Consultation on a Technical, Policy and Licensing Framework for Spectrum in the 600 MHz Band
Contents

1. Intent ....................................................................................................................................... 4
2. Policy objectives ..................................................................................................................... 4
3. Background ............................................................................................................................ 5
4. Band plan ................................................................................................................................ 6
5. Licensing process ................................................................................................................... 6
6. Pro-competitive measures ..................................................................................................... 7
7. Licence areas ........................................................................................................................ 10
8. Treatment of existing spectrum users ................................................................................ 12
   8.1 Over-the-air television (OTA TV) broadcasting ............................................................ 12
   8.2 Remote rural broadband systems (RRBS) ..................................................................... 12
   8.3 Low power apparatus and white space (WS) ................................................................. 13
9. Auction format and rules .................................................................................................... 13
   9.1 Auction format ............................................................................................................... 13
   9.2 Proposed auction attributes ............................................................................................ 13
   9.3 Structure and benefits of auction format options ........................................................... 15
   9.4 Structure of the assignment stage ................................................................................... 19
   9.5 Increasing prices in the clock rounds ............................................................................. 19
10. Bidder participation—Affiliated and associated entities .................................................... 20
    10.1 Affiliated entities ............................................................................................................ 20
    10.2 Associated entities ........................................................................................................ 21
    10.3 Auction integrity and transparency (Information disclosure pre-auction) ................. 22
    10.4 Prohibition of collusion and other communication rules ........................................... 23
11. Conditions of licence for spectrum in the 600 MHz band ................................................ 26
    11.1 Licence term .................................................................................................................. 26
    11.2 Licence transferability and divisibility ......................................................................... 27
    11.3 Deployment requirements ............................................................................................ 29
    11.4 Other conditions of licence ....................................................................................... 30
12. Auction process .................................................................................................................... 30
    12.1 Application to participate ............................................................................................ 31
    12.2 Opening bids ................................................................................................................. 31
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.3</td>
<td>Proposed eligibility points for the 600 MHz spectrum auction</td>
<td>34</td>
</tr>
<tr>
<td>12.4</td>
<td>Pre-auction deposits</td>
<td>35</td>
</tr>
<tr>
<td>12.5</td>
<td>Final payment and forfeiture penalties</td>
<td>35</td>
</tr>
<tr>
<td>12.6</td>
<td>Bidder training and support</td>
<td>36</td>
</tr>
<tr>
<td>13</td>
<td>Post-auction licensing process for unassigned licences</td>
<td>36</td>
</tr>
<tr>
<td>14</td>
<td>Licence renewal process</td>
<td>36</td>
</tr>
<tr>
<td>15</td>
<td>Revisions to the Canadian Table of Frequency Allocations</td>
<td>37</td>
</tr>
<tr>
<td>16</td>
<td>Clarification questions process</td>
<td>37</td>
</tr>
<tr>
<td>17</td>
<td>Submitting comments</td>
<td>37</td>
</tr>
<tr>
<td>18</td>
<td>Obtaining Copies</td>
<td>38</td>
</tr>
<tr>
<td>Annex A</td>
<td>The combinatorial clock auction (CCA) format</td>
<td>39</td>
</tr>
<tr>
<td>Annex B</td>
<td>The combinatorial clock auction format with a GARP-based activity rule</td>
<td>53</td>
</tr>
<tr>
<td>Annex C</td>
<td>The enhanced combinatorial clock auction (ECCA) format</td>
<td>57</td>
</tr>
<tr>
<td>Annex D</td>
<td>Examples of activity rules</td>
<td>70</td>
</tr>
<tr>
<td>Annex E</td>
<td>Proposed pricing rule</td>
<td>79</td>
</tr>
<tr>
<td>Annex F</td>
<td>Deployment requirements</td>
<td>85</td>
</tr>
<tr>
<td>Annex G</td>
<td>Proposed Conditions of Licence</td>
<td>92</td>
</tr>
</tbody>
</table>
1. **Intent**

1. Through the release of this paper, Innovation, Science and Economic Development Canada (ISED), on behalf of the Minister, is hereby initiating a consultation on a licensing framework for the auction of spectrum licences in the band 614-698 MHz (also known as the 600 MHz band) as announced in Canada Gazette notice SLPB-005-17.

2. Subsequent to the initial consultation entitled SLPB-005-14, *Consultation on Repurposing the 600 MHz Band*, released in December 2014, and the resulting policy decisions announced in the document SLPB-004-15, *Decision on Repurposing the 600 MHz Band*, ISED is now seeking comments on the technical, policy and licensing considerations including auction format, rules and processes, as well as on conditions of licence for spectrum in the 600 MHz band.

3. The Minister of Innovation, Science and Economic Development, through the *Department of Industry Act*, the *Radiocommunication Act* and the *Radiocommunication Regulations*, with due regard to the objectives of the Canadian telecommunications policy set out in section 7 of the *Telecommunications Act*, is responsible for spectrum management in Canada. As such, the Minister is responsible for developing national policies for spectrum utilization and ensuring effective management of the radio frequency spectrum resource.

4. In developing a licensing framework for spectrum licences in the 600 MHz band, ISED will be guided by the objectives stated in section 7 of the *Telecommunications Act*, and the policy objective stated in the *Spectrum Policy Framework for Canada* (SPFC) to maximize the economic and social benefits that Canadians derive from the use of the radio frequency spectrum. These objectives and the enabling guidelines listed in the SPFC continue to be relevant for guiding the Minister in delivering their mandate of spectrum management.

2. **Policy objectives**

5. Canadians want high-quality services, ubiquitous coverage and affordable prices from their telecommunication service providers. Mobile communications have become integrated into the daily lives of Canadians as they increasingly rely on mobile services to access a variety of mobile applications, such as multi-media services, social networking and Internet browsing, on a day-to-day basis to do business, connect with others, and to manage finances, health and homes.

6. A robust wireless telecommunications industry drives the adoption and use of digital technologies and enhances the productivity of the Canadian economy and its international competitiveness. The deployment of 600 MHz band will contribute to the strengthening of Canada’s world-leading wireless infrastructure.
7. Spectrum is a critical resource for wireless carriers. Additional spectrum will allow providers to increase network capacity to meet the traffic demands of higher usage rates, and support the deployment of next-generation wireless technologies. ISED views the release of the 600 MHz band as an opportunity to encourage investment and improve services provided by both newer and established carriers. In addition, it presents a key opportunity to support competition and the provision of high quality and innovative wireless services to Canadians.

8. Through the Innovation and Skills Plan and its focus on skills, research, technology and commercialization, program simplification, and investment and scale, the Government of Canada is committed to promoting innovation-led growth across all sectors of the Canadian economy. Today’s economy is digital. The ubiquity of digital technologies and services across sectors is a defining feature of this economy. This spectrum will support the development of Canada’s digital economy and the objectives of the Innovation and Skills Plan by further enabling all Canadians to participate in the digital economy. A world class communications infrastructure, which includes utilizing 600 MHz spectrum, can create a platform for sustainable growth, allowing all Canadians to take advantage of the latest technologies to better compete globally. Consequently, ISED’s policy objectives for the allocation of the 600 MHz spectrum licences are:

- to foster innovation and investment;
- to support sustained competition, so that consumers and businesses benefit from greater choice; and
- to facilitate deployment and timely availability of services across the country, including rural areas.

3. Background

9. In recent years, ISED has been active in allocating additional spectrum for commercial mobile use, including the 700 MHz auction in 2014, as well as the 2500 MHz and AWS-3 auctions in 2015. The Commercial Mobile Spectrum Outlook, published in 2013, identified additional spectrum to be considered for release, including the 600 MHz band.

10. In 2015, ISED issued SLPB-004-15, Decision on Repurposing the 600 MHz Band, in which the Department decided to proceed with repurposing the 600 MHz band jointly with the United States (U.S.). This decision focused on the technical aspects of repurposing broadcasting spectrum for mobile use. The incumbent users of the 600 MHz band include over-the-air (OTA) TV broadcasting, remote rural broadband systems (RRBS), low-power apparatus (e.g. wireless microphones and camera systems) and white space (WS) devices. ISED is now consulting on issues related to the technical, policy and licensing rules pertaining to the repurposed spectrum intended for mobile use.

---

1 Formerly referred to as television white space (TVWS) devices.
4. **Band plan**

11. The 2015 decision to repurpose the 600 MHz band noted the benefits of adopting the U.S. band plan for the repurposed spectrum. ISED committed to repurposing in collaboration with the U.S. and to adopt the same band plan.

12. The 600 MHz band (614-698 MHz) is designated for flexible use for commercial mobile, fixed, and broadcasting services. The band plan includes seven paired blocks of 5+5 MHz totalling 70 MHz, a duplex gap from 652 MHz to 663 MHz, and a guard band from 614 MHz to 617 MHz, as shown in figure 1.

**Figure 1: Band plan for 600 MHz band**

13. It should be noted that channel 37 will continue to be used for Radio Astronomy Systems and wireless medical telemetry services. Additionally no Canadian broadcaster is being moved to channel 36 or 37, which will reduce the potential for interference to broadcast services from the mobile services and vice versa.

14. The guard band 614-617 MHz will be held in reserve until further notice.

5. **Licensing process**

15. Where the demand for spectrum is not expected to exceed the supply, ISED generally uses a first-come first-served licensing process to award licences. In instances where the demand for spectrum is expected to exceed supply, an auction is generally used. Given the high demand for mobile broadband services in Canada and that the 600 MHz band provides an opportunity to service providers to add to their networks, ISED believes that demand is likely to exceed supply for these licences. Therefore, ISED will use an auction process to assign spectrum licences in the 600 MHz band.
6. Pro-competitive measures

16. Commercial mobile services are becoming the preferred communication tool for many Canadians. In 2015, for the first time, more Canadian households subscribed exclusively to mobile wireless services (20.4%) than exclusively to wireline telephone services (14.4%). In 2016, 23.7% of Canadian households subscribed exclusively to mobile wireless services, whereas only 13.6% subscribed exclusively to wireline telephone services. In addition, the Canadian Radio-television and Telecommunications Commission’s (CRTC) 2016 Communications Monitoring Report indicates that while the majority of Canadians still own and use wireline phones, the data confirms the slow and steady shift away from this technology in favour of wireless services. More Canadian households have mobile phones (85.6%) than landlines (75.5%)—a big change from only ten years ago, when just over half of Canadian households subscribed to mobile phones (62.9%) and almost all subscribed to landlines (94.0%).

17. Since taking steps to introduce new competitors to the wireless market in 2008, additional service providers have undertaken the substantial investment required to deploy wireless networks in many markets across Canada and to provide wireless services to Canadians. As a result, competition has increased, bringing benefits to consumers. The 2016 Price Comparison Study of Telecommunications Services in Canada and Select Foreign Jurisdictions found that on average new entrants offer prices up to 36% less than the national incumbents.

18. Spectrum is a critical input for wireless carriers. New competitors that entered the market after the 2008 AWS spectrum auction continue to invest in their wireless networks and increase subscribership. Access to additional spectrum would assist them in their efforts to provide services using the latest technologies and increase network capacity in order to meet the traffic demands of a growing subscribership. In addition, national incumbent service providers would also benefit from access to additional spectrum, allowing them to increase capacity to better serve their substantial subscriber base. ISED views the licensing of 600 MHz spectrum as an opportunity to release spectrum to further support investment by service providers and improve wireless services for Canadians. In particular, it presents a key opportunity to further support the competitiveness of the newer service providers by ensuring that they will have an opportunity to acquire additional low-band spectrum to effectively compete with the services offered by the more established wireless service providers.

19. As noted in the Framework for Spectrum Auctions in Canada (FSAC), there are various measures available in an auction to promote a competitive marketplace if required, notably set-asides and spectrum aggregation limits. These measures can address issues of market power and support competition. The factors that ISED may consider when deciding upon use of a competitive measure are set out in section 4 in the FSAC.

20. A spectrum set-aside ensures that a minimum amount of spectrum is effectively reserved for a certain sub-set of entities. A set-aside was used in the 2008 AWS auction, whereby approximately 40% of the available spectrum was only available to certain bidders, and in the 2015 AWS-3 auction, whereby approximately 60% of the available spectrum was only available to certain bidders. A set-aside is used to address issues of market power.
21. A spectrum aggregation limit, or a spectrum cap, limits the amount of spectrum that each licensee is allowed to obtain. Variations of spectrum caps have been used in past auctions, including the 700 MHz auction in 2014 and the 2500 MHz auction in 2015. A spectrum cap regulates the distribution of spectrum across various auction participants.

22. The Competition Bureau has stated that incumbent service providers have market power in the provision of retail mobile wireless services. There is a risk that competition in the post auction marketplace could suffer without measures to facilitate regional carrier’s access to spectrum. Furthermore, the Competition Bureau recently concluded that the lower prices are caused by the presence of a strong regional competitor. Consistent with the above comments, ISED is of the view that these incumbent entities likely have the means and ability to prevent other service providers from acquiring spectrum licences in an open auction.

23. Similar risks have also been recognized by spectrum regulators in multiple international jurisdictions. In many cases, these regulators have elected to address these risks by adopting competitive auction measures, as was the case in the U.S. 600 MHz incentive auction, which resulted in setting aside 30 MHz of spectrum for non-incumbents.

24. Given the above considerations, and in light of the policy objectives stated in section 2, ISED proposes to adopt competitive measures in the form of a set-aside for the 600 MHz licensing process.

25. **Amount of set-aside:** The minimum technical requirement for the current 4G LTE technology is a paired 5+5 MHz block. Larger blocks would allow for increased capacity and speed and may facilitate more economical deployment for the increased quality of service that may be achieved. Considering there are seven paired 5+5 MHz spectrum blocks in the 600 MHz band and that this spectrum is expected to be in high demand by service providers to improve network quality and capacity, the amount of the set-aside spectrum must be balanced with the total amount of spectrum available in the band. Given these considerations, ISED proposes to set aside 30 MHz of spectrum in the 600 MHz band to eligible entities which would provide them with an opportunity to increase their low-band spectrum holdings to a level closer to that of the national incumbent service providers. The remaining 40 MHz would be open for all bidders.

26. The specific paired blocks for the set-aside would not be predetermined, but rather would be determined by bidders during the auction. The eligibility to bid on the proposed set-aside spectrum licences in each licence area is discussed below.

27. **Eligibility for set-aside spectrum:** In its effort to promote a competitive marketplace, ISED has implemented policies in various auctions that effectively reserved spectrum for certain sub-sets of entities that could acquire access to this spectrum to compete with the well-established wireless service providers. Service providers that have launched wireless services in

---

2 The Competition Bureau has previously stated “incumbent service providers do have market power in the provision of retail mobile wireless services” the Submission by the Commissioner of Competition Before the Canadian Radiotelevision and Telecommunications Commission — Telecom Notice of Consultation CRTC 2013-685 — Wholesale mobile wireless roaming in Canada — Unjust discrimination/undue preference document.

3 Competition Bureau statement regarding Bell’s acquisition of MTS, February 15, 2017.
recent years could benefit from an opportunity to acquire access to additional spectrum to support network improvements to meet the wireless traffic demands of their growing subscriberhip.

28. In the past, ISED has used specific definitions to distinguish between established service providers and newer service providers for the purpose of determining bidding eligibility. For the purpose of this consultation on the 600 MHz band, it is proposed that national incumbent service providers be defined as “companies with 10% or more of national wireless subscriber market share.” The determination of subscriber market share will be based on the most recent CRTC Communications Monitoring Report. All other companies will be referred to as regional service providers.

29. ISED is of the view that the ability to bid on the proposed set-aside spectrum should be limited to a particular sub-set of regional service providers that are best positioned to compete in the commercial mobile services market. As a result, it is proposed that eligibility to bid on the set-aside spectrum be limited to those registered with the CRTC as facilities-based-providers, that are not national incumbent service providers, and that are actively providing commercial telecommunication services to the general public in the licence area of interest, effective as of the date of application to participate in the 600 MHz auction. In this consultation, these entities are referred to as set-aside-eligible bidders. Upon application to participate in the auction, applicants would be required to indicate in their application, whether they are applying to bid as a set-aside-eligible or set-aside-ineligible bidder on a service area by service area basis.

30. Limiting access to the set-aside as noted above is more likely to result in the provision of robust advanced wireless services, allowing for more effective and sustained competition in the post-auction marketplace. Furthermore, in order to ensure the effectiveness of the set-aside and to deter speculation, it is proposed that the set-aside licences acquired by set-aside-eligible bidders, would not be transferable to set-aside-ineligible entities for the first five years of the licence term, as set out in section 11.2 – Licence transferability and divisibility below.

31. Assessing the active provision of commercial telecommunications services: In its assessment of a bidder’s eligibility to bid on the set-aside spectrum, ISED would determine whether commercial telecommunications services are actively being provided to the general public in the licence area, by the potential bidder. Potential bidders would be required to demonstrate this by providing relevant documentation to ISED, which will include, but not be limited to, details outlining:

- the services being offered in the licence area;
- the retail/distribution network; and
- how subscribers access services and the number of subscribers in the service area.

---

4 An applicant must be registered on one of the CRTC lists of facilities-based providers by the date that applications are due.
5 The date of the application to participate in the 600 MHz auction will be defined in the framework as a result of this consultation.
32. **Block size:** As discussed in section 4, Band plan, there are seven paired 5+5 MHz spectrum blocks. A 30 MHz spectrum set-aside could be auctioned as three separate paired blocks of 5+5 MHz or as one paired block of 15+15 MHz. One paired block of 15+15 MHz block set-aside for eligible bidders would ensure that one regional service provider in each licence area would obtain a significant portion of 600 MHz spectrum. This may allow a regional service provider a greater opportunity to effectively compete with national incumbents. Alternatively, auctioning three separate paired blocks of 5+5 MHz for eligible bidders could result in multiple set-aside-eligible bidders acquiring licences in each licence area. It would also provide flexibility for set-aside-eligible bidders to express their valuation for one or more blocks at any point during the auction. Given the considerations listed above, ISED is proposing to auction the set-aside as three separate paired blocks of 5+5 MHz.

| Q1A—ISED is seeking comments on its proposal to implement a set-aside as a pro-competitive measure in the auction process for the 600 MHz band. |
| Q1B—ISED is seeking comments on its proposal to set aside 30 MHz of spectrum in the 600 MHz band for eligible entities and to have open bidding (no pro-competitive measures) on the remaining 40 MHz in the band. |
| Q1C—ISED is seeking comments on its proposal to limit the eligibility criteria to bid on set-aside spectrum to those registered with the CRTC as facilities-based-providers, that are not national incumbent service providers, and that are actively providing commercial telecommunication services to the general public in the licence area of interest, effective as of the date of application to participate in the 600 MHz auction. |
| Q1D—ISED is seeking comments on its proposal to limit the transferability of the set-aside spectrum for the first five years of the licence term. |
| Q1E—ISED is seeking comments on its proposal to auction the set-aside spectrum as three separate paired blocks of 5+5 MHz. |

7. **Licence areas**

33. The Service Areas for Competitive Licensing document outlines the general service areas that are used by ISED for the purposes of issuing spectrum licences. The defined geographic areas have been categorized under “service area tiers” that are based on Statistics Canada’s Census Divisions and Subdivisions.

34. As different wireless services and applications are best suited to different sizes of service areas, four tiers of service areas have been established. Tier 1 is a single national service area. Tier 2 consists of 14 large service areas covering all of Canada. There are eight Tier 2 service...
areas that have provincial/territorial boundaries, and six that are sub-provincial within Ontario and Quebec. Tier 3 contains 59 smaller regional service areas and Tier 4 comprises 172 localized service areas. The population associated with each service area is based on Statistics Canada census information.

35. Licensing based on smaller tier sizes provides additional flexibility to licensees, by allowing them to either concentrate on the geographic markets of most interest or to aggregate smaller service areas into larger regions that correspond to their business needs. However, given the propagation characteristics of the 600 MHz band, smaller tier sizes may result in interference coordination challenges with neighbouring service providers.

36. Licensing based on larger geographic areas, especially for low-band spectrum, such as 600 MHz, results in less coordination being required between adjacent licensees and allows more effective use of radio spectrum. Tier 2 service areas provide licensees with wide regional coverage. Larger geographic service areas also enable deployment of large-scale networks that can be more cost-efficient due to economies of scale, which is critical to the deployment of spectrum given that wireless mobile networks are capital-intensive.

37. Low frequency bands, such as the 600 MHz band, propagate long distances and users may roam over wide areas. As a result, mobile service areas are generally large in order to provide continuous coverage. In this band, radio waves will carry the radio signals to significantly longer distances compared to higher frequencies such as AWS-3 and 2500 MHz bands.

38. Recognizing the continued challenges for regional service providers to provide services in rural and remote areas, there may be a need to unbundle the Northern Tier 2 licence area. Tier 4 is the only tier that divides Northern Canada (Yukon, Northwest Territories and Nunavut) into the three Territories. The Tier 4 areas in the three Territories are sufficiently large, such that they would not lead to the coordination issues typically encountered in other Tier 3 or Tier 4 service areas.

39. Given the technical characteristics of the 600 MHz band and the overarching goal of providing service in rural and remote areas, ISED is proposing to licence using Tier 2 service areas across the country, except in the three Territories where Tier 4 service areas would be applied.

Q2—ISED is seeking comments on its proposal to use Tier 2 service areas across the country, except in the three Territories (Yukon, Northwest Territories and Nunavut) where Tier 4 service areas would apply.
8. Treatment of existing spectrum users

8.1 Over-the-air television (OTA TV) broadcasting

40. OTA TV undertakings in the 600 MHz band are permitted to continue using their current channels and modes of operation (i.e. analog or digital) until the spectrum is needed for the deployment of mobile broadband services, as indicated in SLPB-004-15, Decision on Repurposing the 600 MHz Band. ISED will issue a displacement notification to these TV undertakings only if it is determined that the continued operation of these undertakings will prevent the deployment of new mobile services in the 600 MHz band.

41. For these TV undertakings, the following minimum notification periods apply:
   • regular power TV undertakings located in urban areas are afforded a minimum of a one-year notification period; and
   • regular power TV undertakings located in all other areas are afforded a minimum of a two-year notification period.

42. TV undertakings whose continued operation after their phase completion dates would impair mobile deployment in the U.S. have been notified by ISED that they will need to cease operation at their phase completion dates. As mentioned in section 7.4 of Broadcasting Procedures and Rules, BPR-11, Broadcasting Television Application Procedures During the 600 MHz Transition, the displacement notification for TV undertakings operating in the 600 MHz will not displace TV undertakings prior to their scheduled phase completion date. However, where new mobile service operators prefer to deploy earlier than permitted, the mobile operator and the incumbent may come to a mutually beneficial agreement in which the notification period may be less than one or two year(s), as applicable, subject to ISED’s approval and international obligations with respect to the digital television (DTV) transition schedule. Additional details regarding the DTV transition can be found in the DTV Transition Schedule and BPR-11.

8.2 Remote rural broadband systems (RRBS)

43. RRBS are communication systems that provide broadband services to remote rural communities in Canada, using unused TV broadcasting channels (channels 21 to 51, excluding channel 37) in locations that are more than 121 km from the Canada-U.S. border and at a sufficient distance from major population centres. RRBS licences include restrictions on operating near the border, near cities and on frequencies that create interference with TV broadcasting operations. RRBS are not permitted to cause interference to, or claim protection from, licensed broadcast operations.

44. As indicated in SLPB-004-15, a moratorium remains in place for new applications for licensing of RRBS stations; and applications for modification of an existing RRBS station which would increase the coverage in any direction or change operating frequencies. RRBS operating in the 600 MHz band are afforded a minimum displacement notification period of two years.
8.3 Low power apparatus and white space (WS)

45. As stated in SLPB-004-15, as the 600 MHz band is deployed for mobile broadband systems, low power apparatus are expected to experience interference in this range. In addition, through SMSE-012-12, *Framework for the Use of Certain Non-broadcasting Applications in the Television Broadcasting Bands Below 698 MHz*, ISED allowed the use of WS devices in the 600 MHz band on a secondary basis. ISED will address secondary uses of low power apparatus (including wireless microphones) and WS devices in a separate consultation.

9. Auction format and rules

46. The auction format should be simple, fair and transparent for bidders; one that leads to an efficient assignment of spectrum. In selecting the auction format and related rules, consideration is given to the characteristics of the spectrum being auctioned, for example, the quantity and size of the blocks, their geographic characteristics, as well as the similarities and complementarities that may exist among the blocks.

9.1 Auction format

47. Advancements in auction theory and design have led to new and improved auction formats and rules. ISED continues to examine these new developments and is considering various options for the 600 MHz auction. The first option is the combinatorial clock auction (CCA), similar to the format used for the 700 MHz and 2500 MHz auctions. The second and third options build on the CCA format, and introduce various degrees of modifications to further refine the benefits of the CCA format. The rationale for each option is discussed in section 9.3, while detailed explanations for how each option would be implemented are contained in annexes A, B and C.

9.2 Proposed auction attributes

48. Certain attributes being proposed for the 600 MHz spectrum auction are the same across the three options being considered in this consultation. These include package bidding, the use of generic licences and anonymous bidding.

9.2.1 Package bidding

49. One of the key attributes of the CCA is the use of package bidding where, in each round, the participant specifies the set of licences that it would like, at the announced prices, creating a single bid for a package. The package bid is treated as an all-or-nothing bid and the package is awarded in its entirety, or not at all. Bidding for packages of licences eliminates the risk that a bidder could win some but not all of the licences needed for its business case, leaving it stranded with licences that cannot be used as effectively – a concept known as exposure risk. This is particularly important given the proposed regional nature of the licences to be auctioned and the potential for complementarities across these regional licences.
9.2.2 Generic licences

50. As discussed in section 7 – Licence areas, ISED is proposing that the seven blocks of paired spectrum (5+5 MHz) be auctioned using a mix of Tier 2 and Tier 4 service areas, which would result in 16 service areas across Canada. ISED further proposes that these blocks be offered as generic licences in each of the 16 service areas.

51. Generic licences are blocks of spectrum that are sufficiently similar and comparable in value to one another that they can be offered as a single category in each service area. In determining whether licences should be considered generic, ISED considered the frequency location in the band, the block size, and possible technology and interference constraints. The use of generic licences simplifies the bidding process, as it enables bidders to indicate quantities of licences instead of identifying specific licences, reducing the number of products available to bid on, and also reducing the number of possible combinations that bidders have to consider in placing their bids.

52. As discussed in section 6 – Pro-competitive measures, ISED is proposing that in each service area, 30 MHz of spectrum (three blocks of 5+5 MHz) be set-aside for eligible bidders, and that the remaining 40 MHz of spectrum (four blocks of 5+5 MHz) be open to all bidders. The pairing of a category (set-aside or open) and a service area is referred to as a product. This proposal would result in a total of 32 products being offered in the auction.

53. As described in section 6 – Pro-competitive measures, ISED is proposing that all applicants must indicate in their application whether they are applying to bid as a set-aside-eligible or set-aside-ineligible bidder on a service area by service area basis. Set-aside-ineligible bidders would only be allowed to bid on up to four blocks of spectrum in a service area, while set-aside-eligible bidders would be allowed to bid on up to seven blocks.

54. Given the use of generic licences and the ability of set-aside eligible bidders to bid on all seven blocks in a service area, there is a possibility that set-aside-eligible bidders – individually or collectively – would be able to bid on and win more than three blocks in a service area. In the case where one or more set-aside-eligible bidders collectively win more than 30 MHz in a given service area, ISED is proposing that all of these blocks be considered set-aside blocks, and effectively be subject to the same conditions of licence set out in section 11.2 – Licence transferability and divisibility. Although this rule would restrict the transferability of these licences for the first five years, it is noted that ISED’s proposal to set-aside 30 MHz of spectrum serves to provide a significant advantage to set-aside-eligible bidders by effectively protecting them from competition by national incumbents. The proposed rule would thereby encourage participation from entities that intend to use the spectrum to deploy services.
Consultation a on Technical, Policy and Licensing Framework for Spectrum in the 600 MHz Band SLPB-005-17

<table>
<thead>
<tr>
<th>Q3—ISED is seeking comments on:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) the proposal to use generic licences; and</td>
</tr>
<tr>
<td>b) the proposal to categorize all blocks won by set-aside-eligible bidders as set-aside blocks.</td>
</tr>
</tbody>
</table>

9.2.3 Anonymous bidding

55. As has been the case in recent spectrum auctions, ISED is proposing to use anonymous bidding during the 600 MHz auction. After each clock round, bidders would be provided with information regarding their own bidding activity and the aggregate demand in each service area, as well as their own eligibility and prices of all products in the next clock round. As an exception to this rule, in both the CCA (annex A) and the CCA with a modified activity rule (annex B), aggregate demand from the final clock round would not be disclosed to bidders before supplementary round bidding.

56. This level of information disclosure would provide bidders with enough information to permit price discovery, allowing bidders to make informed decisions regarding their bidding strategies. Anonymous bidding would help bidders focus on their valuations for the licences, the level of aggregate demand, and the prices, rather than on the bidding behaviour of competing bidders. Anonymous bidding is therefore anticipated to reduce the potential for anti-competitive behaviour, while simplifying the bidding process.

<table>
<thead>
<tr>
<th>Q4—ISED is seeking comments on:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) the use anonymous bidding during the auction; and</td>
</tr>
<tr>
<td>b) the information that will be disclosed to bidders during the clock rounds, as described in annex A (which would also apply to the CCA with a modified activity rule set out in annex B) and annex C.</td>
</tr>
</tbody>
</table>

9.3 Structure and benefits of auction format options

57. This section discusses the general structure and benefits of the three options being considered for the design of the auction format, namely the combinatorial clock auction (CCA) with rules similar to those used in the Canadian 700 MHz and 2500 MHz auctions (annex A); the CCA with a modified activity rule (annex B); and the enhanced combinatorial clock auction (ECCA) (annex C).

9.3.1 Combinatorial clock auction (CCA) format

58. Since 2008, the CCA format has been used for spectrum auctions in countries such as Australia, Austria, Denmark, Ireland, the Netherlands, Switzerland and the United Kingdom. Similarly, in Canada, the CCA format was used to auction spectrum licences in the 700 MHz band (2014) and the 2500 MHz band (2015).
59. The CCA is typically a two-stage auction, consisting of an allocation stage and, when generic licences are used, an assignment stage. In the allocation stage, the number of generic licences won by each bidder is determined. Then the assignment stage determines the specific blocks that are assigned to each winning bidder. This process and its rules are illustrated and described in detail in annex A.

60. The CCA introduced many benefits to spectrum auctions. The use of generic licences and package bidding greatly simplifies bidding in the auction and significantly reduces one of the largest sources of risk to bidders (exposure risk). In the clock rounds, the use of anonymous bidding and the hybrid revealed preference/eligibility point activity rule encourages truthful bidding throughout the auction and provides bidders with useful information about the values of the offered licences. The hybrid revealed preference/eligibility point activity rule is generally considered an improvement on the simpler eligibility point activity rule, as it provides bidders with greater flexibility to follow a straightforward bidding strategy. In other words, this rule allows the bidder to switch its bid to a package that exceeds its eligibility in a given round (but within its initial eligibility) when that package has become relatively less expensive compared to bids submitted in earlier rounds.

61. In the 700 MHz and 2500 MHz auctions, this activity rule was based on a principle known as the Weak Axiom of Revealed Preference (WARP), which is explained in detail in annex A. This rule checks whether a bid that exceeds a bidder’s current eligibility satisfies revealed preference with respect to bids in eligibility-reducing rounds starting with the last round in which the bidder had sufficient eligibility to bid on that package.

62. The supplementary round provided bidders with an opportunity to improve their bids and to submit bids on additional packages they were interested in. The second price rule provided bidders with the ability to bid up to their valuations on the licences they wanted, knowing that they would not have to pay any more than what other bidders were willing to pay for the licences. Finally, the assignment stage provided bidders with the option to express their preferences for specific licences.

63. ISED believes that bidders would benefit from the structure of the CCA format, and that the format is able to achieve ISED’s objectives for a fair and efficient allocation of spectrum. For these reasons, ISED is considering the CCA format as an option for the 600 MHz auction.

9.3.2 CCA with modified activity rule

64. As noted above, the hybrid revealed preference/eligibility point activity rule is generally considered an improvement over the simpler eligibility point activity rule, as it provides bidders with greater flexibility to follow a straightforward bidding strategy.

65. Recent advancements in auction theory have developed a method to strengthen this rule by redefining it based on a principle known as the Generalized Axiom of Revealed Preference (GARP). This activity rule is explained in detail in annex B.
66. The GARP-based activity rule would make the clock rounds more informative, by reducing the ability of bidders to submit supplementary bids that deviate significantly from their expressed preferences in the clock rounds, and by ensuring that prices more closely reflect opportunity costs.

67. The GARP-based activity rule performs a stricter test when checking whether to allow a bid on a package that exceeds the bidder’s eligibility. In the clock rounds, the activity rule is stricter in two aspects. First, instead of checking only revealed preference constraints generated by eligibility-reducing rounds, the GARP-based activity rule performs a test against bids in all clock rounds starting with the last round in which the bidder had sufficient eligibility to bid on the given package. Second, instead of performing revealed preference checks one by one, the GARP-based activity rule performs a simultaneous check of all relevant revealed preference constraints. The rule is also stricter in the supplementary round, as the maximum bid amount for a given package using the GARP-based activity rule can only be equal to or lower than the maximum using the WARP-based activity rule. The rule is stricter because GARP includes the same constraints as WARP, with possibly additional constraints.

68. The GARP-based activity rule maintains the desirable properties of the WARP-based activity rule described in annex A. First, it provides flexibility so that a bidder can bid truthfully based on a valuation function that specifies a value for each package. Second, it allows a bidder to bid based solely on eligibility points. However, because the GARP-based activity rule is stricter it may prevent a bidder from submitting some bids that would have been possible using a WARP-based activity rule. Annex D provides examples that illustrate the differences in applying the two activity rules.

69. Redefining the hybrid revealed preference/eligibility point rule based on GARP may improve incentives for bidders to bid truthfully, while supporting ISED’s objectives for a fair and efficient allocation of spectrum. For these reasons, ISED is considering the CCA format with the GARP-based activity rule as an option for the 600 MHz auction.

9.3.3 Enhanced combinatorial clock auction (ECCA) format

70. The third design that ISED is considering using for the 600 MHz spectrum auction is the ECCA format, which uses the GARP-based activity rule described in section 9.3.2 above and in annex B, and makes a number of additional changes related to pricing. The ECCA format is explained in detail in annex C.

71. As stated above, one major change is that the ECCA uses the GARP-based activity rule. A second major change is that bidders will receive information on their potential second-price-based payment throughout the allocation stage. This significantly reduces the uncertainty that bidders face regarding the eventual base price for a given package. Specifically, this is done by providing each bidder with a calculation of the price discount it would receive, relative to its bid amount at the next clock prices and based on all bids submitted in the clock rounds thus far, before it submits its bid for the next round. The bidder will receive this discount on its bid amount if the next round is the final clock round and if there is no excess supply.
72. Conceptually, pricing in the ECCA is broadly similar to the CCA as it sets prices for winners equal to the opportunity costs of the blocks they are allocated (second pricing) by measuring the maximum value that their opponents could have for all available licences. The process for determining this maximum value is explained in detail in annex C.

73. The third major change is that prices in the ECCA are primarily determined during the clock rounds and are less dependent on the supplementary bids of other bidders. This reduces the risks of missing bids, where bidders do not submit a sufficient number of bids to properly assess opportunity costs (prices are too low), or of bidders submitting bids that have no chance of winning simply to increase the prices for competitors (prices are too high). Both of these bidding behaviours could result in price disparities between bidders that win similar packages. Therefore, using the ECCA format is likely to result in prices that are more consistent and better reflections of opportunity costs.

74. In the ECCA, the predominant role of the supplementary round is to reduce the excess supply of licences remaining after the final clock round. Therefore, if the final clock round concludes with no excess supply, the supplementary round is not required. If there is excess supply, supplementary bids can only impact base prices by an amount that is related to the value of excess supply after the final clock round. Thus, the ECCA removes the need to withhold aggregate demand information after the final clock round, and the information would be made available to all bidders, as it is for every other clock round.

75. Similar to the CCA, a bidder can increase its bid amount for its final clock package with a supplementary bid. In the ECCA this increased amount can only be up to a certain limit, as described in annex C. Before the supplementary round, the auction system will calculate and inform each bidder of this limit, which is the highest possible base price amount that the bidder could pay for its final clock package.

76. In addition, the ECCA would reduce the uncertainty that a bidder faces about its chances of winning following the supplementary round. Each bidder will be provided with the information necessary to submit a supplementary bid that increases the bid on its final clock package by an amount that would guarantee the bidder wins one of the packages on which it bid during the allocation stage. This amount would be based on the highest price that the bidder bid in each service area that has excess supply after the final clock round, and would be less than or equal to the bidder’s limit on the supplementary bid amount for its final clock package.

77. Using the ECCA may improve incentives for truthful bidding, and information about the discount amount may reduce a bidder’s uncertainty about the base price it will have to pay for a given package. This would provide bidders with greater confidence to bid up to their full valuations. For these reasons, ISED is considering the ECCA format as an option for the 600 MHz auction.
Q5—ISED is seeking comments on:

a) The advantages and disadvantages of the three auction formats being considered for the 600 MHz auction:
   i. Combinatorial clock auction, using the WARP-based activity rule (annex A);
   ii. Combinatorial clock auction, using the GARP-based activity rule (annex B);
   iii. Enhanced combinatorial clock auction (annex C).

b) Where there is a preference for one of the options, respondents are asked to provide a rationale and explanation.

9.4 Structure of the assignment stage

78. Whenever generic blocks are used, the auction format must include an assignment stage to determine the assignment of specific blocks. Recognizing that using contiguous spectrum is generally more efficient, and thus preferable to fragmented spectrum, ISED is proposing that winners of multiple blocks in a service area receive contiguous licences.

79. Both set-aside-eligible and the set-aside-ineligible bidders will have an opportunity to express their preferences for specific blocks at the same time, and there will be no specific blocks reserved for set-aside-eligible or set-aside-ineligible bidders.

80. ISED is proposing to conduct the assignment stage in sequential rounds, service area by service area, in descending order of population. This structure is designed to allow each bidder to know the specific frequencies it won in the most populated service areas prior to participating in the assignment rounds for less populated service areas.

81. ISED is also proposing that two or more service areas be assigned in a single assignment round when the service areas form a contiguous geographic area, and the winners and the number of licences they have won are the same in the service areas being considered.

82. The structure of the assignment stage, which would apply for all three auction format options being considered, is explained in detail in annex A.

Q6—ISED is seeking comments on:

a) The proposal that winners of more than one block in a single service area be assigned contiguous blocks; and
b) The proposed structure of the assignment stage, including the order of the assignment rounds and the combination of service areas into a single assignment round.

9.5 Increasing prices in the clock rounds

83. ISED is consulting on the opening bid amounts for each of the licences being auctioned, as described in table 1, section 12.2 – Opening bids. Prices for the first clock round will be set according to the opening bid prices in the final licensing framework published by ISED, and will be increased during subsequent clock rounds using the methodology for increasing prices described in annex A.
84. The incrementing of prices for the products in a given service area will depend on the aggregate demand for each product in that service area, in accordance with the incrementing methodology specified in section 3 of annex A. For the 600 MHz spectrum auction, ISED is proposing that price increases will be in the range of 1-20% of prices in the previous clock round, rounded to the nearest thousand. During the auction, ISED reserves the right to adjust the amount of round-to-round price increases within this range to facilitate the progress of an efficient and timely auction. Increasing prices according to the methodology described in annex A would provide bidders with the price information needed to inform their bidding strategies; and ensure that the clock price of the set-aside blocks would never exceed the clock price of the open blocks in a given service area.

Q7—ISED is seeking comments on the proposed methodology for incrementing prices during the clock rounds, as described in annex A.

10. Bidder participation—Affiliated and associated entities

85. In order to maintain auction integrity, as in past auctions, ISED proposes that there be rules relating to the participation of affiliated and associated entities in order to ensure that each bidder is an independent bidder. As was the case in previous auctions, it is proposed that affiliated entities not be allowed to participate separately in the auction. It is also proposed that associated entities only be allowed to participate separately if following a review of their application, ISED is satisfied that their participation would not have an adverse impact on auction integrity. As in previous auctions, applicants will be required to disclose information about their company(ies), including affiliations and associations.

10.1 Affiliated entities

86. Proposed definition of affiliated entities: It is proposed that the definition of affiliated entities remain as it was for previous auctions, as follows:

Any entity will be deemed to be affiliated with a bidder if it controls the bidder, is controlled by the bidder, or is controlled by any other entity that controls the bidder. “Control” means the ongoing power or ability, whether exercised or not, to determine or decide the strategic decision-making activities of an entity, or to manage or run its day-to-day operations.

87. Presumption of affiliate status: If a person owns, directly or indirectly, at least 20% of the entity’s voting shares (or where the entity is not a corporation, at least 20% of the beneficial ownership in such entity), ISED will generally presume that the person can exercise a degree of control over the entity to establish a relation of affiliation. The ability to exercise control may also be demonstrated by other evidence. Under this rule, ISED may, at any time, ask a prospective bidder for information in order to satisfy any question of affiliation.
88. Applicants may provide information to ISED to rebut the presumption of affiliate status. Applicants must notify ISED in writing if they are rebutting the presumption and must file material that will enable ISED to review the question and make that determination. It is the responsibility of the applicant to file the appropriate material. Such material may include copies of the relevant corporate documentation relating to both entities; a description of their relationship; copies of any agreements and arrangements between the entities and affidavits or declarations, signed by officers from the two entities, dealing with the control as outlined in the definition of “affiliate” above.

89. Upon receipt of this material, ISED will either make a ruling based on the materials submitted or ask the applicant for further information (and provide a timeline within which to do so).

90. Should the entities fail to provide the relevant information in a timely fashion in order to allow ISED to complete its determination, ISED may make a ruling on eligibility that the entities in question are affiliated.

91. **Eligibility to participate separately in the auction:** It is proposed that only one member of an affiliate relationship be permitted to become a qualified bidder in the auction or the affiliated entities may apply to participate jointly as a single bidder. Affiliated entities must decide prior to the application deadline which entity will apply to participate in the auction. All affiliations must be disclosed at the time of the application.

10.2 Associated entities

92. **Proposed definition of associated entities:** As a basis for participating in the 600 MHz auction, ISED proposes that associated entities be defined as follows:

   Any entities that enter into any partnerships, joint ventures, agreements to merge, consortia or any arrangements, agreements or understandings of any kind, either explicit or implicit, relating to the acquisition or use of any spectrum in the 600 MHz band will be treated as associated entities. Typical roaming and tower sharing agreements would not cause entities to be deemed associated.

93. As in past auctions, the proposed rules would allow carriers to form a bidding consortium and to participate in the auction as a single bidder if they wish to coordinate their bids through a single bidder. In such a case, the eligibility rules would apply jointly in each licence area. In the cases where any of the entities participating jointly would not qualify as a set-aside-eligible bidder, the bidding consortium would not be eligible to bid on set-aside spectrum.

94. The spectrum and network efficiencies that can be achieved through various forms of associations and arrangements may help to address the high demand for capacity by customers and the high cost of network deployment. In support of the stated policy objectives of competition and investment, and in light of the high demand for capacity by customers, the high cost of network deployment, particularly in rural areas, as well as the spectrum and network efficiencies that can be achieved through such arrangements, ISED recognizes the need to
provide increased flexibility in the treatment of a certain subset of associated entities, as long as this would not have an adverse impact on the integrity of the auction.

95. Depending on the nature of the association, it may not preclude the ability of the entities to participate separately in the auction. It should be noted that under the proposed definition, entities are only deemed to be associated with respect to arrangements that relate to the acquisition or use of spectrum in the 600 MHz band. For example, significant joint equipment purchase agreements and joint backhaul networks would not be captured under the definition unless they relate to the 600 MHz spectrum.

96. **Eligibility to participate separately in the auction:** ISED proposes that associated entities may apply to participate separately in the 600 MHz auction. ISED is of the view that allowing associated entities that are competitors in the market to bid separately would not have an adverse impact on the integrity of the auction provided that auction participants comply with the information disclosure and anti-collusion rules as proposed below (section 10.3 – Auction integrity and transparency and section 10.4 – Prohibition of collusion).

97. To obtain approval to participate separately in the auction, associated entities will be required to demonstrate to ISED’s satisfaction that they intend to separately and actively provide services in the applicable licence area. Associated entities wishing to participate in the auction separately would be required to submit their application at least two weeks in advance of the final application deadline. This requirement would provide ISED with the additional time necessary to assess the nature of the association between the entities. The assessment would be based on factors similar to those established for the subordinate licence requests as set out in section 11.2. Should the request be denied, only one of the associated entities will be eligible to apply to participate in the auction. This may also impact this associated entity’s eligibility to bid on the set-aside spectrum.

98. Bidders are reminded that the provisions of the *Competition Act* apply independently of, and in addition to, the proposed policy.

99. Please note that all entities participating in the auction will be subject to the same prohibition of collusion rules, as stated below in section 10.4.

---

**Q8**—ISED is seeking comments on the proposed Affiliated and Associated Entities rules that would apply to bidders in the 600 MHz auction.

### 10.3 Auction integrity and transparency (Information disclosure pre-auction)

100. In order to ensure auction integrity and transparency, all entities wishing to participate in the auction process will be required to disclose in writing, as part of their application, the names of affiliated and associated entities. It is proposed that a narrative also be submitted, describing all key elements and the nature of the affiliation or association in relation to the acquisition of the spectrum licences being auctioned and the post-auction relationships of the said entities. It is proposed that this narrative include arrangements with another potential bidder that relate in any way to the future use of the 600 MHz spectrum directly or indirectly.
101. Some examples of arrangements that would require disclosure include, but are not limited to, agreements to establish a joint network using spectrum licences acquired by each of the entities and agreements with respect to a joint backhaul network if they relate to the use of 600 MHz spectrum. It is also proposed that agreements, such as significant joint equipment purchases, be disclosed. Typical roaming and tower sharing agreements and other agreements, such as the purchase of backhaul capacity, would not cause entities to be deemed associated entities and hence need not be disclosed.

102. The submitted narrative would be made available to other bidders and to the public on ISED’s website prior to the auction in order to ensure transparency of the licensing process.

10.4 Prohibition of collusion and other communication rules

103. As in previous auctions, in order to ensure the integrity of the bidding process, all applicants will be prohibited from cooperating, collaborating, discussing or negotiating agreements with other bidders regarding the licences being auctioned or the post-auction market structure. Any such discussions occurring at any time prior to the public announcement of provisional licence winners by ISED are prohibited.

104. In order to maintain the integrity of the auction, bidders are prohibited from signalling either publicly or privately, their bidding intentions or post-auction market structure related to spectrum in the 600 MHz band, while the auction is ongoing. This would include comments or any communication with or via the media. An example would be making a public announcement regarding which licences the company intends to bid on or its rollout intentions.

105. Given that ISED is proposing to allow the participation of some associated entities as separate bidders in this auction process, the proposed prohibition of collusion rules are as follows:

All applicants, including affiliated and associated entities, are prohibited from cooperating, collaborating, discussing or negotiating agreements with competitors, relating to the licences being auctioned or relating to the post-auction market structure, including frequency selection, bidding strategy and post-auction market strategy, until after the public announcement of provisional licence winners by ISED.

Prospective bidders will note that the auction application forms contain a declaration that the applicant will be required to sign certifying that the applicant has not entered into and will not enter into any agreements or arrangements of any kind with any competitor regarding the amount to be bid, bidding strategies or the particular licence(s) on which the applicant or competitors will or will not bid. For the purposes of this certification, “competitor” means any entity, other than the applicant or its affiliates, which could potentially be a bidder in this auction based on its qualifications, abilities or experience.
Prospective bidders should note that the definition of “affiliate” for the purposes of this licensing process (defined by reference to “control in fact”) differs from “affiliate” for the purposes of the *Competition Act*. The provisions of the *Competition Act* apply independently of, and in addition to, the policies contained in this framework.

10.4.1 Communication during the auction process

106. In order to preserve the integrity of the auction process, any communications from an applicant, its affiliates, associates or beneficial owners or their representatives that discloses or comments on bidding strategies, including but not limited to the intent of bidding and post-auction market structures, shall be considered contrary to this framework and may result in disqualification and/or forfeiture penalties. Statements that indicate national or particular licence areas of interest will generally be found to be in contravention of the rules on prohibition of collusion. This will include communications with or via the media. This prohibition of communication applies until the public announcement of provisional licence winners by ISED.

107. Prior to the auction, an applicant who wishes to participate separately in the licensing process may approach another potential bidder to discuss a joint infrastructure build, a joint equipment purchasing agreement or a potential spectrum sharing agreement under the circumstances outlined in the following two paragraphs.

108. Once a consortium has been established and if the entities within that consortium have had communications that contravene the anti-collusion rules, these entities would no longer be eligible to participate separately in the auction. The same entities would therefore no longer be deemed competitors for the purpose of the auction, and discussions regarding issues such as bidding strategies could then take place. Should the consortium be dissolved prior to the auction, only one of the entities would be eligible to participate in the auction, and all parties would continue to be subject to the prohibition of collusion rules. The same restrictions apply to entities that have had unsuccessful discussions regarding the formation of a consortium to bid as a single bidder.

109. Where communications that fall within the definition of associated entities have taken place, the nature of the association must be disclosed. Entities applying to participate separately are required to make a declaration that they have not entered into and will not enter into any agreements or arrangements of any kind with any competitor regarding the amount to be bid, bidding strategies or the particular licence(s) on which the applicant or competitor will or will not bid. In the case where discussions that contravene the prohibition of collusion rules have occurred, the entities would only be permitted to participate in the auction as one single bidder, or only one of the entities could participate.
10.4.2 Discussion regarding beneficial ownership

110. Information regarding the beneficial ownership of each applicant will be made publicly available so that all bidders have knowledge of the identity of other bidders. Any discussions involving two bidders or any of their affiliates or associates regarding an addition or a significant change of beneficial ownership of a bidder, from the receipt deadline for applications until the public announcement of provisional licence winners by ISED, would fall into the area of prohibited discussions and would be considered contrary to the auction rules.

111. However, an applicant may discuss changes in beneficial ownership with parties who are completely unrelated to other applicants, as long as:

- any change to the beneficial ownership of the applicant that provides a new party with a beneficial interest or which significantly alters the beneficial ownership structure is effected at least 10 days before the commencement of bidding; and
- the applicant informs the Minister immediately in writing of any change in beneficial ownership, which will be reflected in its published qualified bidder information on ISED’s Spectrum Management and Telecommunications website.

112. Bidders must cease all such negotiations at least 10 days before the commencement of bidding until the public announcement of provisional licence winners by ISED.

10.4.3 Other communication rules

113. **Discussions on tower sharing:** The prohibition of communication includes discussions about tower and site sharing regarding the licences that are the subject of this auction until after the public announcement of provisional licence winners by ISED. Discussions concerning new arrangements or the expansion of existing sharing arrangements that relate to spectrum outside of licences being offered in this auction process are not prohibited.

114. **Communication with local exchange carriers:** The prohibition of communication includes discussions regarding interconnection services with a local exchange carrier (LEC) that is a qualified bidder (or one of its affiliates/associates) in this auction, where the services relate to spectrum in the bands offered in this auction process.

115. **Consulting services, legal and regulatory advice:** Separate bidders may not receive consulting advice from the same auction consulting company. Separate bidders may receive legal and regulatory advice from the same law firm provided that the law firm complies with the conflict of interest and confidential information requirements of the applicable law society and that the applicants otherwise comply with the provisions set forth in the licensing framework.

Q9—ISED is seeking comments on the proposed rules prohibiting collusion and other communication rules, which would apply to bidders in the upcoming 600 MHz auction.
11. Conditions of licence for spectrum in the 600 MHz band

116. It should be noted that licences are subject to the relevant provisions in the Radiocommunication Act and the Radiocommunication Regulations. For example, the Minister continues to have the power to amend the terms and conditions of spectrum licences pursuant to paragraph 5(1)(b) of the Radiocommunication Act. The Minister may do so for a variety of reasons, including furtherance of the policy objectives related to the band. Such action would normally only be undertaken after consultation.

11.1 Licence term

117. The Framework for Spectrum Auctions in Canada, published in March 2011, states that ISED has adopted a flexible approach in determining licence terms (up to 20 years) based on the specific spectrum being offered and subject to a public consultation preceding the specific auction or renewal process.

118. This decision was based on the recognition that licence terms in excess of 10 years would create greater incentive for financial institutions to invest in the telecommunications industry and for the industry itself to further invest in the development of network infrastructure, technologies and innovation.

119. The 600 MHz band has the potential to facilitate the offering of high-capacity mobile broadband services to Canadians. Given that the use of this band is harmonized in North America, there is little risk that there will be any usage changes to this spectrum in the foreseeable future. It is also unlikely that any developments in technology would result in a change to another use that is incompatible with mobile broadband services.

120. It is also important to note that ISED recognizes that the current rate of wireless technology development is ever evolving and these developments, such as cognitive radio and dynamic spectrum access, are expected to provide opportunities for increased efficiency for spectrum access. As a result, it is expected that although long-term spectrum licences will continue to provide priority access to spectrum, future consultations will likely explore the possibility of providing for opportunistic access to licensed spectrum.

121. In light of the above, ISED is proposing that auctioned spectrum licences in the 600 MHz band have a licence term of 20 years. The proposed condition of licence is as follows:

The term of this licence is 20 years. At the end of this term, the licensee will have a high expectation that a new licence will be issued for a subsequent term through a renewal process unless a breach of licence condition has occurred, a fundamental reallocation of spectrum to a new service is required, or an overriding policy need arises.

The process for issuing licences after this term and any issues relating to renewal, including the terms and conditions of the new licence, will be determined by the Minister following a public consultation.
Q10—ISED is seeking comments on its proposal to issue spectrum licences in the 600 MHz band with a 20-year licence term and the proposed wording of the condition of licence above.

11.2 Licence transferability and divisibility

122. In general, spectrum licences may be transferred in whole or in part (either in geographic area or in bandwidth) subject to the approval of the Minister. All commercial mobile spectrum licence transfer requests are subject to review under the Client Procedure Circular, CPC-2-1-23, Licensing Procedures for Spectrum Licences for Terrestrial Services, and the Framework Relating to Transfers, Divisions and Subordinate Licensing of Spectrum Licences for Commercial Mobile Spectrum (Transfer Framework) as provided for in the proposed condition of licence below.

123. As commercial mobile services are permitted in the 600 MHz band, the Transfer Framework will apply to spectrum licences in this band. As described in section 2 of this consultation, ISED views the licensing of 600 MHz spectrum as a key opportunity to support competition and to enable regional service providers to improve their wireless networks.

124. As described in section 6, with respect to spectrum in the 600 MHz band, it is proposed that transfers not be permitted where they will result in set-aside-ineligible licensee obtaining set-aside spectrum for the first five years of the licence term. Furthermore, it is proposed that after the first five years, subject to ISED’s approval as defined in section 5.6 of CPC 2-1-23, set-aside spectrum could be transferable to a set-aside-ineligible entity, as long as all conditions of licence have been met at the time of the transfer request, including the graduated deployment requirements as set out in section 11.3 below.

125. With respect to subordinate licensing of set-aside licences, restrictions would also apply. It is proposed that for the first five years, where licensees establish an agreement to share spectrum such that another entity that is set-aside-ineligible has control over the use of the spectrum, as defined in CPC 2-1-23 section 5.6 — Transfer or Division of Spectrum Licences and Subordinate Licensing, in addition to the conditions under section 5.6 of CPC 2-1-23, applicants would be required to demonstrate to the satisfaction of ISED that they intend to, and continue to, make use of the 600 MHz spectrum to actively and independently provide services in the applicable licence area, based on the assessment factors set out below.

126. Assessment factors: ISED will consider a broad range of criteria to determine the associated entities’ intent and actions to actively and independently provide wireless services. Assessment criteria may include, but will not be limited to:

- the companies’ intent and actions to provide services (coverage) in the area in which the sharing occurs;
- the level of investment, including in distribution, marketing and customer service, in order to acquire and serve customers; and
- the companies’ demonstration of separate presences in the marketplace.
127. **Documentation:** Associated entities will be invited to provide all relevant documentation to ISED in regard to the above-noted assessment factors. These may include, but will not be limited to:

- all agreements relating to the transfer of, use of and access to the 600 MHz spectrum;
- business plans for the area in which the agreement(s) will provide access to spectrum;
- and
- business and financial results, including investments and customer acquisition.

128. ISED may request additional documentation to complete its assessment and may require that documents be certified by an officer of the company.

129. ISED’s review will not extend to an overall assessment of the effects of the agreement between associated entities on competition in the marketplace.

130. Licensees must apply to ISED for the issuance of subordinate licences prior to the implementation of any spectrum sharing agreements or any agreement that provides for another party to operate the licensee’s spectrum. For further information on these requirements, refer to CPC-2-1-23, as amended from time to time. These requirements are subject to revision and amendment for reasons including furtherance of the policy objectives related to the 600 MHz band. Licence transfers may also be subject to the provisions of the *Competition Act*.

131. ISED is proposing the following wording for the condition of licence on transferability and divisibility:

> This licence is transferable in whole or in part (divisibility), in both bandwidth and geographic dimensions, subject to ISED’s approval. A Subordinate Licence may also be issued in regard to this licence. ISED’s approval is required for each proposed Subordinate Licence.

> For the first five years of the licence term from the original date of issuance, a set-aside licence obtained by an entity eligible for set-aside spectrum during the licensing process (i.e. auction) is not transferable to a set-aside-ineligible entity. At all times during the licence term, a licence obtained by an entity eligible for set-aside spectrum during the licensing process is transferable to another entity that was eligible for set-aside spectrum, subject to ISED’s approval.

> The licensee must make the Transfer Request in writing to ISED. The Transfer Request will be treated as set out in Client Procedures Circular CPC-2-1-23, *Licensing Procedure for Spectrum Licences for Terrestrial Services*, as amended from time to time.
The licensee must apply in writing to ISED for approval prior to implementing any Deemed Transfer, which will be treated as set out in CPC-2-1-23. The implementation of a Deemed Transfer without the prior approval of ISED will be considered a breach of this condition of licence.

Should the licensee enter into any Agreement that provides for a Prospective Transfer with another holder of a Licence for commercial mobile spectrum (including any Affiliate, agent or representative of the other licence holder), it must apply in writing to ISED for review of the Prospective Transfer within 15 days of entering into the Agreement, which will be treated as set out in CPC-2-1-23. Should ISED issue a decision indicating that the Prospective Transfer is not approved; it will be a breach of this condition of licence for a licensee to remain in an Agreement that provides for the Prospective Transfer for a period of more than 90 days from the date of the decision.

In all cases, the licensee must follow the procedures as outlined in CPC-2-1-23.

All capitalized terms have the meaning ascribed to them in CPC-2-1-23.

Q11—ISED is seeking comments on the proposals on the condition of licence related to transferability and divisibility, and the proposed wording above.

11.3 Deployment requirements

132. ISED uses deployment obligations to encourage licensees to put the spectrum to use and to deter acquisition of spectrum licences by speculators and those whose intent is to preclude access to the spectrum by their competitors.

133. Deployment requirements generally require licensees to provide coverage to a certain percentage of the population in each licence area within a given time period. Similar conditions of licence have been applied to previously auctioned spectrum licences. In the 700 MHz auction in 2014, general deployment levels were set for each licence area based on a percentage of the population for each Tier 2 service area. Similar levels were also set out for the general deployment requirements for the 2500 MHz and AWS-3 auctions in 2015, with mid-term deployment requirements set at various tier levels in the AWS-3 band.

134. Having mid-term deployment requirements would help to ensure that deployment progresses across all licence areas throughout the licence term. The proposed deployment requirements take into account the unique circumstances of each licence area so that the majority of the population will have access to wireless broadband services expeditiously. Licensees would be required to meet certain deployment levels based on Tier 2 service areas (Tier 4 in the North) by Year 5 (annex F, table F1), levels based on Tier 3 service areas (Tier 4 in the North) by Year 10 (annex F, table F2), and levels based on Tier 4 service areas by Year 20 (annex F, table F3). The proposed deployment requirements would create an obligation for licensees to continue to build-out over time, in support of providing Canadians with timely access to the most advanced wireless technologies and devices.
135. Deployment requirements will be based on the most recent census information available at the time of assessment.

136. Where a licence is transferred, the requirement for the new licensee to deploy will continue to be based on the initial licence issuance date. Deployment by a subordinate licensee will count towards the requirement of the primary licensee.

137. ISED proposes the following wording for this condition of licence:

Licensees will be required to demonstrate to the Minister that this spectrum has been put to use to provide services, as specified in table F1 within 5 years of the initial issuance of the licence, as specified in table F2 within 10 years of the initial issuance of the licence, and as specified in table F3 within 20 years of the initial issuance of the licence.

Where a licence is transferred, the requirement for the new licensee to deploy will continue to be based on the initial licence issuance date.

Q12—ISED is seeking comments on the proposed deployment condition of licence as stated above.

11.4 Other conditions of licence

138. ISED is seeking comments on the above proposed conditions of licence and the conditions of licence outlined in annex G that would apply to licences issued through the proposed auction process for spectrum in the 600 MHz band. The proposed conditions of licence in annex G are based on existing policies and procedures.

Q13—ISED is seeking comments on proposed conditions of licence outlined in annex G that would apply to licences issued through the proposed auction process for spectrum in the 600 MHz band.

12. Auction process

139. The following section outlines the proposed general process for submitting an application to participate in the 600 MHz auction, as well as the general requirements and rules that would apply prior to, during and post-auction.
12.1 Application to participate

140. To participate in an auction, all applicants must submit a completed application form, along with a financial deposit, details of the applicant’s beneficial ownership, information on any affiliations and associations as discussed in section 10 of this document, and other corporate documentation as required. ISED will publish the list of applicants on its website soon thereafter.

12.2 Opening bids

141. Opening bids are the prices for the spectrum licences at the start of the auction, and the minimum that will be accepted for each licence. The proposed opening bid prices can be found in table 1 below.

142. The 600 MHz band is comparable to the 700 MHz band in that they have similar propagation characteristics and are both recognized as commercial mobile frequency bands. The determination of the proposed 600 MHz opening bid prices takes into account the results of the 700 MHz auction and reflects the relative value of the licences in the different service areas.

143. In the 700 MHz auction, the determination of the opening bid prices took into account the results of past Canadian auctions and reflected the relative value of the licences in the different service areas. The minimum acceptable opening bid price, applied to 9 of the 14 service areas, was based on the annual Cellular/PCS licence fee adjusted to reflect a 20-year licence term, using a 14% discount rate. Three of the remaining five service areas (Eastern Ontario and Outaouais, Alberta and British Columbia) were 1.2 times the minimum price level, and the remaining two service areas (Southern Ontario and Southern Quebec) were 2.6 times the minimum price level.

144. The proposed 600 MHz auction opening bid prices are based on the results of the 700 MHz auction and considers the lowest final price paid in each service area. To determine this price, the final 700 MHz auction payment of each auction winner was distributed among the licences that were part of the winning package in proportion to the final clock prices of these licences. The lowest-priced block in each service area, in $/MHz/pop, was used to determine the proposed opening bid prices for the 600 MHz auction.
145. In addition, similar to the 700 MHz auction, it is proposed that the service areas be
grouped into different price levels, to reflect the similarities in the relative value of the licences
in these areas. In order to remain on the conservative side and to reduce the risk of discouraging
participation from viable participants, the lowest final price paid for any service area in a group
was selected as the proposed opening bid price for that group.

146. In the North, one licence was not sold during the 700 MHz auction and did not receive
any bids in the subsequent Auction of Residual Licences in 2015, even though this licence was
split into three smaller licence areas. In order to attract auction participants to bid on these
licences in the 600 MHz band, it is proposed that the opening bids be adjusted to 50% of the
initial 700 MHz opening bids.

147. Proposed opening bid prices are as follows:

- Group 1: $0.804/MHz/pop in Southern Ontario and Southern Quebec
- Group 2: $0.539/MHz/pop in Eastern Ontario and Outaouais, Alberta, and British Columbia
- Group 3: $0.36/MHz/pop in Newfoundland and Labrador, Nova Scotia and Prince Edward Island, New Brunswick, Eastern Quebec, Northern Quebec, Northern Ontario, Manitoba, and Saskatchewan
- Group 4: $0.133/MHz/pop in Yukon, Nunavut and Northwest Territories

148. For each service area, the proposed opening bids were determined by multiplying the
proposed prices in $/MHz/pop as outlined above by the population of the service area as shown
in table 1 below. The population data is based on Statistics Canada’s 2016 Census.

149. Bids at or above the proposed opening bid prices will ensure that Canadians obtain a fair
return for the use of this spectrum and that, at the very least, will be comparable to the minimum
value established in the 700 MHz auction. The total amount of the proposed opening bids for all
seven spectrum blocks nationwide is $1.537 billion.

150. The total amount of opening bids for one block of 10 MHz nationwide would be
$219.5 million.
Table 1: Proposed opening bid prices (in descending order of population)

<table>
<thead>
<tr>
<th>Service area #</th>
<th>Service area name</th>
<th>Population</th>
<th>Opening bid prices S/MHz/pop</th>
<th>Opening bid ($ 10 MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-008</td>
<td>Southern Ontario</td>
<td>10,609,746</td>
<td>0.804</td>
<td>85,302,000</td>
</tr>
<tr>
<td>2-005</td>
<td>Southern Quebec</td>
<td>5,895,985</td>
<td>0.804</td>
<td>47,404,000</td>
</tr>
<tr>
<td>2-013</td>
<td>British Columbia</td>
<td>4,647,973</td>
<td>0.539</td>
<td>25,053,000</td>
</tr>
<tr>
<td>2-012</td>
<td>Alberta</td>
<td>4,070,844</td>
<td>0.539</td>
<td>21,942,000</td>
</tr>
<tr>
<td>2-006</td>
<td>Eastern Ontario and Outaouais</td>
<td>2,435,880</td>
<td>0.539</td>
<td>13,129,000</td>
</tr>
<tr>
<td>2-004</td>
<td>Eastern Quebec</td>
<td>1,699,378</td>
<td>0.360</td>
<td>6,118,000</td>
</tr>
<tr>
<td>2-010</td>
<td>Manitoba</td>
<td>1,278,016</td>
<td>0.360</td>
<td>4,601,000</td>
</tr>
<tr>
<td>2-011</td>
<td>Saskatchewan</td>
<td>1,094,705</td>
<td>0.360</td>
<td>3,941,000</td>
</tr>
<tr>
<td>2-002</td>
<td>Nova Scotia and Prince Edward Island</td>
<td>1,066,470</td>
<td>0.360</td>
<td>3,839,000</td>
</tr>
<tr>
<td>2-009</td>
<td>Northern Ontario</td>
<td>778,449</td>
<td>0.360</td>
<td>2,802,000</td>
</tr>
<tr>
<td>2-003</td>
<td>New Brunswick</td>
<td>745,596</td>
<td>0.360</td>
<td>2,684,000</td>
</tr>
<tr>
<td>2-001</td>
<td>Newfoundland and Labrador</td>
<td>520,176</td>
<td>0.360</td>
<td>1,873,000</td>
</tr>
<tr>
<td>2-007</td>
<td>Northern Quebec</td>
<td>193,926</td>
<td>0.360</td>
<td>698,000</td>
</tr>
<tr>
<td>4-172</td>
<td>Northwest Territories</td>
<td>41,668</td>
<td>0.133</td>
<td>55,000</td>
</tr>
<tr>
<td>4-171</td>
<td>Nunavut</td>
<td>35,975</td>
<td>0.133</td>
<td>48,000</td>
</tr>
<tr>
<td>4-170</td>
<td>Yukon</td>
<td>35,928</td>
<td>0.133</td>
<td>48,000</td>
</tr>
<tr>
<td><strong>Total per 10 MHz block</strong></td>
<td></td>
<td><strong>35,150,715</strong></td>
<td><strong>0.625</strong></td>
<td><strong>219,537,000</strong></td>
</tr>
<tr>
<td><strong>Total for all blocks</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>1,536,759,000</strong></td>
</tr>
</tbody>
</table>

Q14—ISED is seeking comments on the proposed opening bids as presented in table 1.
12.3 Proposed eligibility points for the 600 MHz spectrum auction

151. The proposed eligibility points associated with the licences being made available in the 600 MHz auction are based on opening bids.

152. Proposed points per service area are listed in table 2. One eligibility point has been assigned for each $48,000 of opening bid prices and rounded to ten points in all service areas with the exception of the North. Each service area in the North was assigned one eligibility point.

153. The equivalent of a national licence, comprised of one 10 MHz block of spectrum in the 16 service areas covering the country, would be associated with 4,583 eligibility points.

Table 2: Proposed opening bid prices and eligibility points

<table>
<thead>
<tr>
<th>Service area #</th>
<th>Service area name</th>
<th>Population</th>
<th>Opening bid prices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$/MHz/pop</td>
</tr>
<tr>
<td>2-001</td>
<td>Newfoundland and Labrador</td>
<td>520,176</td>
<td>0.360</td>
</tr>
<tr>
<td>2-002</td>
<td>Nova Scotia and Prince Edward Island</td>
<td>1,066,470</td>
<td>0.360</td>
</tr>
<tr>
<td>2-003</td>
<td>New Brunswick</td>
<td>745,596</td>
<td>0.360</td>
</tr>
<tr>
<td>2-004</td>
<td>Eastern Quebec</td>
<td>1,699,378</td>
<td>0.360</td>
</tr>
<tr>
<td>2-005</td>
<td>Southern Quebec</td>
<td>5,895,985</td>
<td>0.804</td>
</tr>
<tr>
<td>2-006</td>
<td>Eastern Ontario and Outaouais</td>
<td>2,435,880</td>
<td>0.539</td>
</tr>
<tr>
<td>2-007</td>
<td>Northern Quebec</td>
<td>193,926</td>
<td>0.360</td>
</tr>
<tr>
<td>2-008</td>
<td>Southern Ontario</td>
<td>10,609,746</td>
<td>0.804</td>
</tr>
<tr>
<td>2-009</td>
<td>Northern Ontario</td>
<td>778,449</td>
<td>0.360</td>
</tr>
<tr>
<td>2-010</td>
<td>Manitoba</td>
<td>1,278,016</td>
<td>0.360</td>
</tr>
<tr>
<td>2-011</td>
<td>Saskatchewan</td>
<td>1,094,705</td>
<td>0.360</td>
</tr>
<tr>
<td>2-012</td>
<td>Alberta</td>
<td>4,070,844</td>
<td>0.539</td>
</tr>
<tr>
<td>2-013</td>
<td>British Columbia</td>
<td>4,647,973</td>
<td>0.539</td>
</tr>
<tr>
<td>4-170</td>
<td>Yukon</td>
<td>35,928</td>
<td>0.133</td>
</tr>
<tr>
<td>4-171</td>
<td>Nunavut</td>
<td>35,975</td>
<td>0.133</td>
</tr>
<tr>
<td>4-172</td>
<td>Northwest Territories</td>
<td>41,668</td>
<td>0.133</td>
</tr>
<tr>
<td><strong>Total per 10 MHz block</strong></td>
<td><strong>35,150,715</strong></td>
<td><strong>0.625</strong></td>
<td><strong>219,537,000</strong></td>
</tr>
<tr>
<td><strong>Total for all blocks</strong></td>
<td><strong>1,536,759,000</strong></td>
<td><strong>32,081</strong></td>
<td></td>
</tr>
</tbody>
</table>
12.4 Pre-auction deposits

154. In order to enhance the integrity of the auction, ISED requires that all bidders submit a pre-auction financial deposit with their auction application. The financial deposit must be in the form of a certified cheque, bank draft, money order, wire transfer, or an irrevocable standby letter of credit, payable to the Receiver General for Canada, drawn on a financial institution that is a member of the Canadian Payments Association.

155. Similar to previous auctions, ISED proposes to determine the value of the pre-auction financial deposit based on the licences on which the applicant wishes to be eligible to bid. Each licence has been assigned a specific number of eligibility points that are approximately proportionate to the opening bid prices, as demonstrated in table 2. For spectrum licences to be auctioned in the 600 MHz band, it is proposed that the financial deposit be equal to $48,000 per eligibility point.

156. An individual bidder requesting to be eligible to bid on the equivalent of one national 10 MHz block would have to submit a deposit covering 4,583 points, which would equate to $219,984,000 (i.e. $48,000 x 4,583). Financial deposit(s) will be returned to any applicant that is found not to be a qualified bidder and to any applicant that provides written notification to ISED of its withdrawal from the process prior to the auction’s commencement. Financial deposits will be returned to unsuccessful bidders once the auction has closed.

Q15—ISED is seeking comments on the proposed eligibility points for spectrum licences in the 600 MHz as outlined in table 2, and pre-auction deposits as outlined above.

12.5 Final payment and forfeiture penalties

157. Within 10 business days following the publication of provisional licence winners, each provisional licence winner will be required to submit 20% of its final payment. The remaining portion of 80% will be due within 30 business days following the announcement of provisional licence winners. These payments will be non-refundable.

158. Following the conclusion of the auction, winning bidders that fail to comply with the specified payment schedule or fail to come into compliance with the eligibility requirements of the Radiocommunication Regulations, will be considered disqualified and will forfeit their ability to obtain licences through this process. Furthermore, non-compliant bidders will be subject to a forfeiture penalty in the amount of the difference between the forfeited bid and the ultimate price of the licence—to be determined by a subsequent licensing process.

159. In addition to the forfeiture penalties set out above, the applicant and/or its representatives may be subject to prosecution, administrative monetary penalties, or other enforcement procedures under the Radiocommunication Act if the auction rules are breached.
12.6 Bidder training and support

160. Qualified bidders will receive the necessary information to participate in the auction several weeks prior to the start of the auction. Information will include, but will not be limited to, an information session, a user manual for the auction system, instructions and passwords to access the secure auction system, along with the schedule for training, mock auctions, and the start of the bidding process.

161. A mock auction will be held, likely during the weeks prior to the start of the auction, in order to allow qualified bidders to better familiarize themselves with the auction system.

13. Post-auction licensing process for unassigned licences

162. ISED will consider making unassigned licences available for licensing through an alternative process, which could include a subsequent auction at a later date following the close of the initial auction. The timing and form of such a process will depend on the demand for the available licences. ISED may conduct a public consultation should it consider it necessary.

14. Licence renewal process

163. Following the end of the initial licence term, licensees will have a high expectation that a new licence will be issued for a subsequent term through a renewal process unless a breach of licence condition has occurred, a fundamental reallocation of the spectrum to a new service is required, or an overriding policy need arises.

164. As part of the licence renewal process, the Minister retains the power to fix and amend the terms and conditions of spectrum licences during the term of the licence and at the end of the term in accordance with subsection 5(1) of the Radiocommunication Act. As noted in the FSAC, licence fees that reflect some measure of market value will apply to licences issued through a renewal process. Accordingly, the renewal process will serve to determine whether new licences will be issued, the terms and conditions that will apply to the new licences and the applicable licence fees.

165. Generally, approximately two years prior to the end of the licence term, ISED will review whether there is a need for a fundamental reallocation of the spectrum to a new service, or whether an overriding policy need has arisen. A review of the licensee’s continued compliance with the conditions of licence will also begin. ISED will launch a public consultation to discuss whether or not, in light of the above-noted issues, new licences should be issued for a subsequent term. The consultation paper will also propose, and invite comments on, licence conditions and fees that would apply during the subsequent licence term.
166. It is proposed that the renewal process include a public consultation process that would commence approximately two years prior to the end of the licence term.

Q16—ISED is seeking comments on the proposed renewal process for spectrum licences in the 600 MHz band.

15. Revisions to the Canadian Table of Frequency Allocations

167. The Canadian Table of Frequency Allocations (CTFA) establishes the frequency allocations available for radio services in Canada. While the mobile broadband service is expected to be the primary use of the 600 MHz band, ISED proposed to provide flexible licensing in this frequency range, enabling the deployment of any application under the mobile, fixed or broadcasting services.

168. In SLPB-004-15, ISED announced that the required updates to the CTFA after the conclusion of the U.S. incentive auction would allow ISED to determine more precisely and with greater information the frequency ranges where co-primary allocations for mobile and fixed services should be added. Accordingly, the issues related to allocations and the adoption of international footnotes are being addressed in a separate consultation on the CTFA.

16. Clarification questions process

169. As done in previous auctions, following a decision on the questions raised in this consultation paper, ISED will accept written questions soliciting clarification of the rules and policies set out in the decision paper for a limited period of time, which will be specified in the final licensing framework. Written questions, submitted by the deadline, and ISED’s responses will be made public on the department’s website.

17. Submitting comments

170. Respondents are requested to provide their comments in electronic format (WordPerfect, Microsoft Word or Adobe PDF) to the following e-mail address: ic.spectrumauctions-enchereuspectre.ic@canada.ca.

171. Written submissions should be addressed to the Senior Director, Spectrum Licensing and Auction Operations, Innovation Science and Economic Development, 235 Queen Street, Ottawa, Ontario K1A 0H5.
172. All submissions should cite the Canada Gazette, Part I, the publication date, the title and the notice reference number (SLPB-005-17). Parties should submit their comments no later than October 2, 2017, to ensure consideration. Soon after the close of the comment period, all comments received will be posted on the department’s Spectrum management and telecommunications website at http://www.ic.gc.ca/spectrum.

173. Innovation Science and Economic Development will also provide interested parties with the opportunity to reply to comments from other parties. Reply comments will be accepted until October 25, 2017.

174. Following the initial comment period, Innovation Science and Economic Development may, at its discretion, request additional information if needed to clarify significant positions or new proposals. In such a case, the reply comment deadline may be extended.

18. Obtaining Copies

175. All spectrum-related documents referred to in this paper are available on ISED’s Spectrum Management and Telecommunications website at http://www.ic.gc.ca/spectrum.

176. For further information concerning the process outlined in this document or related matters, contact:

Innovation Science and Economic Development Canada
C/o Senior Director, Spectrum Licensing and Policy Branch
235 Queen Street (6th floor, East Tower)
Ottawa, Ontario K1A OH5
Telephone: 613-302-3436
TTY: 1-866-694-8389
Email: ic.spectrumauctions-encheresduspectre.ic@canada.ca
Annex A: The combinatorial clock auction (CCA) format

Note: ISED is currently consulting on multiple options for the auction format. For clarity, this annex is written as a guide for how the auction format would work if implemented based on the proposals set out in this consultation paper, and does not give any indication of the decision that will be made by ISED.

1. A combinatorial clock auction (CCA) is a bidding process that includes a price discovery stage, which is similar to the simultaneous multiple round ascending (SMRA) auction format. However, the CCA format also has attributes that remove or reduce some design concerns associated with the SMRA format. In particular, in a CCA, bidders are able to bid on packages of licences instead of individual licences, eliminating the risk that bidders may win some but not all of the licences that they desire. This is particularly important given the regional nature of the licences to be auctioned in this process and the complementarities that exist between these licences.

2. As proposed in section 6 of the consultation, upon application to participate in the auction, applicants would be required to indicate whether they are applying as a set-aside-eligible or set-aside-ineligible bidder on a service area by service area basis (and, hence, the category of product that they would like to bid for on a service area by service area basis). Set-aside eligibility will be subject to ISED approval.

3. There will be a supply of seven blocks in each of 16 service areas. Three blocks in each of the 16 services areas will be reserved for set-aside-eligible bidders. The pairing of a service area and a category is referred to as a “product.” Given that there will be two categories (“set-aside” and “open”) in each of the 16 service areas, there will be a total of 32 products offered in the 600 MHz auction.

1. Overview of the CCA

4. A CCA usually consists of two stages, the allocation stage and the assignment stage. Figure A1 illustrates the process in each stage. In the allocation stage, the number of spectrum licences that a bidder will win in each service area as well as the base price to be paid by each winning bidder are determined. Where generic licences are offered, an additional stage is needed to determine the specific frequencies that will be assigned to each winning bidder. This stage is referred to as the assignment stage.
2. The allocation stage

5. The allocation stage of the auction determines the winning bidders as well as the number of licences they have won. It is divided into two phases: the clock rounds and the supplementary round. All valid bids submitted during the allocation stage are used to determine the winning packages and the base prices.

6. The clock rounds allow for price discovery, helping to reduce a bidder’s uncertainty regarding the value of the licences. Bidders are able to respond to the price changes accordingly, shifting their bids to licences that continue to be consistent with their business objectives.

7. During each clock round, bidders are able to bid on only one package of licences; however, there may be other packages that they would be interested in winning. The supplementary round provides bidders with an opportunity to improve on bids that they placed in the clock rounds and/or to submit bids on packages that they were eligible to bid on, but did not submit, during the clock rounds.
3. **Clock rounds**

8. The allocation stage begins with the clock rounds.

9. The licences are auctioned simultaneously over multiple clock rounds. In each round, bidders indicate the number of licences in each service area on which they would like to bid, given the prevailing prices. The bid for a product cannot exceed the product’s maximum supply. Thus, a set-aside-eligible bidder’s bid for a set-aside product could be for 0, 1, 2, 3, 4, 5, 6 or 7 licences, while a set-aside-ineligible bidder’s bid for an open product could be for 0, 1, 2, 3 or 4 licences. This applies to bids in both the clock rounds and the supplementary round. All of the individual bids placed by a bidder in a given round are considered to be a single package bid, creating an all-or-nothing bid. The price of the package bid is equal to the sum of the bids for individual products, evaluated at the prevailing clock prices.

10. In the first clock round, the price of all licences in each product will be equal to the opening bid price listed in section 12.2.

11. In subsequent clock rounds:

   a. The price of only the set-aside product in a service area will increase from the previous round when the aggregate demand for the set-aside product exceeds three and both of the following conditions are satisfied: i) the aggregate demand for the open product is at most four; and ii) the price of the set-aside product is less than the price of the open product. However, if this would result in the price of the set-aside product exceeding the price of the open product, then the price of the open product will instead be set equal to the same price that has been determined for the set-aside product. The price of the set-aside product will never be set above the price of the open product.

   b. The price of only the open product in a service area will increase from the previous round when the aggregate demand for the open product exceeds four and the aggregate demand for the set-aside product is at most three.

   c. The prices of both products in a service area will increase from the previous round when the aggregate demand for the set-aside product exceeds three and either of the following two conditions are satisfied: the aggregate demand for the open product exceeds four; or the prices of the two products are equal and the sum of the aggregate demands for the set-aside and open products exceeds seven.

   d. If none of the conditions (a), (b) or (c) are satisfied for a service area, then the prices of neither of the products in the service area will increase from the previous round.
12. The bid increments for the 600 MHz auction will be in the range of 1-20% of prices in the previous clock round (rounded to the nearest thousand). Throughout the course of the auction, ISED reserves the right to adjust the bid increments to facilitate an efficient and timely auction.

13. To remain in the auction, a bidder must submit a valid bid with a value greater than zero for at least one licence in the first clock round. The last valid bid that a bidder submits during each clock round will be binding and will be considered in determining both winning packages and base prices at the end of the allocation stage. However, bidders may increase their bids from the clock rounds in the supplementary round, subject to the activity rules.

4. Conclusion of bidding in the clock rounds

14. The clock rounds will end when there is a round in which there is no product in any service area whose price is required to be incremented. This round is referred to as the final clock round. The package on which a bidder placed a bid in the final clock round is referred to as its final clock package. At this point, ISED will announce to bidders that the clock rounds have ended and that the auction will proceed to the supplementary round (see section 8 of this annex).

5. Information in the clock rounds

15. Before the start of each clock round, bidders will receive information regarding their own bids from the previous round and their own eligibility in the next round. In addition, all bidders will be informed of the aggregate demand for each service area from the previous round as well as the prices for each product in the next round. Bidders will not be informed about the individual bids submitted by other bidders or about the remaining eligibility of other bidders. In addition, information about the aggregate demand from the final clock round will be withheld until the end of the auction.

6. Eligibility points

16. Each of the 16 service areas has been assigned a specific number of eligibility points in proportion to the estimated value of the spectrum. One eligibility point has been assigned per $48,000 in opening bid prices for each 10 MHz block of spectrum in a service area. Section 12.3 of this consultation lists the eligibility points associated with a product in each service area, as well as the population of the service area.

17. Eligibility points are used in the determination of the pre-auction financial deposits and in the activity rules applied during the auction, which influence the bids that bidders can submit. In its application, each potential bidder must indicate the total number of “points” worth of licences on which it wishes to bid and submit a corresponding financial deposit. A bidder’s initial eligibility defines an upper limit on the size of the packages of licences for which the bidder can bid. As in past spectrum auctions, bidders begin each clock round with a set number of eligibility points, which determines their maximum activity level for the given clock round. For example, a
bidder with 100 eligibility points can bid on any package of licences, up to a total sum of 100 points. Subsequent levels of eligibility are based on bids in previous clock rounds. All clock rounds in which the bidder does not bid on licences worth the full amount of its eligibility in that round are considered eligibility-reducing rounds.

18. Bidders will not be able to increase their eligibility points after the deadline for application changes.

7. **WARP-based activity rule in the clock rounds**

19. The revealed preference/eligibility point hybrid activity rule will be applied in each clock round. It comprises both an eligibility point activity rule and a revealed preference activity rule. The revealed preference component of the activity rule is based on the weak axiom of revealed preference (WARP). By contrast, it is also possible for the revealed preference component to be based on the generalized axiom of revealed preference (GARP)—as described in annex B.

20. The activity rule has been established to promote truthful bidding throughout the clock rounds, facilitating the price discovery process and allowing bidders to make changes to their bidding strategies dynamically during the auction, in response to increasing prices. The activity rule discourages bidders from misrepresenting their true demand, as doing so will limit their ability to bid on what they really want later in the auction.

21. ISED will institute a 100% eligibility point activity requirement for the 600 MHz spectrum auction. Specifically, in each round, a bidder will be required to bid on licences totalling 100% of its eligibility points if it wishes to maintain that eligibility in the subsequent round.

22. This means that the eligibility point component considers the “size” of the package being bid on, in terms of total eligibility points, and requires bidders to bid on packages that are the same size or smaller as prices increase. When a bidder switches to a smaller package of licences (in other words, totalling fewer eligibility points) the bidder’s eligibility is reduced to the eligibility points of that package.

23. Bidders are required to have eligibility points to bid during the clock rounds. If a bidder reduces its eligibility to zero, the bidder will no longer be able to bid in the clock rounds, but will still be able to bid in the supplementary round provided that it has submitted at least one valid bid with a value greater than zero during the clock rounds.

24. However, there are some shortcomings with using only an eligibility point activity rule. It may create an incentive for bidders to choose only larger packages when prices are low, rather than packages that may work better for them, so that they maintain a larger number of eligibility points for later in the auction. This could lessen price discovery. Furthermore, an eligibility point activity rule may prevent a bidder from making a desirable substitution to a package that is larger in terms of associated eligibility points, but which has become relatively less expensive. In such a case, the eligibility point activity rule would prevent the bidder from bidding on its most preferred package.
25. Revealed preference refers to the information that a bidder discloses during the auction regarding its inclination toward one package versus another. In particular, under WARP, if a bidder chooses one package over another given a certain price differential between the two packages, then the bidder should always choose the same package given the same price differential. The revealed preference component of the activity rule based on WARP will allow bidders to exceed their eligibility points in order to bid on packages that have become comparatively less expensive, affording bidders greater flexibility to bid on their preferred packages and therefore lessening the shortcomings of only using an eligibility point rule.

26. Consider a bidder who has a well-defined valuation, \( v(Q) \), for every package \( Q \) and who seeks to maximize \( v(Q) - PQ \), i.e. the difference between \( v(Q) \) and the price \( P \) paid for package \( Q \). (In the academic literature, this objective is referred to as “quasilinear” utility.) Suppose that such a bidder desires either a smaller package, \( X \), or a larger package, \( Y \), but not both. At the current prices, \( X \) is preferred, but in subsequent rounds, the prices for the licences in \( X \) increase much faster than the prices for the licences in \( Y \). As a result, the bidder prefers \( Y \) to \( X \) at the new prices. The revealed preference activity rule allows the bidder to switch from \( X \) to \( Y \) because \( Y \) is now the better value for a bidder with quasilinear utility. In contrast, the eligibility point activity rule would not allow the switch because \( Y \) is larger than \( X \). This example illustrates both the problem with using the eligibility point activity rule exclusively as well as the advantage of using the eligibility point activity rule in combination with the revealed preference rule.

27. As indicated by the equation below, a package \( Q_t \) bid in clock round \( t \) satisfies revealed preference with respect to an earlier clock round \( s \) for a given bidder (with quasilinear utility) if the bidder’s package \( Q_t \) has become relatively less expensive than the bidder’s package \( Q_s \) bid in clock round \( s \), as the clock prices have progressed from round \( s \) to round \( t \). Algebraically, the revealed preference constraint is the condition that:

\[
\sum_{i=1}^{m} (Q_{t,i} \times (P_{t,i} - P_{s,i})) \leq \sum_{i=1}^{m} (Q_{s,i} \times (P_{t,i} - P_{s,i}))
\]

where:

- \( i \) indexes the products
- \( m \) is the number of products, proposed to be 32 in the 600 MHz band auction
- \( Q_{t,i} \) is the quantity of the \( i \)th product bid in clock round \( t \)
- \( Q_{s,i} \) is the quantity of the \( i \)th product bid in clock round \( s \)
- \( P_{t,i} \) is the clock price of the \( i \)th product bid in clock round \( t \)
- \( P_{s,i} \) is the clock price of the \( i \)th product bid in clock round \( s \)
28. Under the revealed preference/eligibility point hybrid activity rule based on WARP, a given bidder is allowed to bid for the package, $Q_t$, in clock round $t$ if: (a) the eligibility points associated with $Q_t$ are no greater than the given bidder’s current eligibility; or (b) $Q_t$ satisfies the revealed preference constraint with respect to all eligibility-reducing rounds prior to clock round $t$ for the given bidder, starting with the last round that the bidder had sufficient eligibility for $Q_t$.

29. While a bidder may be permitted by the revealed preference/eligibility point hybrid activity rule to bid for a package larger than its current eligibility, bidding on the larger package will not increase the bidder’s eligibility in subsequent rounds. Furthermore, the bidder will never be able to bid on a package with associated eligibility points that exceed the bidder’s initial eligibility. For examples of the WARP-based activity rule, refer to annex D.

30. Using an activity rule containing both an eligibility point component and a revealed preference component will provide extra flexibility to the bidder. A bidder can continue to bid the same as it would under the eligibility point activity rule. In addition, the bidder is given some extra flexibility to bid on a larger package provided that the larger package has become relatively less expensive, thereby allowing more opportunity for bidders to adjust their bids in response to information received during the clock rounds.

8. Supplementary round

31. The second phase of the allocation stage is the supplementary round. This is a single round process where bidders have the opportunity to place additional bids for packages of licences at prices they choose, subject to constraints based on the bids that they submitted during the clock rounds (see section 9 of this annex). Supplementary bids are critical to ensuring both that the licences are allocated to the bidders who value them the most and that winning bidders pay an amount that is sufficient to ensure that no other bidder or group of bidders was willing to pay more for the licences. The supplementary round will still be held even when all licences are provisionally allocated at the end of the clock rounds.

32. During each clock round, bidders are limited to submitting a single package bid at the announced prices for that round. However, bidders may want to increase their bids in order to reflect their own values for those packages of licences. Furthermore, bidders may be interested in winning other packages that they were eligible for in the clock rounds, but have yet to bid on. The supplementary round provides bidders with an opportunity to submit their best and final bids on packages that they have previously bid on and to submit new bids on the other packages that they are interested in.

33. Each bidder that is eligible to participate in the supplementary round will have the opportunity to submit supplementary bids. These will be all-or-nothing, mutually exclusive package bids on the combinations of licences that the bidder is interested in winning. Valid quantities of licences follow the same rules as in paragraph 9 above.
9. **WARP-based activity rule in the supplementary round**

34. The activity rule in the supplementary round complements the activity rule in the clock rounds, encouraging truthful bidding throughout the allocation stage of the auction by ensuring that supplementary bids are consistent with preferences expressed in the clock rounds.

35. Any bidder that placed at least one valid bid with a value greater than zero in the clock rounds will be able to submit bids in the supplementary round. However, a bidder is not required to submit bids in the supplementary round.

36. All licences are available for bidding in the supplementary round, so that bidders will be able to improve on bids submitted during the clock rounds or to submit bids for packages of licences that they were eligible to bid for in the clock rounds but did not.

37. A bidder will be able to submit a supplementary bid for any given package of licences within its initial eligibility. However, bidders will not be allowed to submit a bid on the zero package, as the only allowable bid amount is zero ($0). The limit on the number of different supplementary round packages that a bidder will be allowed to place will be announced after the bidder qualification has occurred, but will be no less than 500 different packages.

38. The amount of a supplementary bid must be at least the sum of the opening bid prices for all of the licences included in the bid. Furthermore, if a bidder submits a supplementary bid on a package from the clock rounds, the bid amount for that package must be greater than the bidder’s highest clock round bid for that package.

*Revealed preference limit for a supplementary bid*

39. There is no limit on the supplementary bid amount for the final clock package, which is the package that the bidder bid on in the final clock round, unless the final clock package is the zero package. All other supplementary bids must satisfy revealed preference with respect to the final clock round, regardless of whether the supplementary bid package is larger or smaller than the final clock package.

40. In addition, supplementary bids for packages that exceed the bidder’s eligibility in the final clock round must satisfy revealed preference with respect to each eligibility-reducing round, beginning with the last round in which the bidder had sufficient eligibility to bid on the package. The application of the revealed preference limit to limit bids on packages larger than the final clock package could have the effect of creating a chain of constraints on the dollar amount of a supplementary bid relative to the dollar amount of other supplementary bids submitted by the bidder.

41. These activity rules guarantee that the final clock allocation will not change if there is no excess supply in the final clock round. Each winner is guaranteed to win its final clock package without making any supplementary bids. If there is excess supply in the final clock round, a bidder is guaranteed to win its final clock package if its only supplementary bid is for the final clock package, but with a bid amount that is increased by at least the value of the excess supply
Consultation on a Technical, Policy and Licensing Framework for Spectrum in the 600 MHz Band SLPB-005-17

as evaluated at the final clock prices less the opening bid prices. However, since aggregate demand is not disclosed after the final clock round, it may be difficult for a bidder to implement this guarantee. In addition, the certainty of winning at least the final clock package is compromised if any other supplementary bid does not include, at a minimum, all of the licences contained in the bidder’s final clock package.

42. The revealed preference limit with respect to the final clock package provides the bidder with an incentive to bid on its most preferred package throughout the clock rounds. This is because supplementary bids are limited by the bidder’s bid in the final clock round. Given that the bidder does not know which round will be the final clock round, the bidder will be motivated to bid truthfully to improve its chance of winning its most preferred package; otherwise the bidder will be constrained in the supplementary round.

43. Details concerning the process will be included in the final licensing framework.

Algebraic formulation of revealed preference limit

44. A supplementary bid, \( B \), for the package \( Q \) satisfies revealed preference with respect to a clock round \( s \), if \( B \) is less than or equal to the highest dollar amount bid on the package bid on in clock round \( s \) — that is, \( B_s \) — plus the price difference in the respective packages, \( Q \) and \( Q_s \), using the clock prices of clock round \( s \). Algebraically, the revealed preference constraint is the condition that:

\[
B \leq B_s + \sum_{i=1}^{m} \left( P_{s,i} \times (Q_i - Q_{s,i}) \right)
\]

where:

- \( i \) indexes the products
- \( m \) is the number of products, proposed to be 32 in the 600 MHz band auction
- \( Q_i \) is the quantity of the \( i^{th} \) product in package \( Q \)
- \( Q_{s,i} \) is the quantity of the \( i^{th} \) product in package \( Q_s \) of clock round \( s \)
- \( P_{s,i} \) is the clock price of the \( i^{th} \) product in clock round \( s \)
- \( B \) is the dollar amount of the supplementary bid on package \( Q \)
- \( B_s \) is the highest dollar amount bid on package \( Q_s \), either in a clock round or in the supplementary round

45. For a supplementary bid on a package \( Q \), let \( T(Q) \) denote the last clock round in which the bidder’s eligibility was at least the number of eligibility points associated with the package \( Q \).
A given bidder’s supplementary bids are consistent with revealed preference if the bidder’s supplementary bid for package $Q$, with a dollar amount, $B$, satisfies the following condition:

For a supplementary bid on any package $Q$, the dollar amount $B$ must satisfy the revealed preference constraint, as specified in paragraph 44 above with respect to the final clock round and with respect to every eligibility-reducing round equal to $T(Q)$ or later.

Note that, in the application of paragraph 44, the package $Q$, may itself be subject to a revealed preference limit with respect to another package. Thus, the rule may have the effect of creating a chain of constraints on the dollar amount of a supplementary bid for a package $Q$ relative to the dollar amounts of other clock bids or supplementary bids.

See annex D for an example of the revealed preference activity rules for the clock rounds and for the supplementary round.

10. Determining the winning packages in the allocation stage

All valid bids received from bidders in the clock rounds and in the supplementary round are considered for the determination of winning packages.

A reserve bid for every licence, at the opening bid price, will be included in the determination of winning bidders at the end of the allocation stage. In this process, it is as though ISED is a bidder in the auction, placing a bid on every licence at the opening bid price. The purpose of including a reserve bid for every licence is to ensure that the incremental value that a bidder would be prepared to pay for an additional licence is at least the opening bid price of that licence. The reserve bids will not be treated as a package, but rather as having been placed by different bidders so that any number of reserve bids can be selected in the winning combination.

A solver will be used to identify the highest value combination of valid bids subject to the requirements that each bidder wins no more than one of its packages, the quantity of open blocks allocated in a service area must not exceed four, and the quantity of open plus set-aside blocks allocated in a service area must not exceed seven. Note that it is possible to assign more than three blocks to a set-aside-eligible bidder in a service area. If there is only one combination of bids that meets the criteria, this will be the winning outcome that determines the winning packages and the winning bidders.

If more than one combination of valid bids has the same highest value, the tie will first be resolved by minimizing the number of “lost licences,” where a lost licence is a licence that was included in the bidder’s final clock package, but is not included in an alternate package that could be assigned to the bidder. The rationale for selecting the combination of valid bids that minimizes the number of lost licences as the first tie-breaking rule is so that an allocation that is the most similar to the final clock allocation is selected.
53. If there is still a tie, the second tie-breaking rule will be to select the combination of valid bids that includes the greatest number of associated eligibility points. Note that if reserve bids are part of the winning combination, the eligibility points associated with the reserve bids will not count towards the eligibility points of the winning combination. This is to maximize the quantity of spectrum that is allocated. If, subsequently, there is still a tied outcome, the tie will be broken by a pseudo-random number generator built into the auction software.

11. **Determining the base price in the allocation stage**

54. The base price is the minimum amount that winning bidders will pay for their generic winning packages; it does not include the additional, incremental amount that winning bidders may pay for specific licences, as determined in the assignment stage. The base price will be determined using all valid bids submitted by all bidders during the allocation stage, as well as the reserve bids.

55. ISED will use a second-price rule to calculate the base prices such that winning bidders, individually and collectively, will pay an amount that is sufficient to ensure that there is no other bidder or group of bidders prepared to pay more for the licences. This amount will be less than or equal to the actual winning bid submitted in the allocation stage, either in the clock rounds or the supplementary round, and must be greater than or equal to the total sum of the opening bid prices for the combination of licences included in their winning package. The benefit of using a second-price rule is that it encourages bidders to bid truthfully, potentially leading to a more efficient outcome.

56. ISED will apply bidder-optimal core prices and will use the “nearest Vickrey” approach to determine the base prices. In some cases, the second price (Vickrey price) may not be high enough to ensure that there is no alternative bidder or group of bidders prepared to pay more for the licences in question, and so an additional payment above Vickrey prices may be required. In the event that such a payment is required, the calculation of the additional payment to be paid by each winning bidder will be weighted based on the relative size of its winning package of licences evaluated at the opening bid prices. Further information on the proposed determination of base prices can be found in annex E.

12. **Information at the end of the allocation stage**

57. At the end of the allocation stage, each bidder will be informed of its own winning package, along with the base price that it will pay for its package.

58. At this point, bidders will know with certainty the number of licences in each product that they have won; however, given that these are generic licences, they will not necessarily know the specific licences that they have won.
13. The assignment stage

59. As there are generic licences, the auction will then advance to the assignment stage, where the specific assignment of the generic licences will be determined. Only bidders that have won one or more generic licences during the allocation stage will have the option to participate in the assignment stage.

60. The assignment stage will be used to determine the specific frequency blocks that winning bidders will be assigned. The assignment stage will make no distinction between bidder types (set-aside-eligible or set-aside-ineligible) in the determination of specific assignments.

61. The assignment stage will consist of a sequence of assignment rounds. In each assignment round, bidders will be presented with a set of options available to them for the products being assigned, taking into consideration the number of licences that the bidder won in the allocation stage.

62. The assignment rounds will be run service area by service area in descending order of population, possibly conducting a separate round for each service area. This could potentially result in up to 16 assignment rounds. This process will enable bidders to know which specific frequencies they have won in the most populated service areas prior to their participation in the assignment rounds for the other less populated service areas.

63. In support of simplifying the assignment stage and facilitating the assignment of contiguous spectrum across service areas, two or more service areas will be combined into a single assignment round when they form a contiguous geographic area and when the winners and the number of licences they have won are the same in the service areas to be combined. In the previous sentence, note that set-aside licences and open licences are treated the same; for example, if Bidder A has won two set-aside licences in service area I and has won two open licences in service area II, that will not prevent service areas I and II from being combined into a single assignment round.

64. For example, the two contiguous service areas shown in the tables below would be eligible to be combined into a single assignment round. With the combined service areas, bidders will only be permitted to bid for and win assignments that would give them the exact same blocks in each service area.

Table A1: Example of contiguous service areas

<table>
<thead>
<tr>
<th>Service area</th>
<th>Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service area II</td>
<td>Bidders 1, 2 and 3 win 1 block; Bidder 4, 5 win 2 blocks</td>
</tr>
<tr>
<td>Service area III</td>
<td>Bidders 1, 2 and 3 win 1 block; Bidder 4, 5 win 2 blocks</td>
</tr>
</tbody>
</table>
One possible assignment could be:

Table A2: Example of possible assignment

<table>
<thead>
<tr>
<th>Service area</th>
<th>Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Service area II</td>
<td>Bidder 5</td>
</tr>
<tr>
<td>Service area III</td>
<td>Bidder 5</td>
</tr>
</tbody>
</table>

65. Winning bidders do not have to place bids in the assignment stage if they do not have an assignment preference, as they are guaranteed the number of generic licences that they have already been allocated. Each winning bidder has both a right and an obligation to purchase one of the frequency range options presented to it in the assignment round.

66. For each assignment round, a solver will be used to identify the combination of specific assignments of licences that result in the highest bid amount. In the event of a tied outcome with more than one specific assignment producing the same total value, the tie will be broken by a pseudo-random number generator built into the auction software.

67. Similar to the determination of base prices in the allocation stage, a second-price rule will be used to determine the assignment price to be paid for the assignment of specific licences such that winning bidders will pay an amount sufficient to ensure that there is no other bidder or group of bidders prepared to pay more for the licence(s).

68. The additional amount to be paid for the assignment of specific licences, known as the assignment price, is calculated for the package of specific licences bid for in the round, not for the individual licences. Given the pricing rules, the assignment price of each winning assignment stage package will be equal to or less than the corresponding winning bid amount, and could even be zero.

69. ISED will apply bidder-optimal core prices and use a “nearest Vickrey” approach to determine assignment prices. In the event that an additional payment above Vickrey prices is required, the calculation of the additional payment to be paid by each winning bidder will be weighted based on the relative size of the package it is being assigned in the given assignment round, evaluated at the opening bid prices. Further information on the proposed determination of assignment prices can be found in annex E.
14. Assigning contiguous spectrum in the assignment stage

70. Recognizing the efficiency gains from having contiguous blocks of spectrum, ISED will assign bidders contiguous spectrum within a service area.

71. ISED is proposing to present all contiguous bidding options that are consistent with the allocation stage winnings of a bidder, regardless of what other bidders have won. For example, a bidder that won two generic blocks in the allocation stage will have six bidding options: AB, BC, CD, DE, EF, and FG, regardless of what other bidders won in the allocation stage. The bidder might not be able to win some of its bidding options if they are inconsistent with the contiguity restrictions described above. The purpose in presenting all contiguous bidding options, regardless of what other bidders have won, is to maintain anonymous bidding as much as possible and thereby reduce the potential for gaming behavior in the assignment stage.

72. Further information on the process for submitting assignment round bids will be available in the information package provided to qualified bidders.

15. Information at the end of each assignment round

73. Following the end of each assignment round, after the results have been verified, participating bidders will be notified of the specific licences that they have won and the assignment price to be paid. In doing this, bidders will know their own results from one assignment round before participating in a subsequent assignment round.

16. Final price

74. At the end of the assignment stage, ISED will determine the final price that each winning bidder will be required to pay for the package of licences it has won. This final price will be equal to the base price plus any associated assignment price(s).

17. Information at the end of the assignment stage

75. Following the end of the assignment stage, winning bidders will be notified of the specific licences that they have won, as well as the final price to be paid.

18. Information after the end of the auction

76. The following information will be made publicly available following the conclusion of the auction process:
   - the list of winning bidders, licences won (including category) and prices to be paid;
   - the bids submitted by each bidder in every clock round, including their identity;
   - the prices for each product in every clock round;
   - the supplementary bids submitted by each bidder, including their identity; and
   - the assignment bids submitted by each bidder, including their identity.
Annex B: The combinatorial clock auction format with a GARP-based activity rule

Note: ISED is currently consulting on multiple options for the auction format. For clarity, this annex is written as a guide for how the auction format would work if implemented based on the proposals set out in this consultation paper, and does not give any indication of the decision that will be made by ISED.

1. The combinatorial clock auction (CCA) format, with an activity rule based on the Weak Axiom of Revealed Preference (WARP), was used for the 700 MHz band and 2500 MHz band auctions. In the context of the 600 MHz band auction, this auction format is described in detail in annex A. ISED is considering replacing the activity rule based on the WARP with an activity rule based on the Generalized Axiom of Revealed Preference (GARP).

2. The CCA format with the GARP-based activity rule follows all the rules of the CCA format described in annex A, but replaces the activity rule (sections 7 and 9 of annex A) with the following sections of this annex.

1. **GARP-based activity rule in the clock rounds**

3. Similar to the CCA format using the WARP-based activity rule, described in annex A, the GARP-based activity rule is a revealed preference/eligibility point hybrid activity rule. That is, it comprises both an eligibility point activity rule and a revealed preference activity rule. The eligibility point component of the activity rule has remained exactly the same as described in annex A while the revealed preference component has changed.

4. The GARP-based activity rule allows a bidder to submit a bid for a package $Q$ that exceeds its eligibility if all of its bids—starting with the last round in which the bidder had sufficient eligibility for package $Q$ and ending in the current round with a bid for package $Q$—are consistent with truthful bidding for the bidder’s implied set of valuations. It is possible that these valuations would not be expressed as bids during the auction. Nonetheless, based on actual bids placed up to this point, it is reasonable that the bidder would possess such a set of implied valuations and would bid in accordance with them.

5. Algebraically, to check whether in round $t$ a bidder is permitted to bid on a package $Q_t$ that exceeds the bidder’s eligibility, the auction system considers the last round (denoted by $s$) that the bidder had sufficient eligibility for the package $Q_t$. The bidder is allowed to bid on package $Q_t$ in round $t$ if there exists a set of numbers $V_j$ for $j = s,...,t$ such that the following inequalities are satisfied:
\[ V_j - \sum_{i=1}^{m} P_{k,i} \cdot Q_{j,i} \leq V_k - \sum_{i=1}^{m} P_{k,i} \cdot Q_{k,i}, \text{ for all } j = s, \ldots, t \text{ and } k = s, \ldots, t, \]

where:

- \( j \) and \( k \) index the rounds
- \( i \) indexes the products
- \( m \) is the number of products (currently proposed to be 32)
- \( Q_{j,i} \) is the quantity of the \( i^{th} \) product in package \( Q_j \) of clock round \( j \)
- \( P_{k,i} \) is the clock price of the \( i^{th} \) product in clock round \( k \)
- \( V_j \) is the bidder’s implied valuation for package \( Q_j \) of clock round \( j \)
- \( V_k \) is the bidder’s implied valuation for package \( Q_k \) of clock round \( k \)

The inequalities above require that, for each round \( k \), the bidder’s implied valuation for the package it selected in round \( k \) minus the price for that package in round \( k \) is greater than or equal to the bidder’s implied valuation for the package it selected in another round, for example, \( j \) minus the price for that package in round \( k \). This test is conducted for all pairs of rounds up to round \( t \).

6. The existence of numbers \( V_j \) for \( j = s, \ldots, t \) that satisfy the inequalities in paragraph 5 is equivalent to GARP. Consider a bidder who has a well-defined valuation, \( v(Q) \), for every package \( Q \) and who seeks to maximize \( v(Q) - P_Q \), i.e. the difference between \( v(Q) \) and the price \( P_Q \) paid for package \( Q \). GARP requires that the bidder’s bidding strategy corresponds to bidding truthfully with respect to a consistent set of valuations, \( v(Q) \).

2. **GARP-based activity rule in the supplementary round**

7. The activity rule for bids on packages in the supplementary round complements the activity rule in the clock rounds, encouraging truthful bidding throughout the allocation stage of the auction by ensuring that supplementary bids are consistent with preferences expressed in the clock rounds.

8. Any bidder that placed at least one valid bid with a value greater than zero in the clock rounds will be able to submit bids in the supplementary round. However, a bidder is not required to submit bids in the supplementary round.

9. All licences are available for bidding in the supplementary round, so that bidders will be able to improve on bids submitted during the clock rounds or to submit bids for packages of licences that they were eligible to bid for in the clock rounds but did not.
10. A bidder will be able to submit a supplementary bid for any given package of licences within its initial eligibility. However, bidders will not be allowed to submit a bid on the zero package (i.e. null set), as the only allowable bid amount is zero ($0). The limit on the number of different supplementary round packages that a bidder will be allowed to place will be announced after the bidder qualification has occurred, but will be no less than 500 different packages.

11. The amount of a package bid in the supplementary round must be at least the sum of the opening bid prices for all of the licences included in the package. Furthermore, if a bidder submits a package bid on a package from the clock rounds, the bid amount for that package must be greater than the bidder’s highest clock round bid for that package.

12. There is no limit on the supplementary bid amount for the final clock package, which is the package that the bidder bid on in the final clock round, unless the final clock package is the zero package. The WARP-based activity rule described in annex A requires that each package bid in the supplementary round must satisfy revealed preference with respect to the final clock round and, in case the size of the package exceeds the bidder’s eligibility in the final clock round, all eligibility-reducing rounds beginning with the last round in which the bidder had sufficient eligibility to bid on the package.

13. The GARP-based activity rule strengthens this constraint. Specifically it requires that each package bid in the supplementary round must satisfy revealed preference with respect to the final clock round and, in cases where the size of the package exceeds the bidder’s eligibility in the final clock round, all rounds beginning with the last round in which the bidder had sufficient eligibility to bid on the package, excluding those rounds before the final clock round in which the bidder bid for packages of the same or larger size than this package.

14. The structure of the supplementary round bidding constraints guarantees that the final clock allocation will not change if there is no excess supply in the final clock round. If there is excess supply, a bidder will be allocated its final clock package if its only supplementary bid is for the final clock package, but with a bid amount that is increased by at least the value of the excess supply as evaluated at the final clock prices less the opening bid prices of the excess supply. However, because the aggregate demand in the final clock round will not be made available to bidders as they go into the supplementary round, the bidder should be motivated to bid truthfully to improve its chance of winning its most preferred package. Furthermore, the ability to ensure this allocation may be compromised if any other supplementary bid does not include, at a minimum, all of the licences contained in the bidder’s final clock package.

15. The revealed preference limit in conjunction with the non-disclosure of the final clock round aggregate demand provides a strong incentive for truthful bidding during the supplementary round, encouraging bidders to bid based on their valuations rather than on any expected guarantee of winning their final clock package.
Algebraic formulation of revealed preference limit

16. A supplementary bid, $B$, for the package $Q$ satisfies revealed preference with respect to a clock round $s$, if $B$ is less than or equal to the highest dollar amount bid on the package bid on in clock round $s$ — that is, $B_s$ — plus the price difference in the respective packages, $Q$ and $Q_s$, using the clock prices of clock round $s$. Algebraically, the revealed preference constraint is the condition that:

$$B \leq B_s + \sum_{i=1}^{m} (P_{s,i} \times (Q_i - Q_{s,i}))$$

where:

- $i$ indexes the products
- $m$ is the number of products
- $Q_i$ is the quantity of the $i^{th}$ product in package $Q$
- $Q_{s,i}$ is the quantity of the $i^{th}$ product in package $Q_s$ of clock round $s$
- $P_{s,i}$ is the clock price of the $i^{th}$ product in clock round $s$
- $B$ is the dollar amount of the supplementary bid on package $Q$
- $B_s$ is the highest dollar amount bid on package $Q_s$ either in a clock round or in the supplementary round

17. For a supplementary bid on a package $Q$, let $T(Q)$ denote the last clock round in which the bidder’s eligibility was at least the number of eligibility points associated with the package $Q$.

18. A bidder’s supplementary bids are consistent with revealed preference if the bidder’s supplementary bid for package $Q$, with a dollar amount, $B$, satisfies the following condition:

For a supplementary bid on any package $Q$, the dollar amount $B$ must satisfy the revealed preference constraint, as specified in paragraph 16 above with respect to the final clock round and, in cases where the size of the package exceeds the bidder’s eligibility in the final clock round, with respect to every round equal to $T(Q)$ or later, excluding those rounds before the final clock round in which the bidder bid for packages of the same or larger size than this package.

19. Note that the bid for a constraining package may itself be subject to a revealed preference limit with respect to another package. Thus, the rule may have the effect of creating a chain of constraints on the dollar amount of a supplementary bid for a package $Q$ relative to the dollar amounts of other clock bids or supplementary bids.
Annex C: The enhanced combinatorial clock auction (ECCA) format

Note: ISED is currently consulting on multiple options for the auction format. For clarity, this annex is written as a guide for how the auction format would work if implemented based on the proposals set out in this consultation document, and does not give any indication of the decision that will be made by ISED.

1. The enhanced combinatorial clock auction (ECCA) is one option that ISED is considering for the 600 MHz spectrum auction.

2. This annex describes the changes made in going from the combinatorial clock auction (CCA) described in annex A to the ECCA format. It replaces the activity rule, sections 7 and 9 of annex A, with the GARP-based activity rule described in annex B, and makes the additions in sections 3 and 4 of this annex. It also adds section 2 of this annex to the information policy in the clock rounds found in section 5 of annex A. Finally, it adds sections 5 and 6 of this annex to the processes for winner determination and base price calculation, sections 10 and 11 of annex A.

1. Overview of the ECCA format

3. The ECCA format follows the overall structure and many specific aspects of the CCA, described in annex A, which was used for the 700 MHz and 2500 MHz auctions. At the same time, the ECCA makes two significant modifications to the CCA.

4. First, the activity rule used in previous auctions is replaced by the modified activity rule based on the Generalized Axiom of Revealed Preference (GARP) described in annex B. Second, the modified activity rule is used to estimate second prices, and to provide each bidder with a calculation of the price discount it would receive, relative to its bid amount at the next clock prices and based on all bids submitted thus far, before it submits its bid for the next round. Conceptually, the ECCA follows a pricing methodology that is broadly similar to the CCA as winners pay the opportunity cost of the spectrum that they are allocated (second pricing).

5. In the CCA, the determination of prices for each winning bidder is based on the comparison between the solution to the winner determination problem that excludes the given winning bidder and the solution to the winner determination problem that includes all bidders. In contrast, in the ECCA, prices are based on a measure of the highest valuations that opponents could possess for licences, given their bidding histories and subject to the stricter GARP-based activity rule. As a result, prices are likely to be more consistent and to be better reflections of opportunity cost.

6. In the CCA, there is uncertainty about the prices that a winning bidder might pay until after the supplementary round, since prices depend directly on its opponents’ supplementary bids. In the ECCA, it is possible to inform each bidder, before each clock round, of the discount it would receive relative to current clock prices. This discount is calculated based on the assumption that the current clock is the final clock round, and that there is no excess supply in the final clock round. The knowledge of the discount helps to reduce uncertainty about a bidder’s base price.
7. In the ECCA, prices are determined primarily during the clock rounds. Supplementary bids are used to set prices to the extent that these bids contribute to reducing excess supply. As a result, the information withholding policy described in annex A is no longer necessary and aggregate demand will be revealed after the final clock round, as it is for every other clock round.

8. In the CCA, the supplementary round plays an important role in discovering opportunity costs; therefore a supplementary round is needed even when there is no excess supply following the final clock round (demand exactly equal to supply). Because the predominant role of the supplementary round in the ECCA is to reduce excess supply, the supplementary round is skipped if the final clock round concludes with no excess supply.

9. Lastly, in the CCA, each bidder faces the uncertainty that it may not win its final clock package after the supplementary round (and, in fact, the bidder may be entirely displaced and win nothing). An exception to this is if the bidder increases its bid on its final clock package by at least the value of excess supply, evaluated at final clock prices, minus the opening bid prices. In situations where excess supply is significant, increasing a bid to this extent could be prohibitively expensive. As described in paragraph 25 of this annex, the ECCA introduces a more affordable opportunity for a bidder to guarantee that it will win one of the packages for which it bid.

2. Information in the clock rounds

10. In the ECCA, the information that a bidder receives during the clock rounds is similar to the information received in the CCA as described in annex A, with the following modifications.

11. Before the start of each clock round, each bidder will be informed about its price discount (paragraphs 15-19) for the next round, which can be used by the bidder to infer the magnitude of its base price for the allocation stage. Bidders will also be informed of the aggregate demand for each service area after each clock round. This differs from the CCA, where aggregate demand after the final clock round is not disclosed to bidders.

12. If, after a clock round, there is no product in any service area whose price is required to be incremented (per the incrementing rules described in section 3 of annex A), then that round is the final clock round. If aggregate demand in each service area equals supply for all products after the final clock round, then the supplementary round will be skipped. In this scenario, each bidder will be allocated the package it bid on in the final clock round and will have a base price equal to its bid amount in the final clock round, less the discount that the bidder was quoted prior to the start of the final clock round. The resulting base price is required to be at least the sum of the reserve prices for that package.
13. If aggregate demand in at least one service area is less than supply, then the auction proceeds to the supplementary round. In this scenario, allocations will be determined following the supplementary round, and each winning bidder will generally pay an amount equal to its bid amount in the final clock round, less the discount that the bidder was quoted prior to the start of the final clock round, plus an adjustment that depends on the amount of excess supply in the final clock round and the net value opposing bidders gain through the supplementary round. If excess supply in the final clock round is small (in value), then a bidder’s payment will be close to its bid amount in the final clock round less the discount that the bidder was quoted prior to the start of the final clock round. Again, the resulting base price is required to be at least the sum of the reserve prices for that package.

3. **GARP-based activity rule in the clock rounds**

14. The ECCA format uses the GARP-based activity rule for each clock round, as described in section 1 of annex B, comprised of both an eligibility point component and a revealed preference component. This section describes how the GARP-based activity rule is applied during the clock rounds to provide each bidder with a calculation of its price discount.

*Calculation of the GARP-based price discount*

15. The price discount for each bidder is calculated in three steps.

- The first step calculates the maximum implied valuation for each package that each bidder has bid on in prior rounds; in other words, the maximum amount that each bidder would be allowed to bid at this point in the auction, given its GARP-based revealed preference constraints.
- The second step uses the maximum implied valuations calculated in the previous step to determine, for each bidder, the maximum possible aggregate value of allocating all blocks to that bidder’s opponents.
- The third step calculates each bidder’s discount as the price in that round for all available blocks, less the maximum possible aggregate value of allocating all blocks to its opponents, as calculated in step 2.

The following paragraphs provide algebraic formulations for these three steps.

16. **Step 1.** To calculate each bidder’s discount before round $t$, first calculate, for each bidder, the maximum implied valuations for the packages it bid on in rounds $1, \ldots, t - 1$. Let $e(Q_j^k)$ be the eligibility of the package demanded in round $k$ by bidder $j$, and $e_t^j$ be that bidder’s eligibility in round $t$. Bidder $j$’s maximum implied valuation for its package in round $k$ is denoted $V_j^k$. These valuations are calculated for each bidder $j$ using the following formulas:
1. First, consider all rounds $k \leq t - 1$ in which the package demanded is equal in size to the bidder’s eligibility for round $t$; that is, $e(Q_k^j) = e_t^j$. The maximum implied valuation for the package bid in such a round $k$ is set equal to:

$$V_k^j = \sum_{i=1}^{m} P_{t,i} \cdot Q_{k,i}^j$$

2. Then, consider all packages $Q_k^j$ demanded in a round $k \leq t - 1$ such that $e(Q_k^j) > e_t^j$, in increasing order of their package size (note that for packages of equal size, the order in which implied valuations are computed does not affect the result). The maximum implied valuation for the package bid on in round $k$ is calculated as:

$$\hat{V}_k^j = \min_{n \in \{1, \ldots, t-1\} : e(Q_n^j) < e(Q_k^j)} \left\{ V_n^j + \sum_{i=1}^{m} P_{n,i} \cdot (Q_{k,i}^j - Q_{n,i}^j) \right\}$$

$$V_k^j = \min \left\{ \sum_{i=1}^{m} P_{t,i} \cdot Q_{k,i}^j, \hat{V}_k^j \right\}$$

That is, the maximum implied valuation for packages the same size as the bidder’s eligibility in round $t$ is set equal to the dollar amount for that package in round $t$. The maximum implied valuation for larger packages is calculated based on the maximum implied valuations that have been calculated for smaller packages and the GARP-based revealed preference constraints; the result is then capped by the dollar amount for the package in round $t$.

17. **Step 2.** The second step consists of solving an optimization for each bidder $j$ to determine the maximum possible aggregate value from allocating all available blocks to the opponents of bidder $j$ (including the reserve bidders; like in past auctions, ISED will use the reserve bidder approach to calculate winning bidders and base prices as described in sections 5 and 6); this value is denoted by $W_t^j$. This value is calculated by solving the following optimization problem:
\[ W_t^J = \max_{Q^s, B^s} \left\{ \sum_{s \neq j} B^s + \sum_{l=1}^{L} r_l \cdot \left( 7 - \sum_{s \neq j} [Q^s_{l(a)} + Q^s_{l(o)}] \right) \right\} \]

subject to:

1. \[ \sum_{s \neq j} Q^s_{l(o)} \leq 4 \quad \text{for any service area } l = 1, \ldots, L \]
2. \[ \sum_{s \neq j} [Q^s_{l(a)} + Q^s_{l(o)}] \leq 7 \quad \text{for any service area } l = 1, \ldots, L \]
3. \[ Q^s \in F^s \quad \text{for all bidders } s \neq j \]
4. \[ B^s \leq V^s_k + \sum_{i=1}^{m} P_{k,i} \cdot (Q^s_i - Q^s_{k,i}) \quad \text{for } k \in \{1, \ldots, t-1\} : e(Q^s_k) < e(Q^s) \text{ and for all } s \neq j \]
5. \[ B^s \leq \sum_{i=1}^{m} P_{l,i} \cdot Q^s_i \quad \text{for all } s \neq j \]

where:

- \( k \) indexes the rounds
- \( i \) indexes the products
- \( s \) indexes the bidders
- \( l \) indexes service areas
- \( l(a) \) refers to the set-aside product in service area \( l \)
- \( l(o) \) refers to the open product in service area \( l \)
- \( m \) is the number of products (currently proposed to be 32)
- \( L \) is the number of service areas (currently proposed to be 16)
- \( r_l \) is the opening price of both the open and the set-aside product in service area \( l \)
- \( e(Q^s) \) is the eligibility size of package \( Q^s \)
- \( e(Q^s_k) \) is the eligibility size of package \( Q^s_k \) demanded in round \( k \) by bidder \( s \)
- \( Q^s_{k,i} \) is the quantity of the \( i^{th} \) product in the package that bidder \( s \) bid on in round \( k \)
- \( P_{k,i} \) is the clock price of the \( i^{th} \) product in clock round \( k \)
- \( V^s_k \) is the maximum implied valuation for the package that bidder \( s \) bid on in round \( k \)
$F^s$ is the set of all packages that bidder $s$ is allowed to win in the auction. This set depends on the bidder’s initial eligibility and the service areas in which the bidder is reserve-eligible.

This optimization finds, for each bidder $s \neq j$, a package $Q^s$ and the bidder’s valuation for that package, $B^s$, that is consistent with GARP and the maximum implied valuations calculated in Step 1.

18. The optimization in Step 2 searches for the most valuable allocation of all available blocks among all bidders (including reserve bidders) except for bidder $j$, using the revealed preference information gathered in rounds $1, \ldots, t - 1$ and the prices for round $t$.

Constraint (1) ensures that the total number of blocks allocated in this hypothetical allocation for a given open product does not exceed 4.

Constraint (2) ensures that the total number of blocks allocated in this hypothetical allocation for a given service area does not exceed 7.

Constraint (3) ensures that, in this hypothetical allocation, each bidder is allocated a package that it is allowed to win, based on the bidder’s initial eligibility and the service areas in which it is reserve-eligible.

Constraint (4) ensures that, in this hypothetical allocation, the bidder’s valuation for the allocated package satisfies GARP with respect to the maximum implied valuations calculated in Step 1, for all rounds in which the bidder bid for smaller packages than the allocated package.

Constraint (5) requires that, in this hypothetical allocation, the bidder’s valuation for the allocated package does not exceed the maximum possible bid amount for that package in round $t$.

19. Step 3. The discount for bidder $j$ for round $t$ is calculated as follows:

$$D^t_j = \sum_{l=1}^{L} [P_{t,l(a)} \cdot 3 + P_{t,l(o)} \cdot 4] - W^t_j$$

Note that $\sum_{l=1}^{L} [P_{t,l(a)} \cdot 3 + P_{t,l(o)} \cdot 4]$ represents an upper bound on the value of $W^t_j$.

Thus, a bidder’s discount for round $t$ is equal to 0 if its opponents have indicated implied valuations such that they can achieve the maximum possible sum of valuations in round $t$, based on their bids in rounds $1, \ldots, t - 1$. 

62
4. **GARP-based activity rule in the supplementary round**

20. As described in annex A, any bidder that placed at least one valid bid with a value greater than zero during the clock rounds will be able to submit bids in the supplementary round, but no bidder is required to submit bids in the supplementary round. In the ECCA, the GARP-based activity rule is applied in the supplementary round as described in annex B, with the following modification that places a maximum limit on the supplementary bid amount for the final clock package. In the CCA, this amount is unlimited.

*Limit on the supplementary bid amount for the final clock package*

21. In the ECCA format, a bidder can increase its bid amount for its final clock package with a supplementary bid, which may not exceed a certain limit. Before the supplementary round, the auction system will calculate and inform each bidder of this limit, which is the highest possible amount that the bidder could pay for its final clock package. In the supplementary round, a bidder will not be allowed to submit a bid for its final clock package that exceeds this limit, as bidding any amount above this limit (together with increasing all other bids by the same amount) would have the same effect as bidding this limit.

22. If the final clock package is the zero package, the limit for the final clock package is zero ($0). For any non-zero final clock package, the limit is equal to the bidder’s bid amount in the final clock round minus the bidder’s discount for the final clock round plus an amount that depends on the amount of excess supply in the final clock round and the difference between final clock and opening bid prices of the excess supply.

23. Algebraically, for any non-zero final clock package, the limit in the supplementary round for bidder $j$ is given by:

$$
\sum_{i=1}^{m} P_{T,i} \cdot Q_{T,i}^j - D_T^j + \sum_{i=1}^{m} [P_{T,i} - r_i] \cdot U_{T,i}
$$

where:

$i$ indexes the products

$m$ is the number of products (currently proposed to be 32)

$Q_{T,i}^j$ is the quantity of the $i^{\text{th}}$ product in the final clock package of bidder $j$

$D_T^j$ is the discount of bidder $j$ for the final clock round

$P_{T,i}$ is the final clock price of the $i^{\text{th}}$ product

$r_i$ is the opening price of the $i^{\text{th}}$ product
$U_{T,i}$ is the amount of excess supply of the $i^{th}$ product in the final clock round. In most cases, this is equal to its initial supply minus the aggregate demand for the product in the final clock round. The only exception arises if, in a service area, the aggregate demand for the set-aside product in the final clock round exceeds 3, in which case the excess supply of the set-aside product is equal to 0 and the excess supply of the open product is equal to 7 minus the sum of the aggregate demands for the set-aside and the open product in that service area.

5. **Determining winning packages in the allocation stage**

24. In the ECCA, the winner determination process is the same as described in annex A, with a modification that enables a bidder to guarantee that it will be a winner in the auction.

*Protecting winnings*

25. A bidder is guaranteed to be a winner in the auction, and thus to win some package that it bid on during the clock rounds or the supplementary round, if its final clock package is not the zero package and its bid amount for its final clock package is greater than or equal to the protection price specified in paragraph 27. In particular, if the bidder’s bid amount in the final clock round is greater than or equal to its protection price, then the bidder will be a winner even if it does not bid in the supplementary round. If the bidder’s bid amount in the final clock round is less than its protection price, then the bidder can ensure that it will be a winner by submitting a bid in the supplementary round for its final clock package with a bid amount equal to its protection price. Note that this limit is less than or equal to the bidder’s limit on the supplementary bid amount for its final clock package, described in paragraphs 21-23. The protection price will be equal to the limit on the supplementary bid amount for a bidder that had positive demand for all open products in its final clock package; however, the protection price will be significantly less for a small bidder that was only bidding on a few products in the clock rounds.

26. A solver will be used to identify the highest value combination of valid bids, subject to the requirements described in annex A, with the additional requirement that each bidder who satisfied the protection requirement wins one of its packages.

*Algebraic formulation for protection price*

27. A bidder is guaranteed to be a winner in the auction, and thus to win some package that it bid on during the clock rounds or the supplementary round, if its final clock package is not the zero package and its bid amount for its final clock package is greater than or equal to:
\[ \sum_{i=1}^{m} P_{T,i} \cdot Q_{T,i}^j - D_T^j + \sum_{l=1}^{L} \left[ P_l^j - r_l \right] \cdot U_{T,l(o)} + \sum_{l=1}^{L} \left[ \min \{ P_l^j, P_{T,l(a)} \} - r_l \right] \cdot U_{T,l(a)} \]

where:

- \( i \) indexes the products
- \( m \) is the number of products (currently proposed to be 32)
- \( l \) indexes the service areas
- \( L \) is the number of service areas (currently proposed to be 16)
- \( l(a) \) refers to the set-aside product in service area \( l \)
- \( l(o) \) refers to the open product in service area \( l \)
- \( Q_{T,i}^j \) is the quantity of the \( i^{th} \) product in the final clock package of bidder \( j \)
- \( D_T^j \) is the discount of bidder \( j \) for the final clock round
- \( P_l^j \) is the clock price of the product (either the set-aside product \( l(a) \) or the open product \( l(o) \)) for which bidder \( j \) is eligible to bid in service area \( l \) in the last clock round in which bidder \( j \) demanded positive quantity of this product. In case bidder \( j \) never demanded positive quantity of that product, \( P_l^j \) is equal to the opening price for service area \( l \)
- \( r_l \) is the opening price for service area \( l \)
- \( U_{T,l(a)} \) (respectively, \( U_{T,l(o)} \)) is the amount of excess supply of the set-aside product (respectively, open product) in service area \( l \) in the final clock round. In most cases, this is equal to its initial supply minus the aggregate demand for the product in the final clock round. The only exception arises if, in a service area, the aggregate demand for the set-aside product in the final clock round exceeds 3, in which case the excess supply of the set-aside product is equal to 0 and the excess supply of the open product is equal to 7 minus the sum of the aggregate demands for the set-aside and the open products in that service area.
6. Determining base prices in the allocation stage

28. Compared to the CCA, the process for determining base prices at the end of the allocation stage differs significantly in the ECCA. The base price is the minimum amount that a winning bidder will have to pay for the generic licences it has been allocated. It does not include the additional, incremental amount that a winning bidder may have to pay for specific licences, as determined in the assignment stage. The base price will be determined using all valid bids submitted by all bidders during the allocation stage, as well as reserve bids.

29. Base prices for each winning bidder are calculated in three steps.

- The first step calculates bidder-specific adjustments that reflect the net value its opposing bidders gain (including the ISED reserve bids) as a result of the supplementary round, relative to final clock round bids.
- The second step calculates a tentative base price for winning bidders from the following four amounts: (1) the bidder’s bid amount in the final clock round, (2) the bidder’s discount in the final clock round, (3) an amount that depends on the excess supply in the final clock round and the difference between the final clock prices and the opening bid prices, and (4) the adjustment calculated in step 1.
- If needed, the tentative base price is adjusted so that it is greater than or equal to the associated reserve price for the package of licences won by the bidder and less than or equal to the bidder’s bid amount for that package.

Paragraphs 32-35 provide the algebraic formulation for these three steps.

30. In the event that there is no excess supply in the final clock round, the structure of the supplementary round bidding constraints guarantees that each bidder will win its final clock package. In the ECCA format, since the supplementary round would have no impact on the outcome, it will not be held and the base price for each bidder will depend only on clock round bids.

31. Specifically, if there is no excess supply in the final clock round, then each winning bidder’s adjustment is zero, and its base price is equal to the maximum of (1) the opening bid price for its final clock package and (2) the bidder’s bid amount in the final clock round, less its discount for that round. The discount will be known to the bidder, as it was provided prior to the start of the final clock round.
Algebraic formulation for base prices

32. As described in paragraph 29, base prices are calculated in three steps.

33. **Step 1.** The base price adjustment $\Delta^j$ for bidder $j$ is calculated using the following formula:

$$\Delta^j = \sum_{l \neq j} (B^l - B^l_T) + \sum_{i=1}^{m} r_i \cdot (U_i - U_{T,i})$$

where:

- $l$ indexes the bidders
- $B^l$ is the bid amount of bidder $l$ for its winning package
- $B^l_T$ is the highest bid amount of bidder $l$ for its final clock package (either in the supplementary round or in the final clock round)
- $i$ indexes the products
- $m$ is the number of products (currently proposed to be 32)
- $U_{T,i}$ is the amount of excess supply for the $i^{th}$ product in the final clock round
- $U_i$ is the number of unsold blocks for the $i^{th}$ product in the allocation stage

This formula calculates the net value opponents of bidder $j$ (including the ISED reserve bids) gain as a result of the supplementary round, relative to the allocation in the final clock round. If $\Delta^j > 0$, then the supplementary round resulted in a positive value gain for bidder $j$’s opponents. Alternatively, if $\Delta^j < 0$, then the supplementary round resulted in a value loss for bidder $j$’s opponents.

Similar to the description in paragraphs 23 and 27, in most cases, the number of unsold blocks in the allocation stage ($U_i$ in the formula above) for a set-aside product is equal to its initial supply (3) minus the number of blocks won by set-aside-eligible bidders, and the number of unsold blocks for an open product is equal to its initial supply (4) minus the number of blocks won by set-aside-ineligible bidders. The only exception arises if, in a service area, the number of blocks won by set-aside-eligible bidders exceeds 3, in which case the number of unsold blocks of the set-aside product is equal to 0 and the number of unsold blocks of the open product is equal to 7 minus the aggregate number of blocks won by all bidders in that service area.
34. **Step 2.** The tentative base price of bidder $j$ is calculated using the following formula:

$$\overline{BP}_j = \sum_{i=1}^{m} P_{T,i} \cdot Q_{T,i}^j - D_T^j + \sum_{i=1}^{m} \left[ P_{T,i} - r_i \right] \cdot U_{T,i} - \Delta^j$$

where:

- $i$ indexes the products
- $m$ is the number of products (currently proposed to be 32)
- $P_{T,i}$ is the final clock price of the $i^{th}$ product
- $Q_{T,i}^j$ is the quantity of the $i^{th}$ product in the final clock package of bidder $j$
- $D_T^j$ is the discount of bidder $j$ for the final clock round
- $r_i$ is the opening price of the $i^{th}$ product
- $U_{T,i}$ is the amount of excess supply of the $i^{th}$ product in the final clock round (defined in paragraph 33)
- $\Delta^j$ is the adjustment calculated in Step 1 above

This formula has two parts. The first part, represented by the first and second terms, is the price component for which the bidder is responsible as a result of its bidding in the clock rounds. The second part, represented by the third and fourth terms, is the price component for which the bidder is responsible as a result of its bidding in the supplementary round.
35. **Step 3.** If the tentative base price is greater than or equal to the reserve price for the package and less than or equal to the bidder’s bid amount for that package, then the bidder’s base price is set equal to its tentative base price. Otherwise, the base price is adjusted accordingly. In particular, the base price $BP^j$ for bidder $j$ is set according to the following formula:

$$BP^j = \begin{cases} R^j & \text{if } \overline{BP}^j < R^j \\ \overline{BP}^j & \text{if } R^j < \overline{BP}^j < B^j \\ B^j & \text{if } \overline{BP}^j > B^j \end{cases}$$

where:

- $R^j$ is the total reserve price associated with the blocks in the winning package of bidder $j$
- $\overline{BP}^j$ is the tentative base price for bidder $j$ calculated in Step 2
- $B^j$ is the bid amount of bidder $j$ for its winning package
Annex D: Examples of activity rules

1. Annex A and annex B describe the activity rules ISED is considering for the 600 MHz spectrum auction. The two examples in this annex demonstrate how each of these activity rules will work during the clock and supplementary rounds of the auction. The first example illustrates how the two activity rules differ in the clock rounds; and the second example illustrates how the two activity rules differ in the supplementary round, after following a clock round bidding history that is consistent with both activity rules.

2. Note that with only an eligibility points-based rule bidders are never able to switch to packages that are larger than its eligibility in the round it is currently bidding.

**EXAMPLE 1**

3. Consider a set-aside-ineligible bidder, with initial eligibility of 20 points, which is interested in three (3) service areas associated with the following eligibility points: SA1 (15 points), SA2 (10 points), and SA3 (20 points).

4. Table D1 provides a clock round bidding history that, as explained below, is allowed by the WARP-based activity rule but not by the GARP-based activity rule.

<table>
<thead>
<tr>
<th>Round</th>
<th>SA1</th>
<th>SA2</th>
<th>SA3</th>
<th>Bid</th>
<th>Activity (eligibility)</th>
<th>Bid amount (thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$100</td>
<td>$100</td>
<td>$100</td>
<td>1 open in SA1</td>
<td>15 (20)</td>
<td>$100</td>
</tr>
<tr>
<td>2</td>
<td>$100</td>
<td>$100</td>
<td>$110</td>
<td>1 open in SA2</td>
<td>10 (15)</td>
<td>$100</td>
</tr>
<tr>
<td>3</td>
<td>$110</td>
<td>$100</td>
<td>$110</td>
<td>1 open in SA3</td>
<td>20 (10)</td>
<td>$110</td>
</tr>
</tbody>
</table>

5. Note that both round 1 and round 2 (in **bold**) were eligibility-reducing rounds. In round 1 and 2, bids were within the bidder’s eligibility, so revealed preference did not apply; however, in round 3, the bidder’s activity exceeded its eligibility points. Paragraphs 6-11 describe how the two different activity rules would apply to this bid, which would be allowed by the WARP-based activity rule but not the GARP-based activity rule.

**WARP-based activity rule**

6. Using the WARP-based activity rule, to bid on SA3, the bid must satisfy revealed preference with respect to all eligibility-reducing rounds (Rounds 1 and 2), starting with the last round in which the bidder had sufficient eligibility to bid on SA3 (Round 1). Mathematically, these two revealed preference constraints are calculated as follows (R refers to the round).
With respect to Round 1:

\[
(\text{Price SA3 in R3}) - (\text{Price SA3 in R1}) \leq (\text{Price SA1 in R3}) - (\text{Price SA1 in R1})
\]
\[
\$110,000 - \$100,000 \leq \$110,000 - \$100,000
\]
\[
\$10,000 \leq \$10,000
\]

The constraint is satisfied since, compared to round 1, the prices in round 3 have increased by the same amount for both SA1 and SA3.

With respect to Round 2:

\[
(\text{Price SA3 in R3}) - (\text{Price SA3 in R2}) \leq (\text{Price SA2 in R3}) - (\text{Price SA2 in R2})
\]
\[
\$110,000 - \$110,000 \leq \$100,000 - \$100,000
\]
\[
\$0 \leq \$0
\]

The constraint is satisfied since, compared to round 2, the prices in round 3 have not increased for either SA1 or SA3.

7. Therefore the WARP-based activity rule would allow the bidder to submit a bid for one block of SA3 in round 3.

GARP-based activity rule

8. To bid on SA3, the GARP-based activity rule requires that all of the bidder’s bids, starting with the last round in which the bidder had sufficient eligibility to bid on SA3 (round 1) and ending in round 3 with a bid on SA3, must be consistent with truthful bidding for some implied valuations. Mathematically, these revealed preference constraints are calculated in the following way. There needs to exist values \((V_1, V_2, and V_3)\) such that the following inequalities are satisfied:

\[
V_j - \sum_{i=1}^{m} P_{k,i} \cdot Q_{j,i} \leq V_k - \sum_{i=1}^{m} P_{k,i} \cdot Q_{k,i} \quad \text{for } j = 1, 2, 3 \text{ and } k = 1, 2, 3
\]

These inequalities are trivially satisfied when \(j = k\). The remaining values for \(j\) and \(k\) result in the following six inequalities:

\[
V_2 - (\text{Price SA2 in R1}) \leq V_1 - (\text{Price SA1 in R1})
\]
\[
V_3 - (\text{Price SA3 in R1}) \leq V_1 - (\text{Price SA1 in R1})
\]
\[
V_1 - (\text{Price SA1 in R2}) \leq V_2 - (\text{Price SA2 in R2})
\]
\[
V_3 - (\text{Price SA3 in R2}) \leq V_2 - (\text{Price SA2 in R2})
\]
\[
V_1 - (\text{Price SA1 in R3}) \leq V_3 - (\text{Price SA3 in R3})
\]
\[
V_2 - (\text{Price SA2 in R3}) \leq V_3 - (\text{Price SA3 in R3})
\]

The first two inequalities arise because of the bid on SA1 in round 1 (instead of SA2 or SA3), the next two inequalities because of the bid on SA 2 in round 2 (instead of SA1 or SA3), and the final two inequalities because of the desired bid on SA3 in round 3 (instead of SA1 or SA2).
9. These six inequalities then become

\[
\begin{align*}
V_2 - (100,000) &\leq V_1 - (100,000) \implies V_2 \leq V_1 \\
V_3 - (100,000) &\leq V_1 - (100,000) \implies V_3 \leq V_1 \\
V_1 - (100,000) &\leq V_2 - (100,000) \implies V_1 \leq V_2 \\
V_3 - (110,000) &\leq V_2 - (100,000) \implies V_3 \leq V_2 + 10,000 \\
V_1 - (110,000) &\leq V_3 - (110,000) \implies V_1 \leq V_3 \\
V_2 - (100,000) &\leq V_3 - (110,000) \implies V_2 \leq V_3 - 10,000
\end{align*}
\]

These inequalities imply \( V_2 = V_3 \) and that \( V_2 = V_3 - 10,000 \), which cannot hold simultaneously for any values.

10. Therefore the GARP-based activity rule would not allow the bidder to submit a bid for one block of SA3 in round 3.

11. The results of the GARP-based activity rule differ from the WARP-based activity rules for two reasons, as described in annex B. First, the GARP-based activity rule goes back to the last round the bidder had sufficient eligibility to bid for the package and then calculates revealed preference with respect to all subsequent clock rounds and not just eligibility-reducing rounds (WARP). Second, the GARP-based activity rule calculates whether there are values that are able to satisfy all of the revealed preference constraints simultaneously and not just as individual pairs (WARP).

**Example 2**

12. Consider a set-aside-ineligible bidder, with initial eligibility of 200 points and a budget of $1,600,000, which is interested in ten (10) service areas associated with the following eligibility points: SA1, \ldots, SA5 (20 points) and SA6, \ldots, SA10 (14 points).

13. Suppose the bidder wants to bid on two open licences in each of five service areas, SA1 to SA5 (Package A). However, if the price of Package A exceeds the price of a package with two licences in SA6 to SA10 (Package B) by more than $400,000, then the bidder prefers Package B.

14. As prices increase, the bidder may be unable to continue bidding on either Package A or B, and will need to reduce its demand to one licence. In this case, the bidder prefers one licence in SA1 to SA5 (Package C) but will switch to one licence in SA6 to SA10 (Package D) if the price of Package C exceeds the price of Package D by more than $200,000.
15. Table D2 provides the clock round bidding history for this bidder.

<table>
<thead>
<tr>
<th>Round</th>
<th>SA1</th>
<th>...</th>
<th>SA5</th>
<th>SA6</th>
<th>...</th>
<th>SA10</th>
<th>Bid</th>
<th>Activity (eligibility)</th>
<th>Bid Amount (thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$100</td>
<td>...</td>
<td>$100</td>
<td>$70</td>
<td>...</td>
<td>$70</td>
<td>2 open in SA1 to SA5 (A)</td>
<td>200 (200)</td>
<td>$1,000</td>
</tr>
<tr>
<td>2</td>
<td>$120</td>
<td>...</td>
<td>$120</td>
<td>$70</td>
<td>...</td>
<td>$70</td>
<td>2 open in SA6 to SA10 (B)</td>
<td>140 (200)</td>
<td>$700</td>
</tr>
<tr>
<td>3</td>
<td>$140</td>
<td>...</td>
<td>$140</td>
<td>$90</td>
<td>...</td>
<td>$90</td>
<td>2 open in SA6 to SA10 (B)</td>
<td>140 (140)</td>
<td>$900</td>
</tr>
<tr>
<td>4</td>
<td>$140</td>
<td>...</td>
<td>$140</td>
<td>$110</td>
<td>...</td>
<td>$110</td>
<td>2 open in SA1 to SA5 (A)</td>
<td>200 (140)</td>
<td>$1,400</td>
</tr>
<tr>
<td>5</td>
<td>$160</td>
<td>...</td>
<td>$160</td>
<td>$130</td>
<td>...</td>
<td>$130</td>
<td>2 open in SA1 to SA5 (A)</td>
<td>200 (140)</td>
<td>$1,600</td>
</tr>
<tr>
<td>6</td>
<td>$180</td>
<td>...</td>
<td>$180</td>
<td>$150</td>
<td>...</td>
<td>$150</td>
<td>2 open in SA6 to SA10 (B)</td>
<td>140 (140)</td>
<td>$1,500</td>
</tr>
<tr>
<td>7</td>
<td>$200</td>
<td>...</td>
<td>$200</td>
<td>$170</td>
<td>...</td>
<td>$170</td>
<td>1 open in SA1 to SA5 (C)</td>
<td>100 (140)</td>
<td>$1,000</td>
</tr>
<tr>
<td>8</td>
<td>$220</td>
<td>...</td>
<td>$220</td>
<td>$170</td>
<td>...</td>
<td>$170</td>
<td>1 open in SA6 to SA10 (D)</td>
<td>70 (100)</td>
<td>$850</td>
</tr>
</tbody>
</table>

16. Note that Round 2, Round 7 and Round 8 (in bold) were eligibility-reducing rounds, and that Round 8 is also the final clock round.

17. In Rounds 1, 2, 3, 6, 7, and 8, bids were within the bidder’s eligibility, so revealed preference did not apply; however, in Rounds 4 and 5, the bidder’s activity exceeded its eligibility points. Paragraphs 18-28 describe how the two different activity rules would apply to the bids in Rounds 4 and 5.

**WARP-based activity rule**

18. Using the WARP-based activity rule, to bid on Package A in Rounds 4 and 5, the bid must satisfy revealed preference with respect to all eligibility-reducing rounds (Round 2), starting with the last round in which the bidder had sufficient eligibility to bid on Package A (Round 2). Mathematically, the revealed preference constraints for the two bids are calculated as follows.
19. **Round 4 with respect to Round 2:** In Round 4, the prices increased on Package B, resulting in a price difference between Package A and Package B of $300,000 ($1,400,000 compared to $1,100,000), therefore the bidder would prefer to switch back to Package A. However, it already reduced its eligibility from 200 points to 140 points in Round 2. To bid on Package A, the bid must satisfy revealed preference with respect to Round 2.

$$\begin{align*}
(\text{Price A in R4}) - (\text{Price A in R2}) & \leq (\text{Price B in R4}) - (\text{Price B in R2}) \\
1,400,000 - 1,200,000 & \leq 1,100,000 - 700,000 \\
200,000 & \leq 400,000
\end{align*}$$

20. The constraint is satisfied since, compared to Round 2, the prices in Round 4 have increased by $200,000 for Package A and $400,000 for Package B. The bidder is allowed to submit this bid for Package A. Note that this did not increase the bidder’s eligibility back to 200 points.

21. **Round 5 with respect to Round 2:** In Round 5, prices increased by the same amount across all service areas. Since the relative price difference ($300,000) has not changed, the bidder will continue to prefer to bid on the same package as in Round 4, Package A. Since the bidder’s eligibility is still only 140 points, the bid must again satisfy revealed preference with respect to Round 2.

$$\begin{align*}
(\text{Price A in R5}) - (\text{Price A in R2}) & \leq (\text{Price B in R5}) - (\text{Price B in R2}) \\
1,600,000 - 1,200,000 & \leq 1,300,000 - 700,000 \\
400,000 & \leq 600,000
\end{align*}$$

22. The constraint is satisfied since, compared to Round 2, the prices in Round 5 have increased by $400,000 for Package A and $600,000 for Package B. The bidder is again allowed to submit this bid for Package A.

**GARP-based activity rule**

23. **Round 4 with respect to Rounds 2 and 3:** Using the GARP-based activity rule, to bid on Package A in Round 4, all of the bidder’s bids, starting with the last round in which the bidder had sufficient eligibility to bid on Package A (Round 2) and ending in Round 4 with a bid on Package A, must be consistent with truthful bidding for some implied valuations. Mathematically, these revealed preference constraints are calculated in the following way. There needs to exist values $V_2, V_3,$ and $V_4$ such that the following inequalities are satisfied:

$$\begin{align*}
V_3 - (\text{Price B in R2}) & \leq V_2 - (\text{Price B in R2}) \\
V_4 - (\text{Price A in R2}) & \leq V_2 - (\text{Price B in R2}) \\
V_2 - (\text{Price B in R3}) & \leq V_3 - (\text{Price B in R3}) \\
V_4 - (\text{Price A in R3}) & \leq V_3 - (\text{Price B in R3}) \\
V_2 - (\text{Price B in R4}) & \leq V_4 - (\text{Price A in R4}) \\
V_3 - (\text{Price B in R4}) & \leq V_4 - (\text{Price A in R4})
\end{align*}$$
The first two inequalities arise because of the bid in Round 2, the next two inequalities because of the bid in Round 3, and the final two inequalities because of the desired bid on Package A in Round 4.

24. These six inequalities then become

\[
\begin{align*}
V_3 - 700,000 & \leq V_2 - 700,000 \quad \Rightarrow \quad V_3 \leq V_2 \\
V_4 - 1,200,000 & \leq V_2 - 700,000 \quad \Rightarrow \quad V_4 \leq V_2 + 500,000 \\
V_2 - 900,000 & \leq V_3 - 900,000 \quad \Rightarrow \quad V_2 \leq V_3 \\
V_4 - 1,400,000 & \leq V_3 - 900,000 \quad \Rightarrow \quad V_4 \leq V_3 + 500,000 \\
V_2 - 1,100,000 & \leq V_4 - 1,400,000 \quad \Rightarrow \quad V_2 \leq V_4 - 300,000 \\
V_3 - 1,100,000 & \leq V_4 - 1,400,000 \quad \Rightarrow \quad V_3 \leq V_4 - 300,000 \\
\end{align*}
\]

25. These six inequalities are satisfied if and only if \( V_2 = V_3 \) and \( V_2 + 300,000 \leq V_4 \leq V_2 + 500,000 \). Note that \( V_2 = V_3 \) since the bidder bid on the same package in both Rounds 2 and 3. Since there exists values that satisfy all of these constraints simultaneously, the bidder is allowed to bid on Package A in Round 4.

26. \textit{Round 5 with respect to Rounds 2, 3, and 4}: Similar to Round 4, to bid on Package A in Round 5, all of the bidder’s bids, starting with Round 2 and ending in Round 5, must be consistent with truthful bidding for some implied valuation. Mathematically, these revealed preference constraints are calculated in the following way. There needs to exist values \( V_2, V_3, V_4, \) and \( V_5 \) such that the following inequalities are satisfied. As noted in Paragraph 25, \( V_2 = V_3 \) so the inequalities involving \( V_3 \) are redundant with those involving \( V_2 \):

\[
\begin{align*}
V_4 - (\text{Price of Package A in R3}) & \leq V_3 - (\text{Price of Package B in R3}) \\
V_5 - (\text{Price of Package A in R3}) & \leq V_3 - (\text{Price of Package B in R3}) \\
V_3 - (\text{Price of Package B in R4}) & \leq V_4 - (\text{Price of Package A in R4}) \\
V_5 - (\text{Price of Package A in R4}) & \leq V_4 - (\text{Price of Package A in R4}) \\
V_3 - (\text{Price of Package B in R5}) & \leq V_5 - (\text{Price of Package A in R5}) \\
V_4 - (\text{Price of Package A in R5}) & \leq V_5 - (\text{Price of Package A in R5}) \\
\end{align*}
\]

The first two inequalities arise because of the bid in Round 3, the next two because of the bid in Round 4, and the final because of the desired bid on Package A in Round 5.

27. These six inequalities then become

\[
\begin{align*}
V_4 - 1,400,000 & \leq V_3 - 900,000 \quad \Rightarrow \quad V_4 \leq V_3 + 500,000 \\
V_5 - 1,400,000 & \leq V_3 - 900,000 \quad \Rightarrow \quad V_5 \leq V_3 + 500,000 \\
V_3 - 1,100,000 & \leq V_4 - 1,400,000 \quad \Rightarrow \quad V_3 \leq V_4 - 300,000 \\
V_5 - 1,400,000 & \leq V_4 - 1,400,000 \quad \Rightarrow \quad V_5 \leq V_4 \\
V_3 - 1,300,000 & \leq V_5 - 1,600,000 \quad \Rightarrow \quad V_3 \leq V_5 - 300,000 \\
V_4 - 1,600,000 & \leq V_5 - 1,600,000 \quad \Rightarrow \quad V_4 \leq V_5 \\
\end{align*}
\]
28. These six inequalities are satisfied if and only if \( V_4 = V_5 \) and \( V_3 + 300,000 \leq V_4 \leq V_3 + 500,000 \). Note that \( V_4 = V_5 \) since the bidder bid on the same package in both Rounds 4 and 5. Since there exists values that satisfy all of these constraints simultaneously, the bidder is again allowed to bid on Package A in Round 5.

**Supplementary round**

29. The following table summarizes the bidder’s highest bid on each of its packages based the clock round bidding history listed above. These four bids will be carried into the supplementary round.

<table>
<thead>
<tr>
<th>Package</th>
<th>Round</th>
<th>Bid</th>
<th>Activity</th>
<th>Bid amount (thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>2 open in SA1 to SA5</td>
<td>200</td>
<td>$1,600</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>2 open in SA6 to SA10</td>
<td>140</td>
<td>$1,500</td>
</tr>
<tr>
<td>C</td>
<td>7</td>
<td>1 open in SA1 to SA5</td>
<td>100</td>
<td>$1,000</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>1 open in SA6 to SA10</td>
<td>70</td>
<td>$850</td>
</tr>
</tbody>
</table>

30. Package D is the bidder’s final clock package. Suppose that this bidder does not revise its bid for its final clock package or for any other constraining packages (Packages B and C).

31. Suppose that the bidder is now interested in bidding on a package consisting of one licence in all service areas (SA1 to SA10), called Package E, and that the bidder wants to submit a bid on this package at its maximum budget of $1,600,000. Package E is associated with 170 eligibility points, so the bidder last had sufficient eligibility to bid on this package in Round 2, when it had 200 eligibility points.

**WARP-based activity rule**

32. Using the WARP-based activity rule, to bid on Package E, the bid must satisfy revealed preference with respect to the final clock round (Round 8) and all eligibility-reducing rounds, starting with the last round in which the bidder had sufficient eligibility to bid on Package E (Rounds 2, 7, and 8). Mathematically, the revealed preference constraints are calculated as follows.

*Package B with respect to Round 2:*

\[
\begin{align*}
(Sup. Bid E) - (Price E in R2) & \leq (Highest bid B) - (Price B in R2) \\
(Sup. Bid E) & \leq (Highest bid B) - (Price B in R2) + (Price E in R2) \\
(Sup. Bid E) & \leq 1,500,000 - 700,000 + 950,000 \\
(Sup. Bid E) & \leq 1,750,000
\end{align*}
\]
Consultation on a Technical, Policy and Licensing Framework for Spectrum in the 600 MHz Band
SLPB-005-17

Package C with respect to Round 7:

\[
(Sup.\text{ Bid } E) - (Price \text{ in R7}) \leq \(Highest\text{ bid C}) - (Price \text{ in R7})
\]
\[
(Sup.\text{ Bid } E) \leq \(Highest\text{ bid C}) - (Price \text{ in R7}) + \(Price \text{ in R7})
\]
\[
(Sup.\text{ Bid } E) \leq \$1,000,000 - \$1,000,000 + \$1,850,000
\]
\[
(Sup.\text{ Bid } E) \leq \$1,850,000
\]

Package D with respect to Round 8:

\[
(Sup.\text{ Bid } E) - (Price \text{ in R8}) \leq \(Highest\text{ bid D}) - (Price \text{ in R8})
\]
\[
(Sup.\text{ Bid } E) \leq \(Highest\text{ bid D}) - (Price \text{ in R8}) + \(Price \text{ in R8})
\]
\[
(Sup.\text{ Bid } E) \leq \$850,000 - \$850,000 + \$1,950,000
\]
\[
(Sup.\text{ Bid } E) \leq \$1,950,000
\]

33. Without submitting a supplementary bid that increases the bid amount on any of its constraining packages, the bidder would be allowed to submit a bid on Package E up to $1,750,000. Therefore the WARP-based activity rule would allow the bidder to submit its desired bid of $1,600,000 on Package E.

34. Note that the revealed preference activity rule can result in a chain of constraints that links back to the final clock package. By increasing the bid on its final clock package, a bidder can increase its maximum allowable bids on its constraining packages, thereby increasing its maximum allowable bids for other packages as well. This chained effect can be calculated by carrying out the calculations outlined in paragraph 32 for constraining packages.

GARP-based activity rule

35. The GARP-based activity rule requires that each supplementary bid satisfy revealed preference with respect to the final clock round and, in cases where the package is larger than the bidder’s eligibility in the final clock round, with respect to all rounds starting with the last round in which the bidder had sufficient eligibility to bid on the package, excluding rounds before the final clock round where the bidder bid on a package that was the same size or larger than the supplementary bid.

36. For Package E, the bid must satisfy revealed preference with respect to the final clock round, and with respect to all rounds starting with Round 2. Rounds 4 and 5 are excluded because Package A (bid on in Rounds 4 and 5) is larger than Package E.

37. The revealed preference constraints with respect to Rounds 2, 7, and 8 are the same as calculated using the WARP-based activity rule in paragraph 32. The additional revealed preference constraints because of the GARP-based activity rule (with respect to Rounds 3 and 6) are calculated as follows.
Package B with respect to Round 3:

\[
(\text{Sup. Bid } E) - (\text{Price } E \text{ in R3}) \leq (\text{Highest bid } B) - (\text{Price } B \text{ in R3})
\]

\[
(\text{Sup. Bid } E) \leq (\text{Highest bid } B) - (\text{Price } B \text{ in R3}) + (\text{Price } E \text{ in R3})
\]

\[
(\text{Sup. Bid } E) \leq $1,500,000 - $900,000 + $1,150,000
\]

\[
(\text{Sup. Bid } E) \leq $1,750,000
\]

Package B with respect to Round 6:

\[
(\text{Sup. Bid } E) - (\text{Price } E \text{ in R6}) \leq (\text{Highest bid } B) - (\text{Price } B \text{ in R6})
\]

\[
(\text{Sup. Bid } E) \leq (\text{Highest bid } B) - (\text{Price } B \text{ in R6}) + (\text{Price } E \text{ in R6})
\]

\[
(\text{Sup. Bid } E) \leq $1,500,000 - $1,500,000 + $1,650,000
\]

\[
(\text{Sup. Bid } E) \leq $1,650,000
\]

38. Without submitting a supplementary bid that increases the bid amount on any of its constraining packages, the bidder would be allowed to submit a bid on Package E up to $1,650,000. Note that this limit is lower than the limit calculated by the WARP-based activity rule ($1,750,000). This is because the GARP-based activity rule includes revealed preference constraints for more rounds. Still, in this example, the GARP-based activity rule would allow the bidder to submit its desired bid of $1,600,000 on Package E.
Annex E: Proposed pricing rule

1. ISED is seeking comment on the combinatorial clock auction (CCA) with WARP (described in annex A), CCA with GARP (described in annex B), and the enhanced combinatorial clock auction (ECCA) (described in annex C). In each of these formats, prices are determined at two points in the auction, in the following order: first, at the end of the allocation stage, in order to determine the base prices, which are the minimum that winning bidders will pay for their winning packages; and second, in the assignment stage at the end of each assignment round in order to determine the incremental payments for specific licences, known as assignment prices. The proposed pricing rule for the ECCA is described in annex C. This annex describes the proposed pricing rule for the allocation stage of the CCA and for the assignment rounds of both the CCA and the ECCA.

2. ISED is proposing to use a second-price rule to determine the prices to be paid by winning bidders. More specifically, ISED is proposing to apply bidder-optimal core prices and use the “nearest Vickrey” approach in determining both the base prices and the assignment prices in the CCA, and in determining the assignment prices in the ECCA. In any case, the final price paid by a winning bidder is the sum of the base price and the assignment price(s).

Base prices for CCA

3. Each winning allocation stage bid has an associated price for the package of licences contained within the bid, known as the base price. A separate base price is determined for each winning bidder.

4. ISED is proposing to use a second-price rule to calculate base prices such that the base price for a winning bidder will be at least the opening bid price, but no higher than the actual amount bid. Second prices are often referred to as Vickrey prices and represent the opportunity cost of the bidder winning the package.

5. The Vickrey price for each winning bidder (known as “Bidder J” in this explanation) is calculated as follows. First, from the value of the winning combination of packages, subtract Bidder J’s winning bid (value A). Next, recalculate the winning combination of packages for the hypothetical situation in which all Bidder J’s bids are excluded, as if Bidder J had not participated (value B). The Vickrey price for Bidder J is calculated as the value of the winning combination of packages with all Bidder J’s bids excluded (value B) minus the sum of the winning allocation stage bids for all bidders other than Bidder J (value A), that is, value B minus value A. This is the minimum amount that the winning bidder could have bid in order to still have won the package, given the bids of all other bidders.

6. An extra payment beyond the Vickrey prices is sometimes required as a result of complementarities. In the event that an extra payment is required, the payment to be made will be adjusted relative to the size of the bidder’s package, as measured by the bidder’s winning package evaluated at the opening bid prices.
7. The set of base prices for the winning allocation stage bids must satisfy the following conditions:

(a) **First condition:** The base price for a winning allocation stage bid must be greater than or equal to the opening bid prices for the licences included in the package associated with the winning bid, but not more than the dollar amount of the winning bid.

(b) **Second condition:** The set of base prices must be sufficiently high that there is no alternative bidder, or group of bidders prepared to pay more than any winning bidder or group of winning bidders. If there is only one set of base prices that meet the first and second conditions, this determines the base prices for the allocation stage.

(c) **Third condition:** If there are many sets of base prices that fulfil the first and second condition, the set(s) of base prices minimizing the sum of base prices across winning bidders is (are) selected. If there is only one set of base prices satisfying these three conditions, this set determines the base prices for the allocation stage.

(d) **Fourth condition:** If there is more than one set of base prices that satisfy the first three conditions, the set of base prices that minimize the weighted sum of squares of differences between the base prices and the Vickrey prices will be selected. The weighting is relative to the price of the bidder’s package as evaluated at the opening prices. This approach for selecting among sets of base prices that minimize the sum of base prices across winning bidders is referred to as the “nearest Vickrey” approach.

8. These conditions characterize a unique set of base prices such that each winning bidder pays no more than the dollar amount of its winning bid and pays at least the aggregate value of the opening bid prices for the package of licences.

9. A software algorithm will be used to determine the set of base prices that meets the conditions outlined above.

10. The following is an example of how base prices are calculated. This example is based on the 2013 *Spectrum Auction Design* paper by Peter Cramton.
11. For expository ease, in this example there are only two products, A and B, and the supply of each is equal to one. Suppose that there are five bidders, 1, 2, 3, 4, 5, bidding for two licences, A and B. The following bids are submitted ("b" designates the bidder):

\[
\begin{align*}
    b_1\{A\} &= 28 \\
    b_2\{B\} &= 20 \\
    b_3\{AB\} &= 32 \\
    b_4\{A\} &= 14 \\
    b_5\{B\} &= 12 \\
\end{align*}
\]

The bids of the five bidders are represented in figure E1.

12. In this example, the highest value combination of bids would assign Licence A to Bidder 1 and Licence B to Bidder 2, generating $48 in value. There is no other assignment of the licences that yields a higher value.

13. To calculate the Vickrey price for Bidder 1, its winning bid ($28) is subtracted from the value of the winning combination ($48), resulting in $20. Next, the winning combination of packages is recalculated for the hypothetical situation in which Bidder 1’s bids are excluded. The best assignment, excluding Bidder 1, assigns Licence A to Bidder 4 at $14 and Licence B to Bidder 2 at $20, resulting in $34. The Vickrey price for Bidder 1 is the value of the winning combination of packages with all Bidder 1’s bids excluded ($34) less the sum of the winning allocation stage bids for all bidders other than Bidder 1 ($20) — that is, its Vickrey price is $14 ($34 - $20).

14. Similarly, to calculate the Vickrey price for Bidder 2, its winning bid ($20) is subtracted from the value of the winning combination ($48), resulting in $28. Next, the winning combination of packages is recalculated for the hypothetical situation in which Bidder 2’s bids are excluded. The best assignment, excluding Bidder 2, assigns Licence A to Bidder 1 and Licence B to Bidder 5, resulting in a value of $40. The Vickrey price for Bidder 2 is the value of the winning combination of packages with all Bidder 2’s bids excluded ($40) less the sum of the winning allocation stage bids for all bidders other than Bidder 2 ($28) — that is, its Vickrey price is $12 ($40 - $28).

15. Hence, the Vickrey outcome is for Bidder 1 to pay $14 for Licence A and for Bidder 2 to pay $12 for Licence B. Total revenues with these payments are $14 + $12 = $26. As shown in figure E1, this means that Bidder 1 can reduce its bid to $14 before being displaced by Bidder 4. Similarly, Bidder 2 can reduce its bid to $12 before being displaced by Bidder 5.

16. However, these payments sum to $26, which is less than Bidder 3’s bid of $32 for both licences A and B. Therefore, Bidder 1 and Bidder 2 must split an additional payment of $6 ($32 – $26) in order to ensure that their combined payment is greater than that of Bidder 3, satisfying the condition that no other bidder or group of bidders were prepared to pay more for the licences in question. To do so, Bidder 1 and Bidder 2 must pay, collectively, at least $32.
17. If the opening bid prices for Licence A and Licence B are the same amount, the additional payment of $6 is split equally between the two bidders in this example. Each bidder is therefore paying an additional $3 above its Vickrey price, with Bidder 1 paying $17 ($14 + $3) and Bidder 2 paying $15 ($12 + $3), as shown in figure E1.

18. However, if the opening bid prices for the two licences are different amounts, the two bidders must split the extra payment proportionately, in reference to the opening bid amounts (the fourth condition). For example, if the opening bid price for Licence A is $8 and the opening bid price for Licence B is $4, then the opening bid price of Bidder 1’s package is twice as large as that of Bidder 2. Therefore, in this example, Bidder 1 would pay twice as much as Bidder 2 of the extra payment, with Bidder 1 paying an additional $4, for a total payment of $18 and Bidder 2 paying an additional $2, for a final payment of $14.

Assignment prices for CCA and ECCA

19. The assignment stage will make no distinction between the set-aside or open status of a license in making specific assignments. The assignment rounds will be run service area by service area in descending order of the service area populations, and possibly conducting a separate round for each service area. This could potentially result in up to 16 assignment rounds.
20. In support of simplifying the assignment stage and facilitating the assignment of contiguous spectrum across service areas, two or more service areas will be combined into a single assignment round when the service areas form a contiguous geographic area and when the winners and the number of licences they have won are the same. Service areas may also be combined into a single assignment round when the winners, and the number of licences they have won, are sufficiently similar. See Section 13 of annex A for examples.

21. The assignment bid is a package bid for the specific frequency locations of all licences being assigned in the round. The assignment prices will be determined from the set of assignment bids for the products being assigned in that round.

22. ISED is proposing to use a second-price rule to calculate the assignment prices. The assignment price is attributable to the entire collection of licences assigned in a given assignment round and not to individual licences that comprise the package.

23. For the purpose of calculating assignment prices, the Vickrey price for each winning Bidder J is calculated as follows. First, from the value of the winning combination of assignment bids, subtract Bidder J’s winning bid (value A). Next, recalculate the winning combination of assignment bids in the hypothetical situation where all Bidder J’s assignment bids are equal to zero, as if Bidder J did not have a preference for any of the assignment options that it was presented with in the round (value B). The Vickrey price for Bidder J is defined as the value of the winning combination of assignment bids with all Bidder J’s bids set to equal zero (value B) minus the sum of the winning assignment bids for all bidders other than Bidder J (value A), that is, value B minus value A.

24. The assignment prices from each assignment round must satisfy the following conditions:

   (a) **First condition**: The assignment prices must be positive or zero and not more than the dollar amount of the winning assignment stage bid.

   (b) **Second condition**: The set of assignment prices must be sufficiently high that there is no alternative combination of valid assignment bids that sum to more than the winning assignment bids. If there is only one set of assignment prices that satisfies the first two conditions, this determines the assignment prices.

   (c) **Third condition**: If there are many sets of assignment prices that fulfil the first and second conditions, the set(s) of assignment prices minimizing the sum of assignment prices across winning assignment stage bids is (are) selected. If there is only one set of assignment prices that satisfies these three conditions, this determines the assignment prices.
(d) **Fourth condition:** If there are many sets of assignment prices that satisfy the first three conditions, the set of assignment prices that minimizes the weighted sum of squares of differences between the assignment prices and the Vickrey prices will be selected. The weighting is relative to the price of the bidder’s package being assigned in the given assignment round, evaluated at the opening prices. This approach for selecting among sets of assignment prices that minimize the sum of assignment prices across winning assignment bids is referred to as the “nearest Vickrey” approach.

25. A software algorithm will be used to determine the set of assignment prices that meet the conditions outlined above.
Annex F: Deployment requirements
Population in the following tables are based on 2011 Census data. The deployment requirements will be based on most recent census information available at the time of assessment.

**Table F1: Proposed 5-year deployment requirements**

<table>
<thead>
<tr>
<th>Auction service areas</th>
<th>Service area name</th>
<th>Population</th>
<th>Minimum population coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-001</td>
<td>Newfoundland and Labrador</td>
<td>520,176</td>
<td>15%</td>
</tr>
<tr>
<td>2-002</td>
<td>Nova Scotia and Prince Edward Island</td>
<td>1,066,470</td>
<td>15%</td>
</tr>
<tr>
<td>2-003</td>
<td>New Brunswick</td>
<td>745,596</td>
<td>20%</td>
</tr>
<tr>
<td>2-004</td>
<td>Eastern Quebec</td>
<td>1,699,378</td>
<td>25%</td>
</tr>
<tr>
<td>2-005</td>
<td>Southern Quebec</td>
<td>5,895,985</td>
<td>25%</td>
</tr>
<tr>
<td>2-006</td>
<td>Eastern Ontario and Outaouais</td>
<td>2,435,880</td>
<td>25%</td>
</tr>
<tr>
<td>2-007</td>
<td>Northern Quebec</td>
<td>193,926</td>
<td>15%</td>
</tr>
<tr>
<td>2-008</td>
<td>Southern Ontario</td>
<td>10,609,746</td>
<td>25%</td>
</tr>
<tr>
<td>2-009</td>
<td>Northern Ontario</td>
<td>778,449</td>
<td>25%</td>
</tr>
<tr>
<td>2-010</td>
<td>Manitoba</td>
<td>1,278,016</td>
<td>25%</td>
</tr>
<tr>
<td>2-011</td>
<td>Saskatchewan</td>
<td>1,094,705</td>
<td>20%</td>
</tr>
<tr>
<td>2-012</td>
<td>Alberta</td>
<td>4,070,844</td>
<td>25%</td>
</tr>
<tr>
<td>2-013</td>
<td>British Columbia</td>
<td>4,647,973</td>
<td>25%</td>
</tr>
<tr>
<td>4-170</td>
<td>Yukon</td>
<td>35,928</td>
<td>10%</td>
</tr>
<tr>
<td>4-171</td>
<td>Nunavut</td>
<td>35,975</td>
<td>10%</td>
</tr>
<tr>
<td>4-172</td>
<td>Northwest Territories</td>
<td>41,668</td>
<td>10%</td>
</tr>
</tbody>
</table>

**Table F2: Proposed 10-year deployment requirements**

<table>
<thead>
<tr>
<th>Auction service areas</th>
<th>Tier 3</th>
<th>Service area name</th>
<th>Population</th>
<th>Minimum population coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-001</td>
<td>3-001</td>
<td>Newfoundland and Labrador</td>
<td>520,176</td>
<td>40%</td>
</tr>
<tr>
<td>2-002 Nova Scotia and Prince Edward Island</td>
<td>3-002</td>
<td>Prince Edward Island</td>
<td>142,907</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>3-003</td>
<td>Mainland Nova Scotia</td>
<td>792,184</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>3-004</td>
<td>Cape Breton</td>
<td>131,379</td>
<td>40%</td>
</tr>
<tr>
<td>2-003 New Brunswick</td>
<td>3-005</td>
<td>Southern New Brunswick</td>
<td>167,985</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-006</td>
<td>Western New Brunswick</td>
<td>216,311</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>3-007</td>
<td>Eastern New Brunswick</td>
<td>361,300</td>
<td>40%</td>
</tr>
<tr>
<td>2-004 Eastern Quebec</td>
<td>3-008</td>
<td>Bas du fleuve/Gaspésie</td>
<td>289,315</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>3-009</td>
<td>Québec</td>
<td>1,042,589</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-010</td>
<td>Chicoutimi-Jonquière</td>
<td>367,474</td>
<td>50%</td>
</tr>
<tr>
<td>2-005 Southern</td>
<td>3-011</td>
<td>Eastern Townships</td>
<td>555,933</td>
<td>40%</td>
</tr>
<tr>
<td>Auction service areas</td>
<td>Tier 3</td>
<td>Service area name</td>
<td>Population</td>
<td>Minimum population coverage</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>--------</td>
<td>-------------------------</td>
<td>------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Quebec</td>
<td>3-012</td>
<td>Trois-Rivières</td>
<td>832,846</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>3-013</td>
<td>Montréal</td>
<td>4,381,630</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-014</td>
<td>Upper Outaouais</td>
<td>125,576</td>
<td>20%</td>
</tr>
<tr>
<td>2-006 Eastern Ontario and Outaouais</td>
<td>3-015</td>
<td>Ottawa/Outaouais</td>
<td>1,516,983</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-016</td>
<td>Pembroke</td>
<td>113,567</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>3-018</td>
<td>Cornwall</td>
<td>69,729</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-019</td>
<td>Brockville</td>
<td>83,713</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>3-020</td>
<td>Kingston</td>
<td>177,314</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-021</td>
<td>Belleville</td>
<td>197,975</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>3-022</td>
<td>Cobourg</td>
<td>65,180</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>3-023</td>
<td>Peterborough</td>
<td>211,418</td>
<td>60%</td>
</tr>
<tr>
<td>2-007 Northern Quebec</td>
<td>3-017</td>
<td>Abitibi</td>
<td>193,926</td>
<td>40%</td>
</tr>
<tr>
<td>2-008 Southern Ontario</td>
<td>3-024</td>
<td>Huntsville</td>
<td>82,705</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>3-025</td>
<td>Toronto</td>
<td>7,030,750</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-026</td>
<td>Barrie</td>
<td>716,446</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>3-027</td>
<td>Guelph/Kitchener</td>
<td>737,544</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-028</td>
<td>Listowel/Goderich/Stratford</td>
<td>135,596</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>3-029</td>
<td>Niagara-St. Catharines</td>
<td>380,354</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-030</td>
<td>London/Woodstock/St. Thomas</td>
<td>854,082</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-031</td>
<td>Chatham</td>
<td>99,868</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-032</td>
<td>Windsor/Leamington</td>
<td>401,719</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-033</td>
<td>Strathroy</td>
<td>170,680</td>
<td>60%</td>
</tr>
<tr>
<td>2-009 Northern Ontario</td>
<td>3-034</td>
<td>North Bay</td>
<td>125,647</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>3-035</td>
<td>Sault Ste. Marie</td>
<td>130,515</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-036</td>
<td>Sudbury</td>
<td>178,872</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-037</td>
<td>Kirkland Lake</td>
<td>112,511</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>3-038</td>
<td>Thunder Bay</td>
<td>230,904</td>
<td>50%</td>
</tr>
<tr>
<td>2-010 Manitoba</td>
<td>3-039</td>
<td>Winnipeg</td>
<td>1,098,765</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-040</td>
<td>Brandon</td>
<td>179,251</td>
<td>30%</td>
</tr>
<tr>
<td>2-011 Saskatchewan</td>
<td>3-041</td>
<td>Regina</td>
<td>392,289</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>3-042</td>
<td>Moose Jaw</td>
<td>101,361</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td>3-043</td>
<td>Saskatoon</td>
<td>601,055</td>
<td>50%</td>
</tr>
<tr>
<td>2-012 Alberta</td>
<td>3-044</td>
<td>Edmonton</td>
<td>1,642,295</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-045</td>
<td>Medicine Hat/Brooks</td>
<td>198,798</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>3-046</td>
<td>Lethbridge</td>
<td>189,709</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>3-047</td>
<td>Calgary</td>
<td>1,582,542</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-048</td>
<td>Red Deer</td>
<td>260,727</td>
<td>35%</td>
</tr>
</tbody>
</table>
Table F3: Proposed 20-year deployment requirements

<table>
<thead>
<tr>
<th>Auction service areas</th>
<th>Tier 3</th>
<th>Service area name</th>
<th>Population</th>
<th>Minimum population coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-013 British Columbia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-049</td>
<td></td>
<td>Grande Prairie</td>
<td>196,772</td>
<td>35%</td>
</tr>
<tr>
<td>3-050</td>
<td></td>
<td>Kootenays</td>
<td>139,312</td>
<td>25%</td>
</tr>
<tr>
<td>3-051</td>
<td></td>
<td>Okanagan/Columbia</td>
<td>436,342</td>
<td>50%</td>
</tr>
<tr>
<td>3-052</td>
<td></td>
<td>Vancouver</td>
<td>2,858,890</td>
<td>60%</td>
</tr>
<tr>
<td>3-053</td>
<td></td>
<td>Victoria</td>
<td>458,861</td>
<td>60%</td>
</tr>
<tr>
<td>3-054</td>
<td></td>
<td>Nanaimo</td>
<td>194,922</td>
<td>50%</td>
</tr>
<tr>
<td>3-055</td>
<td></td>
<td>Courtenay</td>
<td>118,732</td>
<td>60%</td>
</tr>
<tr>
<td>3-056</td>
<td></td>
<td>Thompson/Cariboo</td>
<td>184,040</td>
<td>50%</td>
</tr>
<tr>
<td>3-057</td>
<td></td>
<td>Prince George</td>
<td>188,487</td>
<td>50%</td>
</tr>
<tr>
<td>3-058</td>
<td></td>
<td>Dawson Creek</td>
<td>68,387</td>
<td>40%</td>
</tr>
</tbody>
</table>

| 4-170 Yukon           |        |                   | 35,928     | 30%                         |
| 4-171 Nunavut         |        |                   | 35,975     | 13%                         |
| 4-172 Northwest Territories | |                   | 41,668     | 25%                         |

<table>
<thead>
<tr>
<th>Auction service areas</th>
<th>Tier 3 service area</th>
<th>Tier 4</th>
<th>Service area name</th>
<th>Population</th>
<th>Minimum population coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-001 Newfoundland and Labrador</td>
<td>3-001 Newfoundland and Labrador</td>
<td>4-001</td>
<td>St. John's</td>
<td>255,012</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-002</td>
<td>Placentia</td>
<td>15,304</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-003</td>
<td>Gander/Grand Falls/Windsor</td>
<td>144,229</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-004</td>
<td>Corner Brook/Stephenville</td>
<td>77,974</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-005</td>
<td>Labrador</td>
<td>27,656</td>
<td>30%</td>
</tr>
<tr>
<td>2-002 Nova Scotia and Prince Edward Island</td>
<td>3-002 Prince Edward Island</td>
<td>4-006</td>
<td>Charlottetown</td>
<td>95,350</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-003 Mainland Nova Scotia</td>
<td>4-007</td>
<td>Summerside</td>
<td>47,557</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-008</td>
<td>Yarmouth</td>
<td>55,609</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-009</td>
<td>Bridgewater/Kentville</td>
<td>139,289</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-010</td>
<td>Halifax</td>
<td>435,820</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-011</td>
<td>Truro</td>
<td>56,649</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-012</td>
<td>Amherst</td>
<td>33,373</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-013</td>
<td>Antigonish/New Glasgow</td>
<td>71,445</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-014</td>
<td>Sydney</td>
<td>131,379</td>
<td>70%</td>
</tr>
</tbody>
</table>
### Consultation on a Technical, Policy and Licensing Framework for Spectrum in the 600 MHz Band SLPB-005-17

**2-003 New Brunswick**

<table>
<thead>
<tr>
<th>Area</th>
<th>Code</th>
<th>City</th>
<th>Population</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-005 Southern New Brunswick</td>
<td>4-015</td>
<td>Saint John</td>
<td>142,898</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>4-016</td>
<td>St. Stephen</td>
<td>25,087</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>4-017</td>
<td>Fredericton</td>
<td>164,871</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>4-020</td>
<td>Grand Falls</td>
<td>24,936</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>4-021</td>
<td>Edmundston</td>
<td>26,504</td>
<td>60%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area</th>
<th>Code</th>
<th>City</th>
<th>Population</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-006 Western New Brunswick</td>
<td>4-018</td>
<td>Moncton</td>
<td>178,500</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>4-019</td>
<td>Miramichi/Bathurst</td>
<td>156,025</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>4-022</td>
<td>Campbellton</td>
<td>26,776</td>
<td>30%</td>
</tr>
</tbody>
</table>

**2-004 Eastern Quebec**

<table>
<thead>
<tr>
<th>Area</th>
<th>Code</th>
<th>City</th>
<th>Population</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-008 Bas du fleuve/Gaspésie</td>
<td>4-023</td>
<td>Matane</td>
<td>112,039</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>4-024</td>
<td>Mont-Joli</td>
<td>37,788</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>4-025</td>
<td>Rimouski</td>
<td>56,619</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>4-026</td>
<td>Rivière-du-Loup</td>
<td>82,869</td>
<td>50%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area</th>
<th>Code</th>
<th>City</th>
<th>Population</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-009 Québec</td>
<td>4-027</td>
<td>La Malbaie</td>
<td>28,193</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>4-029</td>
<td>Montmagny</td>
<td>56,808</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>4-030</td>
<td>Québec</td>
<td>904,330</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>4-031</td>
<td>Sainte-Marie</td>
<td>53,258</td>
<td>60%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area</th>
<th>Code</th>
<th>City</th>
<th>Population</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-010 Chicoutimi-Jonquière</td>
<td>4-028</td>
<td>Chicoutimi-Jonquière</td>
<td>218,377</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>4-063</td>
<td>Roberval/Saint-Félicien</td>
<td>58,438</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>4-064</td>
<td>Baie-Comeau</td>
<td>43,675</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>4-065</td>
<td>Port-Cartier/Sept-Îles</td>
<td>46,983</td>
<td>50%</td>
</tr>
</tbody>
</table>

**3-011 Eastern Townships**

<table>
<thead>
<tr>
<th>Area</th>
<th>Code</th>
<th>City</th>
<th>Population</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-032</td>
<td>Saint-Georges</td>
<td>71,425</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>4-033</td>
<td>Lac-Mégantic</td>
<td>24,223</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>4-034</td>
<td>Thetford Mines</td>
<td>42,019</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>4-035</td>
<td>Plessisville</td>
<td>22,772</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>4-039</td>
<td>Asbestos</td>
<td>29,744</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>4-040</td>
<td>Victoriaville</td>
<td>56,684</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>4-041</td>
<td>Coaticook</td>
<td>12,981</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>4-042</td>
<td>Sherbrooke</td>
<td>250,227</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>4-043</td>
<td>Windsor</td>
<td>16,777</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>4-045</td>
<td>Cowansville</td>
<td>29,083</td>
<td>70%</td>
<td></td>
</tr>
</tbody>
</table>

**3-012 Trois-Rivières**

<table>
<thead>
<tr>
<th>Area</th>
<th>Code</th>
<th>City</th>
<th>Population</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-036</td>
<td>La Tuque</td>
<td>16,219</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>4-037</td>
<td>Trois-Rivières</td>
<td>265,152</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>4-038</td>
<td>Louiseville</td>
<td>21,708</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>4-044</td>
<td>Drummondville</td>
<td>112,390</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>4-047</td>
<td>Granby</td>
<td>105,440</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>4-048</td>
<td>St-Hyacinthe</td>
<td>92,092</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>4-049</td>
<td>Sorel</td>
<td>58,740</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>4-050</td>
<td>Joliette</td>
<td>161,106</td>
<td>40%</td>
<td></td>
</tr>
</tbody>
</table>

**3-013 Montréal**

<table>
<thead>
<tr>
<th>Area</th>
<th>Code</th>
<th>City</th>
<th>Population</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-046</td>
<td>Farnham</td>
<td>29,593</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>4-051</td>
<td>Montréal</td>
<td>4,352,037</td>
<td>70%</td>
<td></td>
</tr>
</tbody>
</table>

**3-014 Upper Outaouais**

<table>
<thead>
<tr>
<th>Area</th>
<th>Code</th>
<th>City</th>
<th>Population</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-052</td>
<td>Sainte-Agathe-des-Monts</td>
<td>77,087</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>4-054</td>
<td>Mont-Laurier/Maniwaki</td>
<td>48,488</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>Region</td>
<td>City/Region</td>
<td>Population</td>
<td>Coverage Percentage</td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------------------------------</td>
<td>------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>2-006 Eastern Ontario and Outaouais</td>
<td>3-015 Ottawa Outaouais</td>
<td>64,131</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-016 Pembroke</td>
<td>82,200</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-018 Cornwall</td>
<td>69,729</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-019 Brockville</td>
<td>70,563</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-020 Kingston</td>
<td>177,314</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-021 Belleville</td>
<td>42,993</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-022 Cobourg</td>
<td>65,180</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-023 Peterborough</td>
<td>165,516</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-024 Huntsville</td>
<td>43,108</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-025 Toronto</td>
<td>7,030,750</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-026 Barrie</td>
<td>129,279</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-027 Guelph/Kitchener</td>
<td>707,534</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-028 Listowel/Goderich/Stratford</td>
<td>84,257</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-029 Niagara-St. Catharines</td>
<td>31,072</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-030 London/Woodstock/St. Thomas</td>
<td>349,283</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-031 Chatham</td>
<td>68,885</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-032 Windsor/Leamington</td>
<td>401,719</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3-033 Strathroy</td>
<td>123,953</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>46,727</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Region</td>
<td>Code</td>
<td>City</td>
<td>Population</td>
<td>Percentage</td>
</tr>
<tr>
<td>-----------------</td>
<td>------</td>
<td>---------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td><strong>Northern Ontario</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-009</td>
<td>3-034 North Bay</td>
<td>North Bay</td>
<td>104,524</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>3-035 Sault Ste. Marie</td>
<td>Parry Sound</td>
<td>21,123</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>3-036 Sudbury</td>
<td>Elliot Lake</td>
<td>29,520</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>3-037 Kirkland Lake</td>
<td>Iron Bridge</td>
<td>20,162</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sault Ste. Marie</td>
<td>80,833</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sudbury</td>
<td>178,872</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kirkland Lake</td>
<td>32,402</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timmins</td>
<td>42,086</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kapuskasing</td>
<td>38,024</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kenora/Sioux Lookout</td>
<td>64,826</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marathon</td>
<td>24,923</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thunder Bay</td>
<td>121,061</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fort Frances</td>
<td>20,095</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Manitoba</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-010</td>
<td>3-039 Winnipeg</td>
<td>Winnipeg</td>
<td>830,151</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lac du Bonnet</td>
<td>58,076</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Morden/Winkler</td>
<td>51,609</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Portage la Prairie</td>
<td>21,273</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Creighton/Flin Flon</td>
<td>22,228</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thompson</td>
<td>50,665</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steinbach</td>
<td>64,764</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dauphin</td>
<td>75,508</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Saskatchewan</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-011</td>
<td>3-040 Brandon</td>
<td>Brandon</td>
<td>103,743</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dauphin</td>
<td>75,508</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>3-041 Regina</td>
<td>Estevan</td>
<td>46,006</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weyburn</td>
<td>22,877</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yorkton</td>
<td>63,024</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regina</td>
<td>260,382</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>3-042 Moose Jaw</td>
<td>Moose Jaw</td>
<td>55,141</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Swift Current</td>
<td>46,219</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>3-043 Saskatoon</td>
<td>Saskatoon</td>
<td>306,824</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Watrous</td>
<td>27,288</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Battleford</td>
<td>99,433</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prince Albert</td>
<td>130,446</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northern Saskatchewan</td>
<td>37,064</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Alberta</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-012</td>
<td>3-044 Edmonton</td>
<td>Lloydminster</td>
<td>37,539</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vegreville</td>
<td>15,396</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Edmonton</td>
<td>1,325,857</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Edson/Hinton</td>
<td>49,814</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bonnyville</td>
<td>83,631</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Whitecourt</td>
<td>32,669</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Barrhead</td>
<td>23,437</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fort McMurray</td>
<td>73,953</td>
<td>70%</td>
</tr>
<tr>
<td>3-045 Medicine Hat/Brooks</td>
<td>4-131</td>
<td>Medicine Hat/Brooks</td>
<td>107,233</td>
<td>70%</td>
</tr>
<tr>
<td>4-133</td>
<td>Stettler/Oyen/Wainwright</td>
<td>51,420</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>4-139</td>
<td>Camrose</td>
<td>40,145</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>3-046 Lethbridge</td>
<td>4-132</td>
<td>Lethbridge</td>
<td>189,709</td>
<td>50%</td>
</tr>
<tr>
<td>3-047 Calgary</td>
<td>4-134</td>
<td>High River</td>
<td>120,208</td>
<td>40%</td>
</tr>
<tr>
<td>4-135</td>
<td>Strathmore</td>
<td>45,478</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>4-136</td>
<td>Calgary</td>
<td>1,416,856</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>3-048 Red Deer</td>
<td>4-137</td>
<td>Red Deer</td>
<td>206,387</td>
<td>60%</td>
</tr>
<tr>
<td>4-138</td>
<td>Wetaskiwin/Ponoka</td>
<td>54,340</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>3-049 Grande Prairie</td>
<td>4-147</td>
<td>Peace River</td>
<td>86,745</td>
<td>25%</td>
</tr>
<tr>
<td>4-148</td>
<td>Grande Prairie</td>
<td>110,027</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>3-050 Kootenays</td>
<td>4-149</td>
<td>East Kootenay</td>
<td>60,371</td>
<td>30%</td>
</tr>
<tr>
<td>4-150</td>
<td>West Kootenay</td>
<td>78,941</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>3-051 Okanagan/Columbia</td>
<td>4-151</td>
<td>Kelowna</td>
<td>362,815</td>
<td>60%</td>
</tr>
<tr>
<td>4-159</td>
<td>Merritt</td>
<td>15,649</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>4-162</td>
<td>Salmon Arm</td>
<td>51,024</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>4-163</td>
<td>Golden</td>
<td>6,854</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>3-052 Vancouver</td>
<td>4-152</td>
<td>Vancouver</td>
<td>2,731,567</td>
<td>70%</td>
</tr>
<tr>
<td>4-153</td>
<td>Hope</td>
<td>26,093</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>4-157</td>
<td>Powell River</td>
<td>26,865</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>4-158</td>
<td>Squamish/Whistler</td>
<td>74,365</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>3-053 Victoria</td>
<td>4-154</td>
<td>Victoria</td>
<td>458,861</td>
<td>70%</td>
</tr>
<tr>
<td>3-054 Nanaimo</td>
<td>4-155</td>
<td>Nanaimo</td>
<td>194,922</td>
<td>60%</td>
</tr>
<tr>
<td>3-055 Courtenay</td>
<td>4-156</td>
<td>Courtenay</td>
<td>118,732</td>
<td>60%</td>
</tr>
<tr>
<td>3-056 Thompson/Cariboo</td>
<td>4-160</td>
<td>Kamloops</td>
<td>106,972</td>
<td>70%</td>
</tr>
<tr>
<td>4-161</td>
<td>Ashcroft</td>
<td>15,070</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>4-164</td>
<td>Williams Lake</td>
<td>38,440</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>4-165</td>
<td>Quesnel/Red Bluff</td>
<td>23,558</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>3-057 Prince George</td>
<td>4-166</td>
<td>Skeena</td>
<td>56,234</td>
<td>30%</td>
</tr>
<tr>
<td>4-167</td>
<td>Prince George</td>
<td>94,607</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>4-168</td>
<td>Smithers</td>
<td>37,646</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>3-058 Dawson Creek</td>
<td>4-169</td>
<td>Dawson Creek</td>
<td>68,387</td>
<td>40%</td>
</tr>
<tr>
<td>4-170 Yukon</td>
<td>35,928</td>
<td>60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-171 Nunavut</td>
<td>35,975</td>
<td>25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-172 Northwest Territories</td>
<td>41,668</td>
<td>50%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Annex G: Proposed Conditions of Licence

1. In addition to the proposed conditions of licence in section 11 – Conditions of licence for spectrum in the 600 MHz band, it is proposed that the following apply to licences in the 600 MHz band.

2. **Eligibility:** The licensee must comply on an ongoing basis with the applicable eligibility criteria in subsection 9(1) of the *Radiocommunication Regulations*. The licensee must notify the Minister of any change that would have a material effect on its eligibility. Such notification must be made in advance for any proposed transactions within its knowledge.

3. **Radio station installations:** The licensee must comply with Client Procedures Circular CPC-2-0-03, *Radiocommunication and Broadcasting Antenna Systems*, as amended from time to time.

4. **Provision of technical information:** The licensee must provide, and maintain, up-to-date technical information on a particular station or network in accordance with the definitions, criteria, frequency and timelines specified in Client Procedures Circular CPC-2-1-23, *Licensing Procedure for Spectrum Licences for Terrestrial Services*, as amended from time to time.

5. **Compliance with legislation, regulation and other obligations:** The licensee is subject to, and must comply with, the *Radiocommunication Act* and the *Radiocommunication Regulations*, as amended from time to time. The licensee must use the assigned spectrum in accordance with the *Canadian Table of Frequency Allocations* and the spectrum policies applicable to this band, as amended from time to time. The licence is issued on condition that all representations made in relation to obtaining this licence are all true and complete in every respect.

6. **Technical considerations, and international and domestic coordination:** The licensee must comply on an ongoing basis with the technical aspects of the appropriate Radio Standards Specifications (RSS) and Standard Radio System Plans (SRSP), as amended from time to time. The licensee must use its best efforts to enter into mutually acceptable agreements with other parties for facilitating the reasonable and timely development of their respective systems, and to coordinate with other licensed users in Canada and internationally.

7. The licensee must comply with the obligations arising from current and future frequency coordination agreements established between Canada and other countries and shall be required to provide information or take actions to implement these obligations as indicated in the applicable SRSP. Although frequency assignments are not subject to site licensing, the licensee may be required through the appropriate SRSP to furnish all necessary technical data for each relevant site.

8. **Lawful interception:** The licensee operating as a telecommunication common carrier using the spectrum for voice telephony systems must, from the inception of service, provide for and maintain lawful interception capabilities as authorized by law. The requirements for lawful
interception capabilities are provided in the Solicitor General’s Enforcement Standards for Lawful Interception of Telecommunications (Rev. Nov. 95). These standards may be amended from time to time.

9. The licensee may request the Minister to forbear from enforcing certain assistance capability requirements for a limited period of time. The Minister, following consultation with Public Safety Canada, may exercise the power to forbear from enforcing a requirement or requirements where, in the opinion of the Minister, the requirement is not reasonably achievable. Requests for forbearance must include specific details and dates indicating when compliance to the requirement can be expected.

10. **Research and development:** The licensee must invest, as a minimum, 2% of its adjusted gross revenues resulting from the use of this licence, averaged over the term of the licence, in eligible research and development (R&D) activities related to telecommunications. Eligible R&D activities are those which meet the definition of scientific research and experimental development adopted in the *Income Tax Act*, as amended from time to time. Adjusted gross revenues are defined as total service revenues, less inter-carrier payments, bad debts, third party commissions, and provincial goods and services taxes collected. The licensee is exempt from R&D expenditure requirements if it, together with all affiliated licensees that are subject to the R&D condition of licence, has less than $1 billion in annual gross operating revenues from the provision of wireless services in Canada, averaged over the term of the licence. For this condition of licence, an affiliate is defined as a person who controls the carrier, or who is controlled by the carrier or by any person who controls the carrier, as per subsection 35(3) of the *Telecommunications Act*.

11. **Mandatory antenna tower and site sharing:** The licensee must comply with the mandatory antenna tower and site sharing requirements set out in Client Procedures Circular CPC-2-0-17, *Conditions of Licence for Mandatory Roaming and Antenna Tower and Site Sharing and to Prohibit Exclusive Site Arrangements*, as amended from time to time.

12. **Mandatory roaming:** The licensee must comply with the roaming requirements set out in Client Procedures Circular CPC-2-0-17, *Conditions of Licence for Mandatory Roaming and Antenna Tower and Site Sharing and to Prohibit Exclusive Site Arrangements*, as amended from time to time.

13. **Annual report:** The licensee must submit an annual report for each year of the licence term, which includes the following information:
   - a statement indicating continued compliance with all conditions of licence;
   - an update on the implementation and spectrum usage within the area covered by the licence;
   - existing audited financial statements with an accompanying auditor’s report;
   - a statement indicating the annual gross operating revenues from the provision of wireless services in Canada and, where applicable, the annual adjusted gross revenues resulting from the use of this licence, as defined in these conditions of licence;
• a report of the R&D expenditures as set out in these conditions of licence (ISED may request an audited statement of R&D expenditures with an accompanying auditor’s report at its discretion);

• supporting financial statements where a licensee is claiming an exemption based on, together with all affiliated licensees that are subject to the R&D condition of licence, it having less than $1 billion in annual gross operating revenues from the provision of wireless services in Canada, averaged over the term of the licence;

• a copy of any existing corporate annual report for the licensee’s fiscal year with respect to the authorization; and

• other information related to the licence as specified in any notice updating the reporting requirements as issued by ISED.

14. All reports and statements are to be certified by an officer of the company and submitted, in writing, within 120 days of the licensee’s fiscal year-end. Confidential information provided will be treated in accordance with subsection 20(1) of the Access to Information Act.

15. Reports are to be submitted to ISED at the following address:

Innovation, Science and Economic Development  
Spectrum Management Operations Branch  
Manager, Operational Policy  
235 Queen Street  
Ottawa, Ontario  
K1A 0H5

16. Where a licensee holds multiple licences, spectrum implementation reports should be broken down by service area. This information, including the extent of implementation and spectrum usage, is important for analyzing each licensee’s individual performance against its conditions of licence. In addition, it allows ISED to monitor the effectiveness of these conditions in meeting the policy objectives regarding the band and the Department’s intent that the spectrum be deployed in a timely manner for the benefit of Canadians.

17. Amendments: The Minister retains the discretion to amend these terms and conditions of licence at any time.