defined.** for further details on the Uniform-Price Clock auction.

¹⁶ Various adjustments to the standard rules for the Uniform-Price Clock auction that would reduce the likelihood of overshoot while preserving the uniform price rule were explored. However, the only rule that would eliminate the overshoot problem was considered likely to create other, potentially serious, forms of inefficiency.

different prices per lot but the risk of lots going unassigned unnecessarily is eliminated).

- The process is very quick as it requires just one round of bidding to determine the winning bidders. Unlike the Combinatorial Clock auction discussed below, no software is required for bid submission, although software is usually required for the auctioneer to determine the winners and prices (see Sections 5.4.5 and 4.4.6).
- Bidder asymmetry concerns are mitigated by the sealed bid approach as entrants are aware that strong bidders do not have the opportunity to revise their bids in subsequent rounds so as to outbid them and may perceive their chances to be greater in a sealed auction rather than in an open, multiple-round process. Concerns regarding collusion and strategic manipulation are also mitigated.

A drawback of this approach is, however, that without multiple rounds there is no opportunity for price discovery. On the one hand, this could possibly affect the efficiency of the outcome given that bidders are potentially bidding for variable numbers of lots and this is the first auction of its kind in Ireland. Hence, a certain degree of pricing transparency may be preferable. On the other hand, one could argue that common value uncertainty¹⁷ is potentially more modest for this band than for some other bands, given that bidders may have different uses for the spectrum including potentially using it to provide backhaul services, on an own-use or wholesale basis, or to provide wireless broadband. Furthermore, as the spectrum is likely to be used to support existing technologies/services with an existing or established demand, it could be argued that there is greater certainty regarding the potential market value for these licences. This would appear to be distinct from, for example, 3G auctions such as the ones held in the UK and Germany, where demand for services over 3G technology was generally uncertain at the time of auction. Thus, on balance it is arguable that common value uncertainty in the context of the 26 GHz award process is not as significant as it was for the 3G award process.

A.2.2. Combinatorial Clock Auction

The Combinatorial Clock auction is similar to the Uniform-Price Clock auction referred to above, in that it is a multiple-round, ascending auction process involving package or combinatorial bidding. However, the Combinatorial Clock addresses the overshoot problem via the following features:-

- There is a uniform price for all lots that is increased steadily over consecutive rounds and in each round bidders submit a 'primary bid' for a package of generic lots at the prevailing price per lot. The price per lot increases in each round until demand for lots is equal to or below supply.
- During these rounds bidders may also submit 'inter-round bids' for packages at intermediate price points, i.e., at price points between the current round price and the previous round price.
- All bids submitted during clock rounds remain live and are potential winning bidders.

¹⁷ Where bidders participating in an auction (or other type of award process) have related values but are uncertain about the value of the lots available.

- The winning bids are the combination of bids (across all rounds and all price points) of greatest total value (with the result that winners may pay different prices per lot but the risk of lots going unassigned unnecessarily is eliminated).
- As for the Sealed Bid Combinatorial auction above, a follow-up phase is required to assign specific frequencies to the winners.

The Combinatorial Clock auction also fulfils many of ComReg's key auction objectives/criteria identified above:-

- It supports an efficient division of P2P and PMP uses which it achieves by using generic lots in the main auction and assigning specific frequencies in a follow-up phase.
- Bidders do not face any risk of stranded lots and aggregation risks are eliminated as bidders submit package bids which are accepted or rejected in their entirety (bidders can be guaranteed contiguous spectrum).
- It eliminates overshoot risks as bidders have the opportunity to express their demand for various combinations of lots and at various price points.
- It should ensure an efficient outcome as bidders (who might have related valuations) benefit from price discovery and observing competitors' behaviour over multiple rounds.
- Bidder asymmetry concerns can be mitigated via the use of certain rules limiting transparency, such as restricting bidders' identities, during the auction process. It is also relatively robust to strategic behaviour.

A .2.3 Sealed Bid Combinatorial vs. Combinatorial Clock

Both the Sealed Bid Combinatorial and the Combinatorial Clock are viable auction formats for this award. The Combinatorial Clock approach offers superior efficiency properties in terms of price discovery over multiple rounds. However, despite the clear efficiency merits of the Combinatorial Clock, the Sealed Bid Combinatorial has some important advantages in the context of the 26 GHz award process. These include as follows:-

- The Combinatorial Clock is arguably more complex and time-consuming for bidders than the Sealed Bid Combinatorial. It is not as quick to run as a Sealed Bid Combinatorial which requires just one round to determine the winning bidders.
- With the Combinatorial Clock, software is required for both bid submission and for determining the winners. With the Sealed Bid Combinatorial, software is usually only required for determining the winners which should help ease complexity for bidders and pass the complexity of the auction onto the auctioneer instead of the bidders. Notwithstanding this, the complexity of the Combinatorial Clock should not be overstated as having only one category of lots should make bidding decisions easier.

- Given the variety of potential uses for this spectrum, bidder asymmetry concerns are potentially significant for this auction process. Entrants or weaker bidders may be discouraged from participating in multi-round auction processes where there are strong bidders which they perceive might continually outbid them over successive rounds. While measures can help protect against this in the Combinatorial Clock (e.g., by restricting transparency), bidder asymmetry concerns are generally less of a concern for sealed bid auction formats relative to multi-round processes.

Further to the above, while the Combinatorial Clock appears to have much to commend it in terms of efficiency considerations, the Sealed Bid Combinatorial would also appear to offer benefits in terms of speed and cost of implementation. In addition, as bidder asymmetry concerns are somewhat eased relative to a multiple-round process, this may help promote participation which is a key objective for this award process.

A.2.4 Conclusion re Appropriate Auction Format

While the choice between the Sealed Bid Combinatorial and the Combinatorial Clock options is not clear-cut, ComReg has decided to adopt a Sealed Bid Combinatorial auction for the 26 GHz award process. This is based on the following considerations:-

- The Sealed Bid Combinatorial format offers many of the same efficiency advantages as the Combinatorial Clock auction in supporting an efficient division of P2P and PMP uses and eliminating aggregation and overshoot risks.
- The sealed bid format should be effective in addressing possible participation concerns related to potential bidder asymmetries.
- It should also minimize the level of complexity facing bidders and lessen the time investment they need to make in this award process. This might further promote participation by bidders of varying size.
- In the event that common value uncertainty is not as significant a concern for this band as for some other spectrum bands, the Sealed Bid Combinatorial auction with a second price rule should also promote a relatively efficient outcome.

Thus, it is proposed to adopt a **Sealed Bid Combinatorial** auction format for this award process.

A.2.5 Assignment Stage and Appropriate Pricing Rule

The main Sealed Bid Combinatorial auction determines the winning bidders, and the number of P2P and PMP lots that will be included in their licence. After the completion of this stage, an additional sealed bid auction stage takes place to assign winners to specific frequencies in the lower and upper parts of the band. This allows bidders to express potential valuation differences in the choice of frequencies.

In the Assignment Stage, winners of the main auction phase submit bids for particular frequencies corresponding to the number of P2P and/or PMP lots that they won in the main auction. This additional sealed bid round determines the final distribution of those lots, subject to the general rule of P2P lots always being assigned to spectrum at the upper end of the band and PMP lots always being assigned to spectrum at the lower end of the band. Bids in the Assignment Stage are also limited to those frequency range options that are compatible with contiguous blocks being awarded (see section 4.4 below for further details).

There are two possible pricing rules for this auction, either:

- *first-price rule*, where bidders pay the amount of their winning bids, or
- *second price rule*, where the winning price is set at the level that the highest losing bidders (or groups of losing bidders) would have been willing to pay, i.e., the amount of the highest non-winning bids (or groups of bids).

The first-price approach is simpler to implement but has the following drawbacks:-

- it creates an incentive for bidders to shade down their bids relative to their true valuations in order to secure surplus;
- it increases the likelihood of an inefficient outcome where some potentially high value bidders lose out (because they shade too much)¹⁸ or an inequitable outcome where some bidders pay much more than others (because they shade too little); and
- it creates complex decisions for bidders as they need to second-guess what other bidders might do.

The *second-price* approach has the following advantages:-

- bid shading is less of an issue as bids mainly determine whether or not a bidder wins, not how much they pay;¹⁹
- it is simpler for bidders when deciding what to bid as they have good incentives to bid at or close to their true value. This may also have the effect of reducing price differentials between bidders.

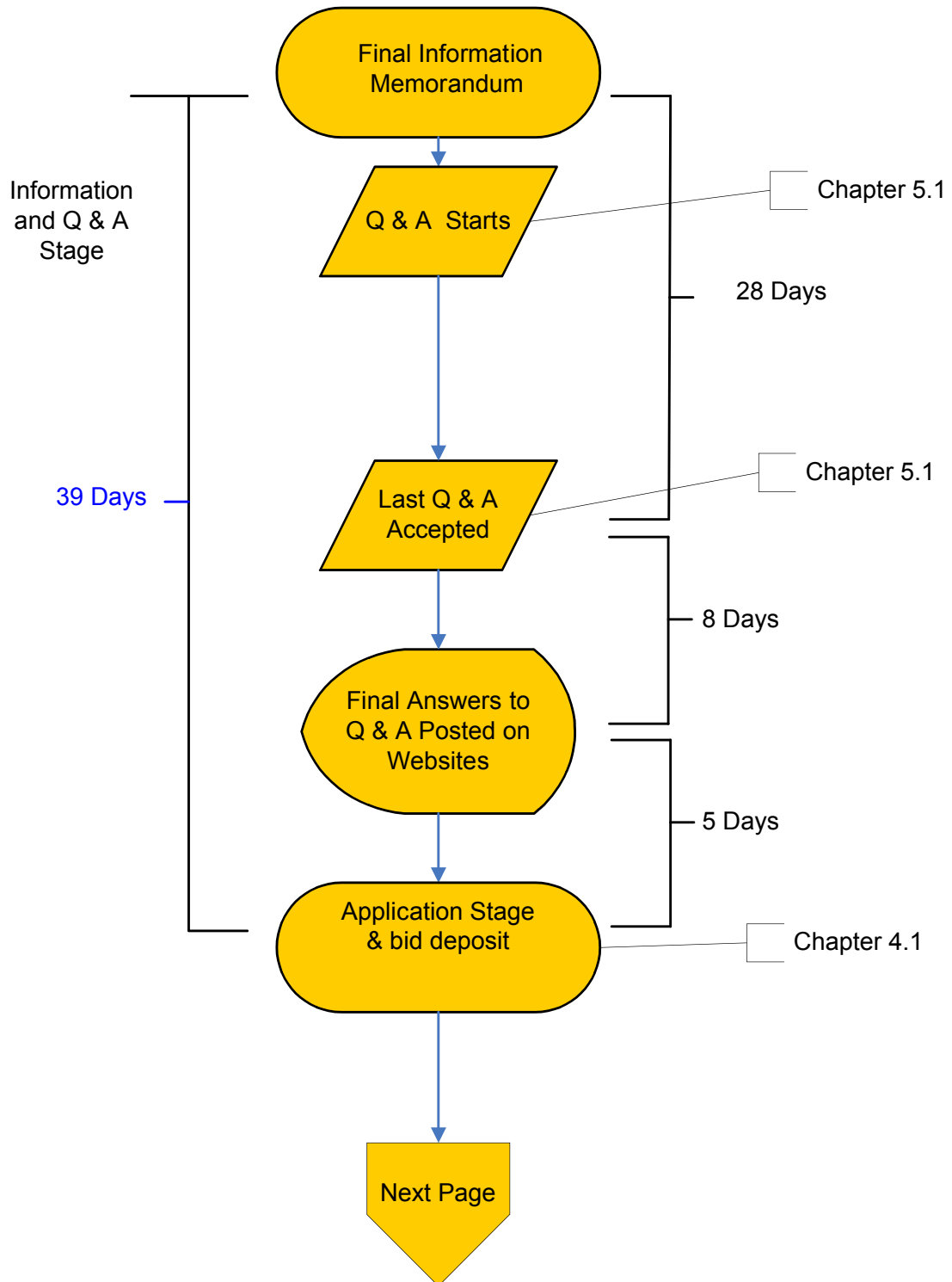
ComReg therefore considers it appropriate to adopt a **Sealed Bid Combinatorial auction format with a Second-Price rule**.

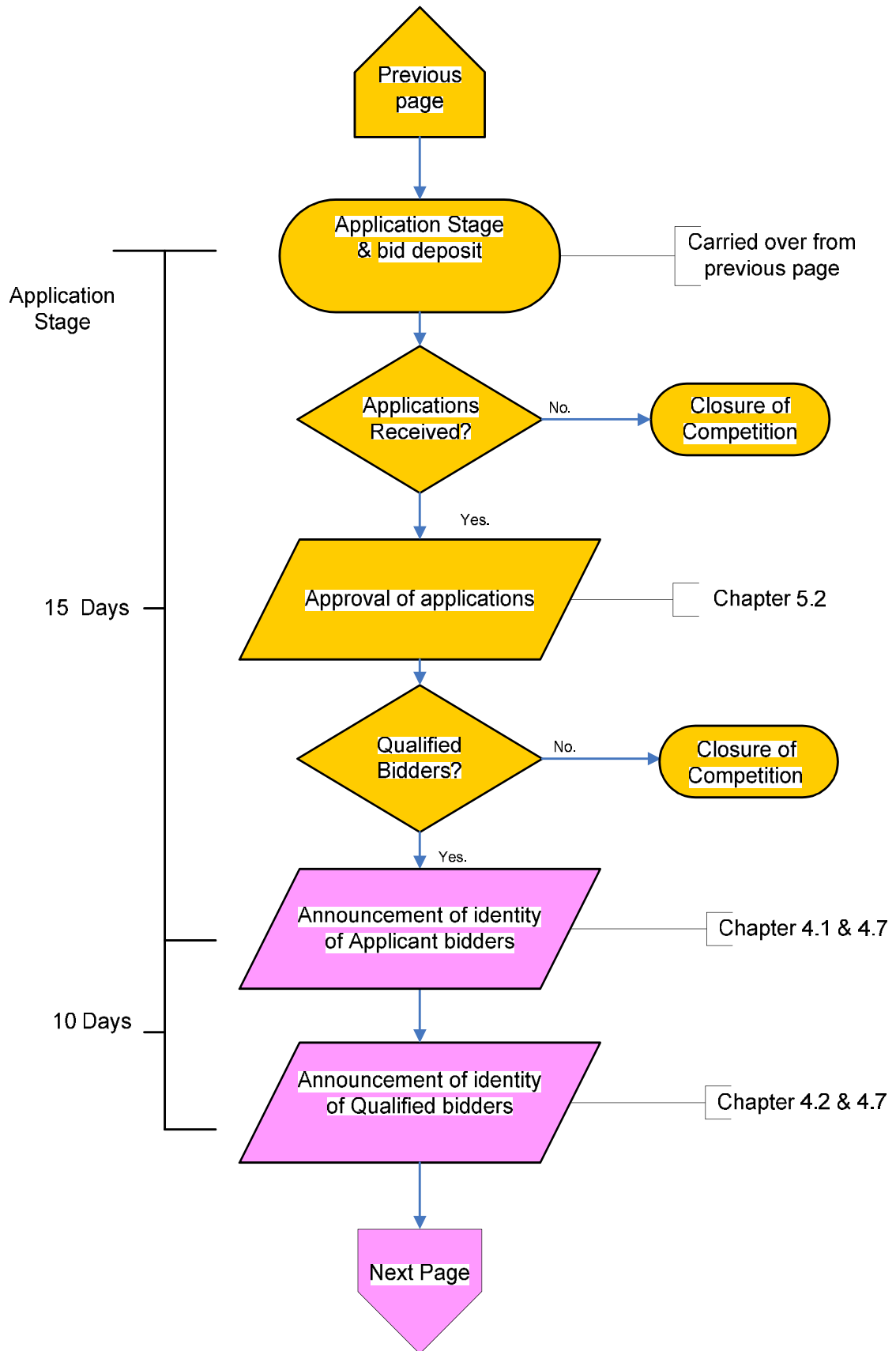
¹⁸ For example, if Bidder A values an item at €150 but believes that the second-highest bidder values the item at €80 then, in a first-price auction, they may have incentives to place a bid slightly higher than €80 but less than €150. If they are wrong about the other bidders' valuations, then the item will not go to the party that values it most.

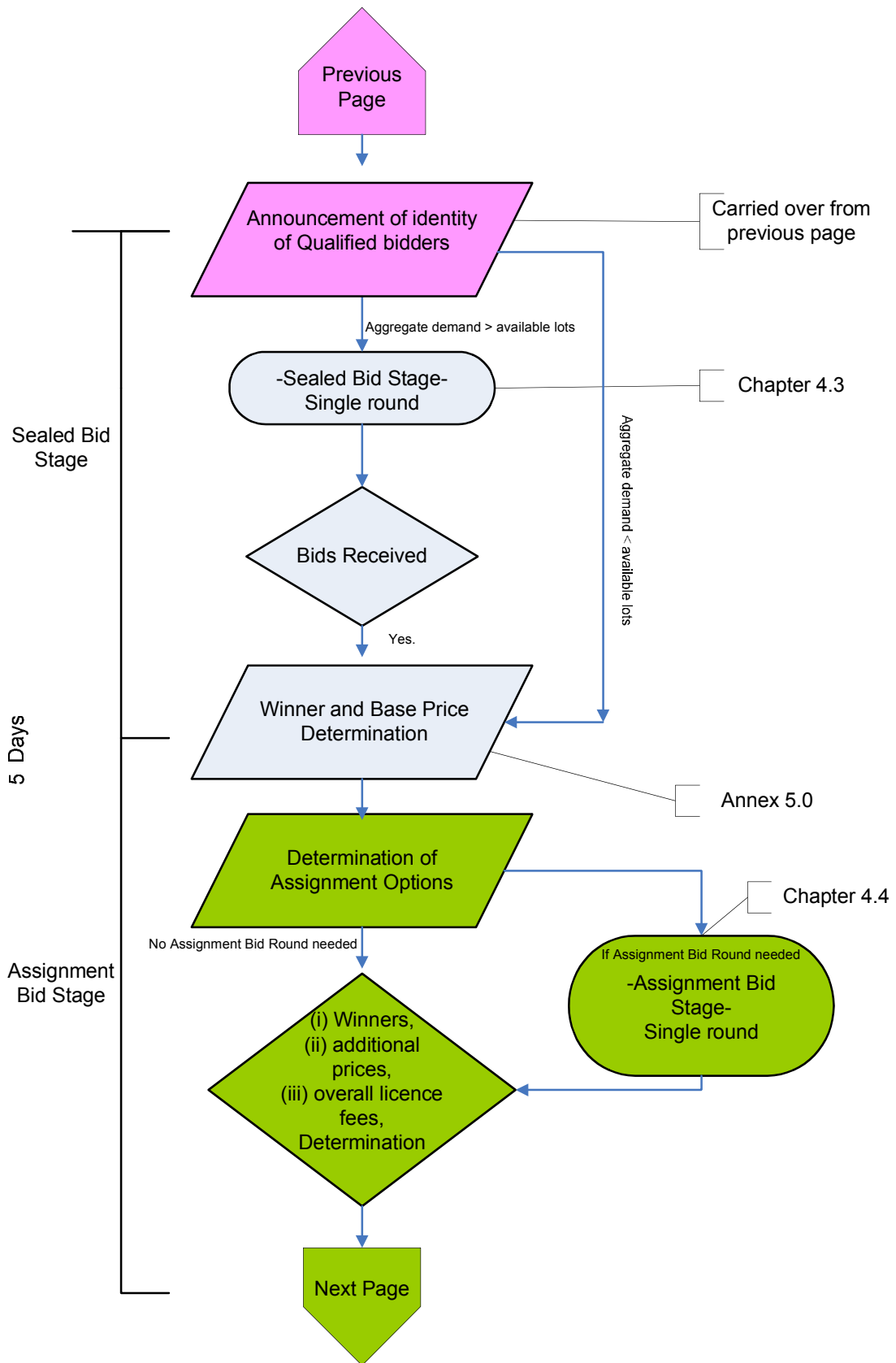
¹⁹ For example, suppose in a second-price auction that Bidder A values an item at €150, and the second-highest bid is €80. Then Bidder A will have an incentive to bid €150 as they will win the bid, but will only have to pay €80 to secure the licence. Thus, the second-price auction gives incentives to participants to submit bids closer to their true valuations as bidding less than your true valuation only increases your chance of losing without having any effect on the final price paid.

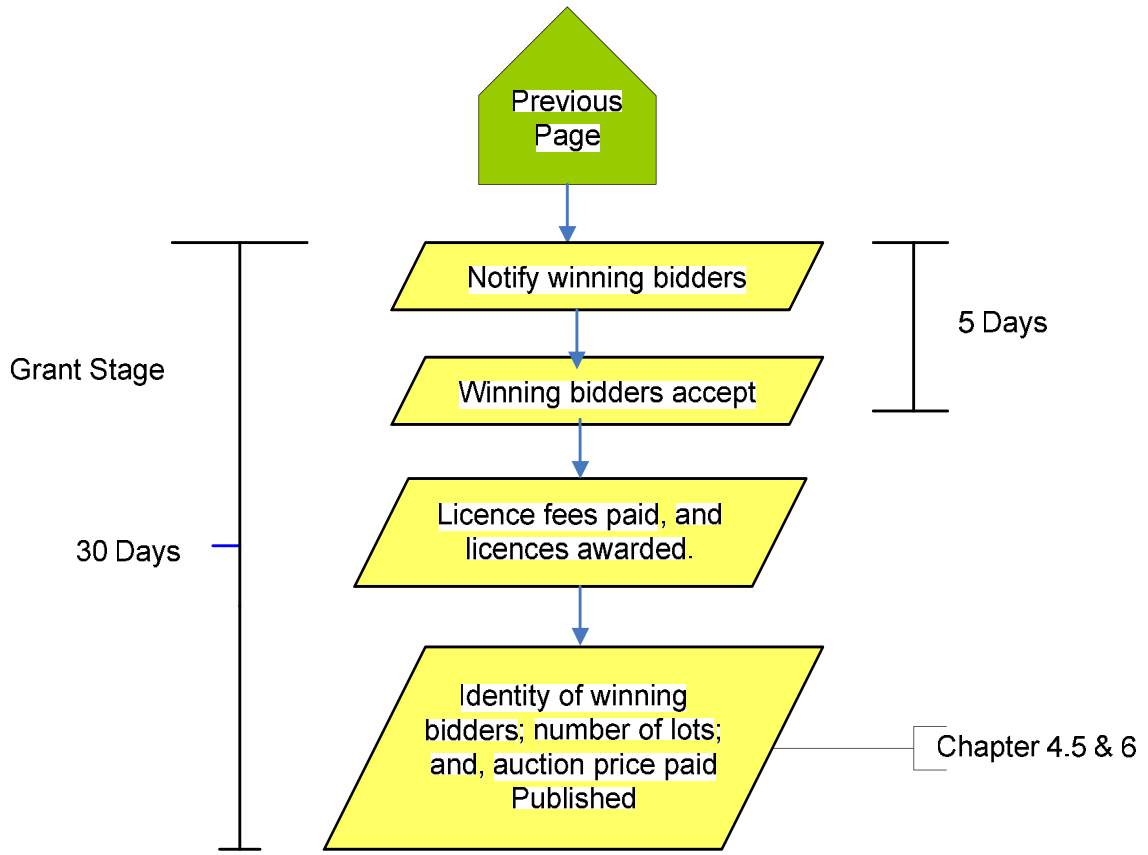
Annex 3 Detailed Flowchart of Award Process

Detail of 26GHz Process









- ends -

Annex 4 Sample Application Form

APPLICATION FOR 26 GHz NATIONAL BLOCK LICENCES

PART 1

APPLICANT DETAILS

Name and address of Applicant:

Company name: _____

Contact Person: _____

PO Box (if any): _____

Address: _____

: _____

: _____

Telephone: _____

Fax : _____

E- Mail: _____

No. of Lots required at the reserve price: _____ In writing: _____

No. of P2P lots: _____ In writing: _____

No. of PMP lots: _____ In writing: _____

DECLARATION BY THE APPLICANT

I accept that ComReg may publish information relating to licensed radio systems and that certain information relating to any licence issued pursuant to this application may be contained in any such publication.

I agree to comply fully with all the terms and conditions of the licensing procedure as outlined in the Information Memorandum 07/93.

I agree to comply fully with all the terms and conditions of the licence, if granted, in accordance with the Wireless Telegraphy (National Point-to-Point and Point-to-Multipoint Block Licences) Regulations, S.I. 762 of 2007.

I accept that a licence does not confer any rights of ownership of the frequency spectrum. It allows the assigned frequency block to be used during the term of the licence in accordance with the conditions of the licence.

I certify that all information provided on this form, including all documentation attached, is true and accurate.

Signature of Applicant:

On behalf of (Company):

Name in Block Letters:

Date: _____

The Signatory must be a Director or Secretary of the company. The contact person may be other than the signatory.

(If applicant is part of a company, please state position held):

Schedule of Fees to accompany any application:

Fee	Amount
Deposit	€70,000 per block

All monies will be returned to unsuccessful applicants unless forfeited.

Bank Transfer/EFT Payments can be made to:
Bank of Ireland, 6 Lower O'Connell Street, Dublin 1
Account number: 17806881
Sort Code: 90-00-33
BIC Code: BOFIE2D
IBAN No: IE62BOFI90003317806887

Applicants bank Details

Information Memorandum:

The applicant shall provide details of the bank account to which any monies will be returned in the event of failure to secure a licence.

PART 2

The Applicant shall provide the following.

Ownership and equity capital

An introductory description of the ownership and commercial relationships of the Applicant, including the size, composition and distribution of legal entities and (where relevant) individuals, of the respective ownership interests, including Group structures, shall be provided.

The Applicant shall provide:

1. The name, registered office, corporate form and a general description of the Applicant.
2. A description of any Participants and of the organisational and capital-related interaction between the Applicant and any Participants. (By this is meant for example, information on the cross-over of staff and of persons at management level and board level as well as technology sharing and in terms of capital-interaction, loans, financial guarantees and credits (non-exhaustive list))
3. A complete description of the ownership structure of the Applicant, including the amount of the equity capital, and its composition and distribution among the owners. In the case of an entity to be formed, similar details of the parties' current intentions should be provided.
4. A description of any Joint Venture Agreement, Shareholder Agreement and/or similar agreements in writing, including, as a minimum, a description of responsibilities, liabilities, voting rights and the transferability of ownership agreed or to be agreed. If the controlling interest differs or can differ from the position appearing in the capital ownership structure, this shall also be described.
5. A description of any agreements in connection with this project concerning the existing owner's future ownership of shares, any options, pre-emptive rights, plans for reserved capital holdings, etc.
6. An overview of the owners' connected undertakings and the description of any financial interest in existing licensees and, as far as possible, other Applicants, including, but not limited to, Connected persons.

Applicant's third-party agreements

The Applicant shall provide a description of any agreements or other co-operation arrangements with third parties agreed or to be agreed between the Applicant and any Participants within the field of telecommunications to the extent that such agreements, etc. have a bearing on the implementation of the investment plan.

Bankruptcy

The applicant shall provide a solemn declaration, signed by at least one of the applicant's representatives that the applicant:

- is not in suspension of payments, liquidation, or bankruptcy or winding up proceedings and is duly established under the legislation governing the country in which the applicant's registered office is situated; and

- is not, nor is expected to be involved in any disputes which may in any material or adverse way affect compliance with the licence.

“Connected person” means a Person who controls an Applicant or is controlled by an Applicant.

A Person shall be deemed to control a body corporate if –

- a) they have a controlling interest in it;
- b) they have a controlling interest in a body corporate which has a controlling interest in the body corporate; or
- c) although they do not have such an interest in the body corporate, or in any body corporate with a controlling interest in the body corporate, it is reasonable, having regard to all the circumstances, to expect that they will be able, by whatever means and whether directly or indirectly, to achieve the result that the affairs of the body corporate are conducted in accordance with its wishes;

and for this purpose a Person has a controlling interest in a body if he holds, or is beneficially entitled to, 50% or more of the equity share capital in the body corporate, or possesses 50% or more of the voting power in it and a Person shall be deemed to control a body corporate where that Person controls another Person which controls that body corporate.

“Person” means an individual, a body corporate or an unincorporated body of persons.

“Group” means for the purposes of this information memorandum, in relation to the Applicant/Licensee:

- a. any parent undertaking of the Applicant/Licensee;
- b. any subsidiary undertaking of the Applicant/Licensee;
- c. any subsidiary undertaking of any parent undertaking referred to in a);
- d. a shareholder or partner in the Applicant/Licensee which beneficially owns (directly or indirectly) shares in the Applicant/Licensee in circumstances where there is one other shareholder or partner in the Applicant/Licensee which beneficially owns (directly or indirectly) the remaining shares in circumstances where neither shareholder or partner has control;
- e. any undertaking of which the Applicant/Licensee beneficially owns (directly or indirectly) shares in circumstances where there is one other shareholder or partner in that undertaking which beneficially owns (directly or indirectly) the remaining shares in circumstances where neither shareholder nor partner has control;
- f. any undertaking in circumstances where two or more of its shareholders or partners which acting in concert together beneficially own (directly or indirectly) more than 50% of the shares or voting rights in that undertaking, acting in concert together beneficially own (directly or indirectly) more than 50% of the shares, or voting rights of the Applicant/Licensee; and

- g. any undertaking of which the Applicant/Licensee beneficially owns (directly or indirectly) together with one or more undertakings acting in concert more than 50% of the shares or voting rights of that undertaking.

Annex 5 Sample Bid Form

(name of bidder) _____ shall hereby submit the following bids for packages of 26GHz frequency blocks.

Packages containing ONE lot:

1 P2P LOT
Amount Bid: in numbers: _____ Euros
in writing: _____

1 PMP LOT
Amount Bid: in numbers: _____ Euros
in writing: _____

Packages containing TWO lots:

2 P2P LOTS
Amount Bid: in numbers: _____ Euros
in writing: _____

2 PMP LOTS
Amount Bid: in numbers: _____ Euros
in writing: _____

1 P2P LOT & 1 PMP LOT
Amount Bid: in numbers: _____ Euros
in writing: _____

Packages containing THREE lots:

3 P2P LOTS
Amount Bid: in numbers: _____ Euros
in writing: _____

3 PMP LOTS
Amount Bid: in numbers: _____ Euros
in writing: _____

2 P2P LOTS & 1 PMP LOT

Amount Bid: in numbers: _____ Euros

in writing: _____

1 P2P LOT & 2 PMP LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

Packages containing FOUR lots:

4 P2P LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

4 PMP LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

3 P2P LOTS & 1 PMP LOT

Amount Bid: in numbers: _____ Euros

in writing: _____

1 P2P LOT & 3 PMP LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

2 P2P LOTS & 2 PMP LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

Packages containing FIVE lots:

5 P2P LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

5 PMP LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

4 P2P LOTS & 1 PMP LOT

Amount Bid: in numbers: _____ Euros

in writing: _____

1 P2P LOT & 4 PMP LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

3 P2P LOTS & 2 PMP LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

2 P2P LOTS & 3 PMP LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

Packages containing SIX lots:

6 P2P LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

6 PMP LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

5 P2P LOTS & 1 PMP LOT

Amount Bid: in numbers: _____ Euros

in writing: _____

1 P2P LOT & 5 PMP LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

4 P2P LOTS & 2 PMP LOTS

Amount Bid: in numbers: _____ Euros

in writing: _____

2 P2P LOTS & 4 PMP LOTS

Amount Bid: in numbers: _____Euros

in writing: _____

3 P2P LOTS & 3 PMP LOTS

Amount Bid: in numbers: _____Euros

in writing: _____

Signature of Authorised Person: _____

Date: _____

Important notes:

- **The maximum number of lots that a bidder can bid for in each package bid cannot exceed their eligibility as determined by their application.**
- **The maximum possible eligibility is 6 lots.**
- **The amount of the bid for a package must be a least €70,000 euro per lot.**
- **All bids for packages are mutually exclusive (i.e. at most one will be accepted amongst the winning bids)**
- **Unless the bidder submits a valid bid that increases the amount of its bid for the package it selected at application, its original bid at application will remain valid.**
- **Each bid shall consist of an amount in whole euros.**
- **The bids are unconditional and irrevocable for a period of 6 months from the submission date.**

No alterations should be made to the bidding form. Individual bids that are illegible, unclear or below the minimum will be rejected but other bids will remain valid. Any other alterations, modifications, inconsistencies or errors will result in the entire bidding form being rejected and all bids made on it will be invalid.

Annex 6 Base Price Determination

A6.1 Base price determination

Each winning bid has an associated base price. A base price is an overall price for the entire package of lots subject to a winning bid. Therefore, a separate base price is determined for each winning bidder. (Notice that we do not determine a price per lot for P2P or PMP.)

Base prices are calculated using a second price rule. This is a single calculation that jointly determines a set of base prices – one for each winning bidder. It consists of a number of steps, as described below.

First, base prices are subject to the condition that the base price of a winning bid must be greater than or equal to the total reserve prices of the lots within the package associated with that winning bid.

Second, base prices are required to satisfy the following condition (which we describe as an algorithm for checking that the condition is satisfied):

- calculate the total amount of the winning bids (call this the “winning bid total” - W);
- for each winning bid, find the difference between the amount of that winning bid and the corresponding base price (call this the “price difference” for that winning bidder);
- calculate the total of the price differences for all winning bidders (call this the “total price difference” - P);
- take all of the winning bidders’ bids, and subtract the corresponding price difference for each winner from all bids made by that winner (call these the “modified bids”);
- re-run the determination of winning bids using the method described in Section 5.3.3, but using (a) all the non-winning bidders’ bids (including their bid at Application if applicable); and (b) the winning bidders’ modified bids as reduced by the price differences (call this the “modified winner determination”);
- calculate the total of the winning bids found in the modified winner determination (call this the “modified winning bid total” - MW);
- the sum of the modified winning bid total (MW) and the total price difference (P) is then required to equal the winning bid total (W).

There are typically many sets of base prices that satisfy these two conditions. However, all have the property that the base price of a winning bid is not more than the amount of that winning bid.

Amongst all these various sets of base prices, we impose a third condition that the sum of the base prices across winning bidders is minimised. Therefore, we only allow sets of base prices that:

- satisfy the two conditions above; and

- such that there is no other set of base prices that also satisfies the two conditions above and where the sum of base prices across bidders is lower.

Where there is only one set of base prices (one base price for each winner) satisfying these three conditions, this determines the base prices for the Sealed Bid Stage. In the case there are many sets of base prices satisfying these three conditions, we impose a fourth condition that selects a unique set of base prices. We express this condition in terms of an algorithm for checking that it is satisfied:

- first calculate the opportunity cost for a particular winning bidder which is defined to be:
 - the amount of the winning bid of that bidder; less
 - the total of all winning bids in the winning combination; plus
 - the greatest possible total of bids subject to: (i) accepting at most one bid from each bidder; (ii) accepting no bids from that winning bidder; and (iii) allocating each lot at most once;
- second, the sum of the squares of the differences between the base price for each winner and the opportunity cost for that winner should be minimised amongst all sets of base prices satisfying the previous three conditions.

This procedure produces a unique base price for each winning bidder that is no more than their winning bid and is at least the reserve price for that package.²⁰ If this is not an amount in whole euros, it will be rounded to the nearest whole euro.

A6.2 Determining additional prices and the licence fee

In each category where there were two or more winning bidders, additional prices will be determined. The additional prices are determined using a second price rule in an analogous manner to the Sealed Bid Stage.

First, additional prices are required to be positive or zero.

Second, additional prices must satisfy the following condition (which we describe as an algorithm for checking that the condition is satisfied):

- calculate the total amount of the winning assignment bids (call this the “winning assignment bid total” - AW);
- for each winning assignment bid, find the difference between the amount of that winning assignment bid and the corresponding additional price (call this the “price difference” for that winning bidder);
- calculate the total of the price differences for all winning bidders (call this the “total price difference” - AP);

²⁰ To illustrate how the second price rule works, consider the following simple example for an auction with 10 lots and one category. Suppose that there are five bidders. The winning bidders are: A (3 lots @ €30); B (3 lots at €30); and C (4 lots at €40); and the losing bidders are: D (2 lots at €15); and E (4 lots at €35). Bidders A, B and C must each pay enough that there is no alternative grouping of bidders prepared to pay more for the spectrum. Therefore, we can describe the following conditions for Prices:

Price (Bidder A) ≥ 15 ; Price (B) ≥ 15 ; and Price (C) ≥ 35 ;

Price (A + B) $\geq 15 + 35 = 50$; Price (B + C) $\geq 15 + 35 = 50$; and Price (A + C) $\geq 15 + 35 = 50$

In this case, there is only one set of prices that meets these conditions: A and B must each pay €25; and C must pay €35.

- take all of the winning bidders' assignment bids, and subtract the corresponding price difference for each winner from all assignment stage bids made by that winner (call these the "modified assignment bids"), setting the modified assignment bids to be zero where they would otherwise be negative;
- re-run the determination of winning assignment bids using the method described in Section 5.4.5, but using the winning bidders' modified assignment bids as reduced by the price differences (call this the "modified assignment winner determination");
- calculate the total of the winning assignment bids found in the modified assignment winner determination (call this the "modified winning assignment bid total" - MAW);
- the sum of the modified winning assignment bid total (MAW) and the total price difference (AP) is then required to equal the winning assignment bid total (AW).

Again, there are typically many sets of additional prices that satisfy these two conditions. Amongst all these various sets of additional prices, we impose a third condition that the sum of the additional prices across winning bidders is minimised.

Where there is only one set of additional prices satisfying these three conditions, this determines the additional prices for the Assignment Stage. In the case that there are many sets of additional prices satisfying these three conditions, we impose a fourth condition that selects a unique set of additional prices. We express this condition in terms of an algorithm for checking that it is satisfied:

- first calculate the opportunity cost for a particular winning bidder which is defined to be:
 - the amount of the winning assignment bid of that bidder; less
 - the total of all winning assignment bids; plus
 - the sum of winning assignment bids in a modified winner determination as described in section 5.4.5 in which that winner's assignment bids are all set to zero;
- second, the sum of the squares of the differences between the additional price for each winner and the opportunity cost for that winner should be minimised amongst all sets of prices satisfying the previous three conditions.

This procedure produces a unique additional price for each winning bidder that is no more than the winning additional bid. If this is not an amount in whole euros, it will be rounded to the nearest whole euro.

The licence fee for each bidder will be the sum of their base price and any additional prices for the specific P2P and/or PMP frequency ranges assigned to them.

Annex 7 Sample Bid Form for Assignment Stage

(NB: These forms are bespoke to each bidder; the following example form is based on the example of Carl from section 5.4.4)

(name of bidder) Carl shall hereby submit the following bids for packages of 26GHz frequency blocks corresponding to the number of P2P and/or PMP lots won in the Sealed Bid Stage

BID OPTION 1:

Lots:	A1 – A6 inclusive
Frequencies:	25.781-25.949GHz paired with 24.773 – 24.941GHz
Amount Bid:	in numbers: _____ Euros
in writing: _____	

BID OPTION 2:

Lots:	A2 – A7 inclusive
Frequencies:	25.809-25.977GHz paired with 24.801 – 24.969GHz
Amount Bid:	in numbers: _____ Euros
in writing: _____	

BID OPTION 3:

Lots:	A4 – A9 inclusive
Frequencies:	25.865-26.033GHz paired with 24.829 – 24.997 GHz
Amount Bid:	in numbers: _____ Euros
in writing: _____	

BID OPTION 4:

Lots:	A5 – A10
Frequencies:	25.893-26.061GHz paired with 24.857 – 25.025GHz
Amount Bid:	in numbers: _____ Euros
in writing: _____	

Signature of Authorised Person: _____

Date: _____

Important notes:

- The minimum bid level for each package is zero.
- Any bid above zero shall consist of an amount in whole euros.
- All bids for packages are mutually exclusive and you are guaranteed to win exactly one of the available packages (i.e. exactly one will be accepted amongst the winning bids)
- If you fail to submit a valid bid for one or more packages, then you will have been deemed to have made a valid bid of zero for all such packages.
- The bids are unconditional and irrevocable for a period of 6 months from the submission date.

No alterations should be made to the bidding form. Individual bids that are illegible, unclear or below the minimum will be rejected but other bids will remain valid. Any other alterations, modifications, inconsistencies or errors will result in the entire bidding form being rejected and all bids made on it will be invalid.

Annex 8 Radio Regulations

STATUTORY INSTRUMENT

S. I. No. 762 of 2007

**Wireless Telegraphy (National Point-to-Point and Point-to-Multipoint Block Licences)
Regulations, 2007.**

Published by the Stationery Office
Dublin

To be purchased through any Bookseller or directly from the Government Publications
Sales Office, Sun Alliance House, Molesworth Street, Dublin 2.

Or by mail order from
Government Publications, Postal Trade Section,
51 St. Stephen's Green, Dublin 2
(Tel: 01 6476834/35/36/37; Fax 01 6476843)
Or through any bookseller

(Prn. /)

Price

The Commission for Communications Regulation, in exercise of the powers conferred on it by section 6(1) of the Wireless Telegraphy Act, 1926 (No. 45 of 1926), as amended by the Communications Regulation (Amendment) Act, 2007 (No. 22 of 2007) and with the consent of the Minister for Communications, Marine and Natural Resources, pursuant to section 37 of the Communications Regulation Act 2002 hereby makes the following Regulations:

Citation and Commencement

1. (1) These Regulations may be cited as the Wireless Telegraphy (National Point-to-Point and Point-to-Multipoint Block Licences) Regulations, 2007.

(2) These Regulations come into force on 1 December 2007.

Interpretation

2. (1) In these Regulations –

“Act of 1926” means the Wireless Telegraphy Act 1926 (No. 45 of 1926);

“Act of 1972” means the Wireless Telegraphy Act, 1972 (No. 5 of 1972);

“Act of 2002” means the Communications Regulation Act 2002 (No. 20 of 2002);

“Apparatus” means apparatus for wireless telegraphy operating in the 26GHz frequency bands for the purpose of the provision of Point-to-Point and Point-to-Multipoint Block Services and, in relation to a Licence, means apparatus to which the Licence relates;

“Authorisation Regulations” means the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2003 (S.I. 306 of 2003);

“Commission” means the Commission for Communications Regulation established under the Act of 2002;

“harmful interference” means interference which endangers the functioning of a radionavigation service or of other safety services or which otherwise seriously degrades, obstructs or repeatedly interrupts any lawfully operating radiocommunications service;

“Licence” means a Licence under section 5 of the Act of 1926, to keep, have possession of, install, maintain, work and use Apparatus in a specified place in the State granted to the licensee;

“Licensee” means the holder of a Licence;

“Point-to-Point and Point-to-Multipoint Block Services” means a service consisting of the provision of Point-to-Point or Point-to Multipoint fixed services in the 26GHz band;

“Principal Regulations” means the Wireless Telegraphy (National Point-to-Point and Point-to-Multipoint Block Licences) Regulations, 2006 (S.I. No. 296 of 2006);

“Radiocommunications Service” means a service involving the transmission, emission, and/or reception of radio waves specified for specific telecommunications purposes;

“Radionavigation service” means a service involving the determination of the position, velocity and/or other characteristics of an object, or the obtaining of information related to these parameters, by means of the propagation properties of radio waves and used for the purposes of navigation, including obstruction warning;

- (2) In these Regulations unless the contrary intention appears:
 - (a) a reference to an enactment or regulation shall be construed as a reference to the enactment or regulation as amended or extended by or under any subsequent enactment or regulation;
 - (b) a reference to a regulation or a schedule is a reference to a regulation or schedule of these Regulations;
 - (c) a reference to a paragraph or subparagraph is a reference to a paragraph or subparagraph of the provision in which the reference occurs.
- (3) The Interpretation Act 2005 applies to these Regulations.

Application for Licence and Form of Licence

3. (1) An application for a Licence shall be made to the Commission and shall be in writing in such form as may be determined by the Commission.

(2) A person who makes an application under paragraph (1) of this Regulation shall furnish to the Commission such information as the Commission may reasonably require for the purposes of its functions under these Regulations and the Authorisation Regulations and if the person, without reasonable cause, fails to comply with this paragraph, the Commission may refuse to grant a Licence to the person.

(3) The Commission may grant a Licence in accordance with the relevant provisions of the Authorisation Regulations.

(4) A Licence shall be in the form set out in the Schedule to these Regulations or such other form as the Commission may from time to time determine.

Licences to which these Regulations apply

4. (1) These Regulations apply to Licences to keep, have possession of, install, maintain, work and use apparatus for the provision of Point-to-Point and Point-to-Multipoint Services having the characteristics set out in the Licence, and operating in accordance with the conditions set out in the Licence.

Licensee to satisfy all legal requirements

5. Nothing in these Regulations shall absolve a Licensee from any requirement in law to obtain any approvals, consents, licences, permissions and authorities as may be necessary for the provision of the service and for the exercise of his rights or the discharge of obligations under the licence. The Licensee is responsible for all costs, expenses and other commitments (financial and non financial) in respect of the Licence and the provision of the service and the Commission shall bear no responsibility for such costs, expenses or commitments.

Duration

6. A Licence shall commence on the date of its grant and expire ten years thereafter.

Licence Fees

7. (1) On the grant of a Licence, the Licensee shall pay to the Commission €70,000.00 per 2 x 28 MHz licensed spectrum.

(2) On the first, second, third and fourth anniversaries of the date of grant of a Licence, the Licensee shall pay to ComReg €20,000.00 adjusted to reflect the rate of inflation between the date of grant of the Licence and the relevant anniversary based on the Consumer Price Index per 2 x 28 MHz licensed spectrum.

(3) On the fifth, sixth, seventh, eighth and ninth anniversaries of the date of grant of a Licence, the Licensee shall pay €40,000.00 adjusted to reflect the rate of inflation between the date of grant of the Licence and the relevant anniversary based on the Consumer Price Index per 2 x 28 MHz licensed spectrum.

(4) If demand exceeds supply and the Commission grants a Licence pursuant to an auction, the Licensee shall pay to the Commission the cumulative amount by which each of its 2 x 28 MHz bids exceeds €350,000.00.

(5) Licence fees shall not be refundable in any circumstances.

(6) In the event that a Licensee surrenders a Licence otherwise than in circumstances of Licence non-compliance, it shall not be liable in respect of any licence fees that arise thereafter.

(7) Fees shall be paid to the Commission by way of banker's draft or such other means and on such terms (including terms as to the place of payment) as the Commission may decide.

Where the date of payment falls on a Saturday, a Sunday or a public holiday payment shall be made on or before the last working day before the date of payment.

(8) An amount payable by a person in respect of a fee under these Regulations may be recovered by the Commission from the person as a simple contract debt in any court of competent jurisdiction.

(9) If a Licence is suspended or revoked, the Licensee shall not be entitled to be repaid any part of the fee paid by the Licensee under these Regulations but shall still be liable to pay any sums (including interest) outstanding.

(10) Where payment is not made in due time, then interest shall be payable by the licensee at the rate per annum standing specified for the time being in section 26 of the Debtors (Ireland) Act, 1840 (1840 c.105), on the fee or part thereof in respect of the period between the date when such fee or part fell due and the date of payment of such fee or part.

Conditions of Licences

8. It shall be a condition of a Licence that:

(1) the Licensee shall comply with the conditions contained within the Licence and these Regulations;

(2) the apparatus used for the provision of point to point and point to multipoint services may only be operated in accordance with any guidelines specified by the Commission;

(3) the Licensee shall make payment of the fees as set out in Regulation 7 of these Regulations;

(4) the Licensee shall ensure that the apparatus used for the provision of point to point and point to multipoint services shall comply with the requirements of the European

Communities (Radio Equipment and Telecommunications Terminal Equipment) Regulations, 2001 (S.I.240 of 2001);

(5) the Licensee will ensure that non-ionising radiation emissions from each radio installation operated under the Licence for the purposes of the Service are within the limits specified by the guidelines published by the International Commission for Non-Ionising Radiation Protection (“ICNIRP”) and that it complies with any radiation emission standards adopted and published from time to time by ICNIRP, any standards of the European Committee for Electrotechnical Standards and any standards which may from time to time be specified by the European Union and that the wireless telegraphy apparatus operated under the Licence is not installed or operated at a location in a manner such as to be the cause of the aggregate non-ionising radiation emissions exceeding the limits specified by the guidelines published by the ICNIRP and that it complies with any radiation emission standards adopted and published by ICNIRP or its successors from time to time, any radiation emission standards of the European Committee for Electrotechnical Standards and any radiation emission standards specified by national and EC law;

(6) if the Licensee’s contact details or any of the information contained in the Licence changes, the Licensee shall, as soon as possible but not later than 28 days, notify the Commission in writing of the change;

(7) the Licensee complies with any special conditions imposed under section 8 of the Act of 1972 and subject to which this Licence is deemed by subsection (3) of that section to be issued;

(8) the Licensee shall not, without the consent of the Commission (which shall not be unreasonably withheld), assign the Licence or any of the powers, duties or functions conferred by it or otherwise transfer any of the rights or obligations conferred by it;

(9) the Licensees complies with obligations under relevant international agreements relating to the use of apparatus or the frequencies to which they are assigned;

(10) the Licensee shall ensure that the installation of the apparatus for the provision of point to point and point to multipoint services is effected, and its maintenance and operation is carried on in such a manner as to ensure that it does not cause harmful interference;

(11) By the third anniversary and on the fifth, seventh and ninth anniversaries of the date of issue of the Licence, the Licensee shall demonstrate to ComReg that it is using its licensed spectrum for point to point and/or point to multipoint services.

Enforcement – Compliance with obligations

9. Where the Commission finds that the Licensee has not complied with one or more of the conditions of the Licence, it may take any of the enforcement measures provided for in the Authorisation Regulation.

Amendment of Licence

10. The Commission may amend a Licence to which these Regulations apply in accordance with the provision of Regulation 15 of the Authorisation Regulations.

Revocation

11. The Principal Regulations are hereby revoked.

SCHEDULE

Part One

WIRELESS TELEGRAPHY ACT, 1926

Section 5

National Point-to-Point and Point-to-Multipoint Block Licences

Licence No.

Fee

Licensee

Postal Address

In full

The Commission, in exercise of the powers conferred on it by section 5 of the Wireless Telegraphy Act, 1926 (No. 45 of 1926) and Section 9(1) of the Communications Regulation Act, 2002 (No. 20 of 2002) grants to the Licensee specified, authorisation to keep, have possession of, install, maintain, work and use apparatus as specified in part two of this Licence subject to the Licensee observing the conditions contained in this licence and in Regulation 8 of the Wireless Telegraphy (National Point-to-Point and Point-to-Multipoint Block Licences) Regulations, 2007 (S.I. No.762 of 2007)

Date + Stamp

From

to

Issuing Officer

For and on behalf of the Commission for Communications Regulation

Part Two

Statement of authorised Apparatus

To include:

Description of apparatus

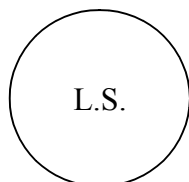
Places at which the Licensee is authorised to keep and have possession of the Apparatus.

Technical restrictions

Details of spectrum

***** End of Schedule *****

GIVEN under the official seal of the Commission for Communications Regulation, this day of 16 November, 2007



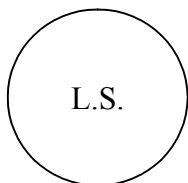
Mike Byrne

For and on behalf of the Commission for Communications Regulation

The Minister for Communications, Energy and Natural Resources consents to the making of the foregoing Regulations.

GIVEN under the Official Seal of the Minister for Communications, Energy and Natural Resources

This day of 14 November, 2007



Eamon Ryan T.D.

Minister for Communications, Energy and Natural Resources

EXPLANATORY NOTE

(This note is not part of the Instrument and does not purport to be a legal interpretation.)

These Regulations provide for the issue of Licences for apparatus for wireless telegraphy used solely for the provision of Point-to-Point and Point-to-Multipoint Block Services, for the regulation of such apparatus and for the payment of fees by persons granted Licences for that purpose.

Annex 9 Winner Determination and pricing algorithms for combinatorial clock auctions