

Comments of Shaw Communications Inc.

Consultation on a New Set of Service Areas for Spectrum Licensing

***Canada Gazette*, Part I, November 27, 2018, Notice No. DGSO-002-18, as amended**

February 19, 2019

I. INTRODUCTION

1. The following constitutes the initial comments of Shaw Communications Inc. (“Shaw”) to Innovation, Science and Economic Development Canada (“ISED” or the “Department”) in connection with the proceeding (the “Consultation”) initiated by *Consultation on a New Set of Service Areas for Spectrum Licensing*, Notice No. DGSO-002-18 (the “Consultation Document”), as amended by Notice No. DGSO-003-18.
2. In the Consultation Document, the Department describes its intention for the present Consultation: to complement ISED’s existing suite of spectrum licensing mechanisms with new service areas that will (a) help ensure that Canada is well prepared to meet current and future wireless needs, (b) encourage additional access to spectrum within rural areas, and (c) support new technologies and emerging use cases.¹ It also identifies the following policy objectives for a new set of service areas:²
 - To improve access to spectrum, furthering more efficient usage across Canada;
 - To address the unique geographic distribution of Canada’s population, allowing for greater flexibility in the design of licensing frameworks; and
 - To better address new and different services, technologies, applications and use cases.
3. It is with these goals and policy objectives in mind that Shaw has assessed the Consultation Document and the Department’s proposals and questions described therein.
4. While Shaw is supportive of these goals and policy objectives, we question the need for the Department to establish a new set of nationwide service tiers at this time to achieve them. In fact, in Shaw’s view, the development and use of an overly prescriptive licensing tool at this time could, as Shaw will explain, actually diminish efficient spectrum usage and hinder Canada’s ability to meet future wireless needs, if the Department’s proposals are not carefully examined and adjusted. As we discuss further below, Shaw recommends that the Department take a more flexible approach to addressing its stated objectives that will be better suited to the rapidly evolving technological environment and the high-degree of variability in different spectrum frequency ranges. It can do this by

¹ Consultation Document at paragraph 12.

² Consultation Document at paragraph 26.

using the licensing tools already available to it, namely applying Tier 4 licence area subdivisions where greater granularity is deemed desirable and appropriate in the context of the licensing of a specific (or group of related) frequency band(s).

5. As the Department itself acknowledges, different attributes of different spectrum frequency bands make them more or less suitable for coordination in smaller service areas. Shaw agrees with the Department that high-band spectrum, which does not propagate well over large distances, can be well-suited to smaller service areas. However, the same cannot be said of low-band or even, universally, of mid-band spectrum. Although it may be true that advancements in technology and network design will enhance the suitability of more granular licence areas for lower-band spectrum, it is premature and unwise to make policy decisions on the basis of speculation.
6. Additionally, service type is an important factor in relation to the appropriateness of more granular licensing tiers.³ While Shaw appreciates ISED's desire to maintain technological and competitive neutrality in the creation of new service area boundaries, it must account for the significant deployment and interference challenges inherent in licensing spectrum for mobile use using small service areas. For any given service area, the total boundary length will be inversely proportionate to the total size of the area. For example, dividing a hypothetically square Tier 4 service area into four equal Tier 5 service areas will double the total border length of the area and, in turn, multiply the likelihood of adjacent system interference and the coordination effort required to mitigate it. If the Department's design of smaller licensing areas does not account for these challenges, its approach will be completely inconsistent with its stated objectives of furthering efficient spectrum usage and ensuring Canada is well prepared to meet future wireless needs.
7. Establishing and using nation-wide Tier 5 licence areas might be feasible for fixed use licences. However, with respect to mobile service (for which there are more than 30 times as many users as for fixed service), it is far more difficult to design workable Tier 5 licence areas, due to the complexity of managing interference and maintaining service consistency and continuity with mobile users. In general, the use of granular licensing areas is inappropriate for mobile wireless use and should be avoided, particularly for

³ We note that Tier 5 service areas are especially inappropriate for satellite, radiolocation and navigation services.

mid- and low-frequency bands (i.e., bands under 24 GHz). Spectrum in these bands that is allocated to mobile service should continue to be auctioned using larger tier sizes (i.e., Tiers 2 or 3). Where exceptional circumstances necessitate the licensing of mobile or flexible use spectrum on a smaller tier basis, only a single block (or one paired block, as applicable) should ever be licensed using such smaller tiers.

8. If a mobile user crosses tier borders, his or her service provider may not be licensed in the adjacent area. The user may therefore experience a loss or degradation of service. Service degradation at licence borders can cause customer frustration, market confusion and even worse, inconsistent emergency services, such as 911. As a matter of principle, therefore, when spectrum is licensed for mobile use (or flexible mobile/fixed spectrum use), it should be done in a way that will allow typical end-users to stay within one service area during a normal daily routine (e.g., one that involves commuting to work, to study, and/or to participate in normal commercial and cultural activities). For example, while Toronto and Milton are two distinct population centres, tens of thousands of people commute on a daily basis between the two. These communities should be considered as a single licence area for mobile services. Unfortunately, neither of the options proposed by the Department would accommodate this reality.
9. Moreover, for mobile service, it will be very difficult to control the propagation of radio signals along the very finely defined contours of potential Tier 5 areas. As referred to above, the substantial increase in border areas requiring interference management will complicate the deployment process and may lead to service quality issues at the borders due to signal interference from territory-adjacent operators or coverage gaps as operators seek to avoid signal interference.
10. Thus, the design of a new set of service areas, particularly if their use is contemplated for mobile, will be a complex process requiring a multi-faceted approach. As service areas become smaller and borders multiply, they must be designed with extreme care and understanding of the various issues affecting spectrum use, including the traffic flows and geographical characteristics of a given area. The design of border areas will need to account for specifics of micro-locations and the management of interference between them. Expertise in demography, geography, topography, and commercial and industrial development and planning will play important role in setting appropriate boundaries.

11. While an approach based on the location of Statistics Canada population centres (as proposed by the Department in Option 2) serves as a good starting point for the creation of Tier 5 licensing areas, given the significant amount of mobile traffic that is generated outside of the home – which will increase exponentially with the emergence of industrial Internet of Things, connected vehicles and other 5G applications – several other factors need to be taken into account in the design process.
12. In Shaw's view, given the limited use cases at present for Tier 5 licence areas, which appear to relate principally to fixed wireless access in rural parts of the country, the Department should avoid an overly formulaic approach to small tier licensing and develop and use smaller tier areas only where a specific need exists. With a country as vast and diverse – economically and geographically – as Canada, the issues the Department seeks to address with the creation of Tier 5 licence areas may not apply across the country and therefore it may not be necessary to develop Tier 5 service areas for every Tier 4 area.
13. Shaw urges the Department to consider adopting a more flexible policy approach to addressing its stated objectives that can better account for the rapid pace of technological change and the high-degree of variability in the different spectrum bands. Establishing nationwide Tier 5 licence areas will be a complex and laborious task and yield a tool of questionable use depending on the circumstances in which Tier 5s are eventually proposed for use (i.e., rationale for use, specific frequency band, status of the equipment ecosystem, applications and uses at that time, etc.). Before undertaking this complicated and potentially fraught exercise, Shaw urges the Department to consider the tools already available to it. Specifically, Shaw recommends that it would be more appropriate to evaluate the need for more granular licence areas on a case-by-case basis, as licensing frameworks are developed for new spectrum bands, and then utilize Tier 4 subdivisions for the achievement of licensing granularity.
14. The use of Tier 4 subdivisions will allow the Government to award a greater number of smaller service area licences in rural areas, improving rural providers' access to spectrum and addressing the unique geographical distribution of Canada's population, based on the characteristics of the frequency band in question at the time of that exercise. Developing Tier 5 licensing now may result in arbitrary borders that are unworkable in the context of certain, later-released spectrum bands.

15. If the Department nevertheless determines that it is appropriate to define Tier 5 licence areas in the present Consultation, Shaw has developed an alternative approach that should be preferred to the options presented in the Consultation Document. Shaw's alternative approach, which we describe in our answer to Question 4, below, respects the design principles established by ISED but also incorporates a number of additional design factors that Shaw submits ISED must take into consideration.

II. RESPONSES TO SPECIFIC QUESTIONS RAISED IN THE CONSULTATION DOCUMENT

16. In the following paragraphs, Shaw responds to the specific questions posed by the Department in the Consultation Document.

Question 1: Design principles

Q1A – ISED is seeking comments on the proposed design principles. When providing responses, including supporting arguments for or against the proposed principles.

Q1B – ISED is seeking any suggestions on additional design principles that should be considered.

17. As described above, in Shaw's view it would be a premature and inefficient endeavour to proceed with the development of nationwide Tier 5 licence areas at this time. A more flexible approach to smaller-tier licensing that is based on the circumstances present at the time of establishing licensing rules (i.e., frequency band, licensed services, available technology and applicable policy objectives) using Tier 4 subdivisions should instead be preferred.
18. It may nevertheless be useful to establish design principles for smaller tier licensing at this time. Such principles could inform the Department's application of the case-by-case licence subdivision approach endorsed by Shaw. Should the Department proceed as planned to develop Tier 5 boundaries in the present consultation, the design principles discussed herein must inform its approach.
19. While Shaw is supportive of each of the design principles proposed by the Department, the proposed principles are insufficient on their own and fail to account for many factors of significant impact for the licensing of spectrum for mobile use. The following factors

should be added to the Department's list of design principles for Tier 5 licence areas to better reflect the realities of wireless network design.

20. *"Areas of interest" must be clustered when establishing service area boundaries.* Major traffic corridors, major industrial areas, such as factories and power generation plants, airport complexes, large commercial centres, and shopping and outlet malls are examples of areas that may have little measurable population. Although Statistics Canada's new (2016) population centre delineation rules now account for employment density and airport locations, in Shaw's view, the Statistics Canada rules are too narrow to ensure that population centres adequately capture all of the areas of high mobile traffic generation. ISED must therefore make adjustments to ensure that all such areas are clustered with adjacent population centres when boundaries are drawn.
21. Using the example provided by ISED at Figure 3 of the Consultation Document, it appears that, under Option 2, the cities of Milton and Toronto would be considered distinct Tier 5 service areas, separated by an unpopulated rural area (which would form part of an another, separate Tier 5 area). However, Milton and Toronto are connected by Highway 401, one of the busiest highways in the world. It should not be assumed that mobile traffic in that area is small just because the population density is low. Quite to the contrary, the Highway 401 corridor is an area with very high traffic density. Additionally, located in that "unpopulated" area are Toronto Outlet Mall, industrial buildings, restaurants, and gas stations. If population distribution is the only factor considered in designing Tier 5 service areas boundaries, these areas will be inappropriately deemed unpopulated and rural.
22. ISED should look at Hamilton, St. Catharines, and the Queen Elizabeth Way (QEW) Highway in much the same way. The area between St. Catharines and Stoney Creek is sparsely populated, but it is an important transit, commercial and tourist area, connecting the Golden Horseshoe with the U.S. border. They should be part of one uninterrupted service area.
23. Therefore, areas of interest (e.g., major traffic corridors, commercial and industrial areas) that are adjacent to population centres should form part of one uninterrupted licence area. This clustering of areas of interest with population centres will in some cases appropriately result in the aggregation of adjacent population centres.

Furthermore, to the extent possible, Tier 5 service area boundaries should not intersect any major traffic corridor within the related Tier 4 service area (e.g., major highways, railways, commuter lines, etc.).

24. *Buffer zones should be incorporated in the design of new service area boundaries.* The Department should implement buffer zones around population centres to allow for population expansion. The use of buffer zones will also help to address border irregularities and discontinuities.
25. *New service area boundaries must account for geographical and topographical characteristics.* In designing service area boundaries, the Department must consider topographical features of the terrain. Propagation studies and prediction models should be used to verify that theoretical borders can be established in the field.
26. To use Figure 3 of the Consultation Document once again, it appears that the area west of Milton is unpopulated and could be considered part of a separate Tier 5 service area. However, west of the city of Milton is the ridge of Niagara Escarpment – a land mass of significant elevation that dominates the landscape, with line of sight to downtown Toronto as well as Hamilton and St. Catharines. Today the Escarpment is used as a site for transmission towers by many service providers. The signals from that location could propagate across multiple Tier 5 areas. Therefore, major topographical features like the Escarpment should not be separated from adjacent populated areas.
27. *The curvature of a Tier 5 service area boundary must be determined on the basis of the lowest possible frequency band where Tier 5 could be applied.* Since the curvature of Tier 5 service area boundaries will be very difficult to apply consistently across different frequency bands, it should be determined using the lowest possible frequency band for which Tier 5 licence areas would potentially be applied, due to the propagation capacity of low-band spectrum. This is consistent with ISED's desire that new service areas be able to support different frequencies.⁴
28. Figure 3 in the Consultation Document shows the Toronto Tier 4 service area. As one can see, if the nesting principle is applied, many of Tier 5 boundary lines would be straight lines or sharp curves, even though the terrain would not support straight line

⁴ Consultation Document at paragraph 32.

radio propagation. See, for example, the western part of the city of Hamilton. As a practical matter, it will be very difficult to design a network that respects such straight-line borders, particularly in lower frequency bands, leading to either excessive overlap with an adjacent service area (and consequent interference management issues) or insufficient coverage near the border of the Tier 5 licence area. In either case, service degradation is likely. As such, as noted above, radio propagation studies should be conducted prior to establishing Tier 5 service area boundaries.

Question 2: Option 1 - Boundaries based on Statistics Canada 2016 census subdivisions

Q2A—ISED is seeking comments on the suitability of Option 1 in addressing the proposed design principles.

29. In Shaw's view, the Statistics Canada 2016 census subdivisions do not provide an optimal starting point for the design of Tier 5 boundaries as they do not fulfill any of the design principles proposed by the Department in the Consultation Document or discussed above. The Department's Option 2 should be preferred to Option 1 because it uses as a starting point the design principles of fostering demand and interference minimization, which have at their core a consideration of population centre location.⁵

Q2B—ISED is seeking comments on whether adjacent urban CSDs should be combined into a single service area.

30. Should the Department proceed with Option 1, adjacent urban census subdivisions should be combined into a single service area. This is consistent with the supplementary design principles Shaw has proposed.

Q2C—ISED is seeking comments on whether there should be a minimum or maximum size for the service areas and if very small CSDs should be amalgamated into the larger surrounding or adjacent CSD.

31. The Department should not set a maximum size for Tier 5 service areas. In fact, as mentioned above, in certain Tier 4 service areas, there may be no need to develop Tier 5 service areas to satisfy the Department's policy objectives.
32. However, it would be appropriate to develop a minimum size for such smaller service areas to ensure their practical usefulness in future licensing purposes. As noted above, the smaller the service area, the longer the overall boundary length and attendant level

⁵ Consultation Document at paragraphs 30 and 33.

of required interference and coordination management. If a service area is too small, it will become impractical to deploy the spectrum for mobile use.

33. Due to the variable propagation of different spectrum bands, an optimal approach to establishing minimum service area size would be based on a specific spectrum band and service allocation. For instance, it could be based on the typical range of a base station. This highlights one of the key benefits of Shaw's alternative licence subdivision approach, under which the Department could develop customized licence areas that account for the characteristics of the frequency band and intended use of the spectrum at the time of licensing. However, Shaw reserves the right to comment on the appropriate minimum Tier 5 size in the reply phase of this proceeding.

Q2D—ISED is seeking comments to gauge if this option is suitable for northern and rural areas.

34. Shaw has no comment on this question at this time but may wish to provide comments as part of the reply phase of this proceeding.

Question 3: Option 2 - Boundaries based on population centres

Q3A—ISED is seeking comments on the suitability of Option 2 in addressing the proposed design principles.

35. As described above, of the options presented in the Consultation Document, Option 2 better addresses ISED's proposed design principles. However, Option 2 fails to account for the supplementary design factors that Shaw submits must be considered in the development of Tier 5 boundaries. As such, we have developed an alternative approach based on these design factors, which we outline in our response to Question 4, below.

Q3B—ISED is seeking comments on the proposed minimum population for small population centre service areas. A rationale should be provided if a different population is proposed.

36. The location of population centres should be a key consideration in the design of smaller service areas. However, population density alone should not be determinative of boundary locations as to do so would result in suboptimal and potentially unusable service areas.

Q3C—ISED is seeking comments on whether the “other” service areas (remainder areas in each Tier 4) should be licensed differently (e.g. on a shared or first-come, first-served basis).

37. All service areas, including “other” service areas (remainder areas in each Tier 4 licence area) should be licensed on the same basis, whether or not they include population centres. First come-first-serve basis licensing is inappropriate for mobile services and should be avoided for mobile and flexible use allocations.

Q3D—ISED is seeking comments on whether this option is suitable for northern or rural areas.

38. Shaw has no comment on this question at this time but may wish to provide comments as part of the reply phase of this proceeding.

Q3E—ISED is seeking comments on whether population centres, which have adjacent boundaries, should be amalgamated to form a single service area.

39. Shaw strongly supports the amalgamation of adjacent population centres in single service areas. As described above, given the character of mobile traffic generation and flow, it will be imperative that adjacent areas of interest, as well as population centres be clustered together in single service areas, in order to ensure service quality and efficient spectrum use. As also explained above, the Department should implement buffer zones around these amalgamated areas of interest and population to accommodate population expansion and allow for the smoothing of border irregularities.

Question 4: Alternative proposals

ISED invites interested parties to submit alternative proposals for smaller service areas. All alternative service area proposals must be applicable to all of Canada and promote the federal government’s policy objectives.

Submissions should include a rationale for the proposal, an explanation of how it satisfies ISED’s policy objectives and how it meets each of the proposed design principles, and any other relevant information. One or more maps should also be included, preferably including one which covers all of Canada. Maps should be in a format that is readily accessible by ISED (e.g. in ArcGIS or MapInfo format, or publicly available on the Internet with a link provided). Submissions should adhere to the requirements listed above in order to allow other stakeholders sufficient information to provide informed comments.

40. As we have discussed, establishing nationwide Tier 5 licence areas will be a complex and laborious task and yield a tool of questionable utility depending on the circumstances in which Tier 5s are eventually proposed for use (i.e., rationale for use, specific spectrum band in question, status of the equipment ecosystem, applications and uses at that time, etc.). Before undertaking this complicated exercise, Shaw urges the Department to consider the tools already available to it. Specifically, Shaw recommends that it would be more appropriate to evaluate the need for more granular licence areas on a case-by-case basis, as licensing frameworks are developed for new spectrum bands, and then employ Tier 4 licence subdivisions for the achievement of licensing granularity.
41. The use of Tier 4 licence subdivisions will allow the Government to award a greater number of smaller service area licences in rural areas, improving rural providers' access to spectrum and addressing the unique geographical distribution of Canada's population, based on the characteristics of the frequency band in question at the time of that exercise. The Department could use licence subdivisions to address, for example, specific availability issues for rural areas contained in the same Tier 4 area as urban centres. Developing Tier 5 licensing now may result in arbitrary borders that are unworkable in the context of later-released spectrum bands.
42. If the Department nevertheless determines that it is appropriate to establish Tier 5 boundaries through the present Consultation, Shaw recommends the following alternative approach. This approach incorporates, in a step-by-step fashion, the critical design factors discussed above and respects the design principles established by ISED.
43. First, the Department would identify all of the Tier 4 service areas for which greater licence granularity is necessary to achieve its objectives.
44. In those Tier 4 areas only, as a second step, the Department would then apply Option 2 of the Consultation Document (i.e., map the boundaries of each population centre with over 2,000 people on to its spectrum grid cells).
45. Third, the Department would then identify the other "areas of interest" (i.e., transportation corridors and major industrial, commercial and cultural areas) adjacent to such population centres and map them onto its grid cells. These areas will be amalgamated to form a single Tier 5 service area. Any service area that is adjacent to another service

area following this process should also be amalgamated. Following the amalgamation process, a buffer zone should be applied.

46. As a fourth step, boundaries would be further adjusted to account for topography and radio propagation analysis.
47. Fifth, the Department would need to undertake a “smoothing” exercise to address sharp curves and irregularities (i.e., discontinuities).
48. An additional process will need to be undertaken for the drawing of boundaries, if any, in the remainder of the Tier 4 service area (i.e., the rural or unpopulated areas),⁶ which will also need to be adjusted based on topography and radio propagation analysis, as above.
49. As a final step, all of the proposed boundaries would need to be validated using propagation models to verify the feasibility of the proposed boundaries.

III. CONCLUSION

50. Shaw is supportive of the goals and policy objectives the Department has established for this Consultation, but we question the need to undertake the complicated and potentially fraught exercise of establishing Tier 5 service areas throughout the country at this time. We urge the Department to instead consider the tools already available to it for the achievement of licensing granularity, such as the Tier 4 licence subdivisions. Licence subdivisions would allow the Department to licence specific spectrum blocks on a more granular basis if the circumstances present at the time of a future licensing proceeding require it. Regardless of the approach ultimately adopted, we strongly recommend that ISED account for the supplementary design factors we have proposed, if smaller tier licensing is to be feasible for mobile (or flexible) use.
51. Shaw thanks the Department for the opportunity to participate in this Consultation.

⁶ Shaw reserves comment on this issue at this stage of the proceeding.