Innovation, Science and Economic Development Canada
Innovation, Sciences et Développement économique Canada

SMSE- 018-17
NOVEMBER 2017

Spectrum Management and Telecommunications

Consultation on the Technical and Policy Framework for White Space Devices

Aussi disponible en français

Canada

Contents

1. Intent

1. Through the release of this document, Innovation, Science and Economic Development Canada (ISED) is hereby initiating a consultation on a technical and policy framework for the use of white space devices.

2. 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 *Telecommunications Act*, is responsible for spectrum management in Canada. As such, the Minister is responsible for developing goals and national policies for spectrum resources use and for ensuring effective management of the radio frequency spectrum resource.

2. Legislation

3. The Minister is provided the general powers for spectrum management in Canada pursuant to section 5 of the *Radiocommunication Act* and sections 4 and 5 of the *Department of Industry Act*. Under the *Radiocommunication Act*, the Minister has the power to establish standards, rules, policies and procedures with regards to radiocommunication, including technical aspects related to broadcasting. The Governor in Council may make regulations with respect to spectrum management pursuant to section 6 of the *Radiocommunication Act*; these regulations have been prescribed under the *Radiocommunication Regulations*.

3. Background

4. In October 2012, ISED issued its *Framework for the Use of Certain Non-broadcasting Applications in the Television Broadcasting Bands Below 698 MHz* (SMSE-012-12). In this document, a regulatory framework was introduced for white space devices to operate under a licence-exempt approach in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz, and 470-698 MHz.

5. In 2015, the *Decision on Repurposing the 600 MHz Band* (SLPB-004-15) was issued, in which a joint repurposing of the 600 MHz band (614-698 MHz) with the United States (U.S.) was announced. This decision focused on the technical aspects of repurposing spectrum that was used for broadcasting and other purposes. It also included the adoption of the mobile band plan aligned with the U.S. and ISED's intent to conduct a future consultation on issues related to other secondary use in the 600 MHz band, including white space devices.

6. Recently in August 2017, a *Consultation on a Technical, Policy and Licensing Framework for Spectrum in the 600 MHz Band* (SLPB-005-17) has been launched to address issues related to the auction of the repurposed spectrum intended for flexible use, including commercial mobile.

7. As a result of repurposing parts of the broadcast television spectrum for mobile broadband services, the regulatory environment in which white space devices operate has changed. In consideration of this change, ISED has reviewed the regulatory framework and

technology for white space systems both domestically and internationally. This consultation is meant to address policies with respect to spectrum utilization by white space devices, in consideration to both the repurposing of the 600 MHz band and developments in the white space frameworks of other countries.

8. White space refers to the part of the spectrum that is not being used by incumbent radio services at particular times and in certain geographic areas. The key components for the provision of wireless broadband service using white space technology include white space devices (WSD), white space databases (WSDB), and white space database administrators (WSDBA). A WSDB is a third-party database that maintains records of all licensed systems that operate within the frequency bands allowed for potential white space use. Based on this information, the WSDB determines channels that are unused by licensed services at a specific time and geographic location. A WSD is a radio apparatus that operates in the white space designated frequency bands using opportunistic spectrum access techniques. A WSD provides its geographical location to a WSDB, which in return provides it with a list of available channels. In the current framework, WSDs operate on a licence-exempt basis and are classified as either fixed or personal/portable. A WSDBA is a third-party service provider designated to administer a WSDB.

9. Canada's white space framework is a first step towards enabling dynamic spectrum access techniques and opportunities for further innovation in wireless technology. The first application currently envisaged for white space is the provision of wireless broadband Internet service in rural and remote areas that are difficult to reach with other solutions. In the future, Canadians could potentially benefit from this technology through other applications such as local area networking by consumers (similar to Wi-Fi), machine-to-machine communications as part of the Internet of Things, as well other innovations that haven't yet been conceived.

10. Furthermore, the practical experience obtained from the use of white space technology may facilitate the development of future dynamic spectrum access technologies, which is a key component in making more spectrum available through improved spectrum sharing techniques.

4. Status in Canada

11. In October 2012, ISED issued a *Framework for the Use of Certain Non-broadcasting Applications in the Television Broadcasting Bands Below 698 MHz* (SMSE-012-12). This document introduced a regulatory framework for white space devices under a licence-exempt approach.

12. In February 2015, the technical standards RSS-222, *White Space Devices (WSDs)*, and DBS-01, *White Space Database Specifications*, were released. These standards completed the implementation of the regulatory framework for white space by providing the technical rules for the operation of WSDBs and certification of WSDs.

13. Since the publication of these technical requirements, the only outstanding element required for the use of white space technology in Canada has been the designation of a WSDBA. In July 2016, the first application for designation of a WSDBA in Canada was

received. A public review and trial of the applicant's system began in February 2017. Following the completion of the review process Keybridge LLC has been designated as a WSDBA and is therefore approved to operate a WSDB system in Canada. A list of WSDBAs, which are designated or under evaluation, is available on ISED's Television white space web page, and will be regularly updated as other applicants complete the review process.

14. Under the current rules, white space devices (fixed or personal/portable) are permitted to operate only in the frequency bands and respective TV channels shown in table 1. The availability of channels, provided by a white space database, is subject to the constraints related to the location and use of licensed operations in the band, which currently include TV broadcast stations, wireless microphones, and remote rural broadband systems. It should be noted that the use of wireless microphones in the 600 MHz band is addressed in a separate consultation .

Table 1: Current permissible channels by type of WSD

Frequency bands (MHz)	TV channels	Personal/portable WSD	Fixed WSD
54-60	2	Not permitted	Permitted
60-72	3-4	Not permitted	Not permitted
76-88	5-6	Not permitted	Permitted
174-216	7-13	Not permitted	Permitted
470-512	14-20	Not permitted	Permitted
512-608	21-36	Permitted	Permitted
608-614	37	Not permitted	Not permitted
614-698	38-51	Permitted	Permitted

5. Status in the United States and United Kingdom

15. The U.S. Federal Communications Commission (FCC) initially released its white space rules in September 2010. In August 2015, the FCC released a Report and Order on actions taken to repurpose broadcast television band spectrum for new wireless services. These changes included rules for the operation of white space devices in the 600 MHz frequency blocks that were to be repurposed for new mobile services. In addition, the capabilities of white space systems were improved by expanding the set of frequency bands permitted for use and by modifying the technical requirements under which the devices operate.

16. In February 2015, Ofcom, the United Kingdom's communications regulator, published its decision to allow the operation of white space devices in the U.K. This approach to white space enables access to unused parts of the radio spectrum in the frequency band 470-790 MHz through opportunistic access controlled by white space databases. White space devices use the

band on an opportunistic basis while protecting digital terrestrial television (DTT) as well as radio systems for program making and special events (PMSE), including wireless microphones. The opportunistic use takes place dynamically, controlled by databases that hold information on the location of DTT, PMSE, and WSDs to allow these latter devices access to the spectrum. In December 2015, Ofcom qualified several database administrators to operate within the U.K, two of which are currently providing WSDB services.

17. The U.K. framework for white space is broadly similar to Canada and the U.S., where WSDBs are used to protect incumbent services and inform WSDs on spectrum availability. However, Ofcom has taken an expanded role on the protection of incumbent services by conducting most of the necessary interference calculations, and providing WSDBs with pixelated geographical maps of white space availability and required power limits for WSDs. This approach is different from the one taken in Canada and the U.S., where the regulator provides the technical data on licensed incumbent services, and the WSDB conducts the necessary calculations to avoid interference based on the regulator's technical requirements and methodology.

6. Additional white space spectrum/channel availability

18. Once the television stations in the broadcast service transition into the broadcasting band below 608 MHz as part of the DTV transition plan, the amount of spectrum available for white space devices will be reduced in areas served by a high number of TV stations. Updating the regulatory framework for white space devices to include additional spectrum could facilitate their use by maximizing the channels that can be used by white space devices, where available.

6.1 TV channels 3 and 4 (60-72 MHz)

19. In the framework released in 2012 (SMSE-012-12), white space devices were not allowed to access TV channels 3 and 4 (60-72 MHz) to minimize interference risks to consumer electronic devices, which use these channels to interface and connect to television sets. These consumer devices include cable TV receivers and personal entertainment systems such as video cassette recorders (VCRs). The transition from analog to digital televisions, as well as the growing consumption of high-definition content by consumers has led to the increased adoption of alternative means for the connectivity of electronic consumer devices to television sets, such as high-definition multimedia interface (HDMI) and composite video cables. Furthermore, current televisions are also equipped with built-in digital TV receivers, and don't require a separate converter to receive over-the-air TV signals. In general, newer televisions and consumer electronic devices do not rely only on using TV channels 3 and 4 to connect to each other. As a result, the potential use of these TV channels by white space devices is unlikely to cause broad interference.

20. The U.S. recently updated their rules to allow fixed white space devices to use channels 3 and 4. The relatively low frequency of these channels requires larger antennas, which are better suited to fixed devices compared to personal/portable devices. Furthermore, the FCC also took into account the lack of current WSDs operating in the lower very high frequency (VHF) range (54-72 MHz and 76-88 MHz), noting potential use could take place in the future as equipment

technology continues to develop. In the United Kingdom, the usage of channels 3 and 4 for white space devices is not allowed since these frequencies do not fall within their digital television spectrum range.

21. ISED is proposing to permit the use of channels 3 and 4 by fixed white space devices. This would allow additional white space spectrum to be used in the future for the provision of fixed services, including broadband to rural and remote regions of Canada. The risk of interference is low and will be further mitigated due to the time it will take for white space equipment to be available for these channels.

Q1. ISED is seeking comments on its proposal to harmonize with the U.S. framework regarding the operation of fixed white space devices in channels 3 and 4 (60-72 MHz).

In providing comments, respondents are requested to include supporting arguments and rationale.

6.2 TV channels 14 to 20 (470-512 MHz)

22. In Canada, the use of channels 14 to 20 (470-512 MHz) by white space devices is currently limited to fixed devices only. At the time that SMSE-012-12 was released, ISED was of the view that there was sufficient other spectrum for the operation of personal/portable white space devices. Furthermore, this policy decision was made in harmonization with the FCC rules, where the restriction on personal/portable white space devices was added to provide additional protection to U.S. land mobile services.

23. Since then, the FCC has decided to remove its previous prohibition on personal/portable devices operating on channels 14 to 20. In order to protect land mobile services from fixed white space devices, the location information where those operations are used is already included in the white space databases. The FCC determined that personal/portable devices can protect the land mobile service in the same way as fixed devices since they both rely on database access to determine their list of available channels. In the United Kingdom, all white space devices are allowed to operate in this frequency range.

24. ISED is proposing to permit the use of channels 14 to 20 by personal/portable white space devices. Harmonization with the U.S. in this regard will help improve the white space equipment ecosystem in Canada. The existing regulatory framework for protecting licensed users in these channels will also provide the same mechanism for ensuring protection from portable white space devices.

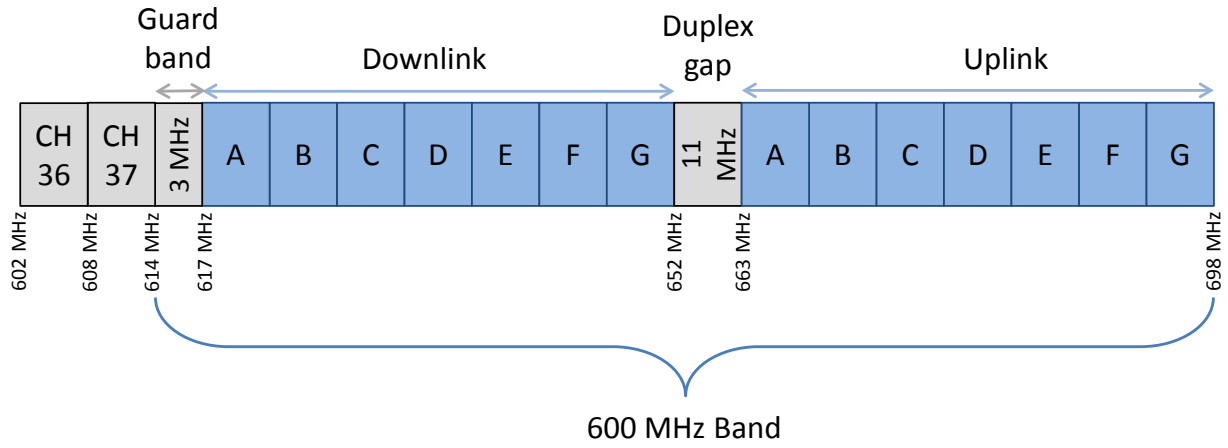
Q2. ISED is seeking comments on its proposal to harmonize with the U.S. framework regarding the operation of personal/portable white space devices in channels 14 to 20 (470-512 MHz).

In providing comments, respondents are requested to include supporting arguments and rationale.

7. White space devices in the 600 MHz range repurposed band

25. The frequency 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 602-698 MHz



26. In the Report and Order, the FCC adopted technical rules to allow white space device operations in the 614-698 MHz band including the duplex gap, guard band, and mobile service uplink/downlink blocks. To facilitate access to this spectrum by white space devices, a framework was implemented to protect the mobile service by requiring a minimum separation distance between 600 MHz mobile service areas and white space devices for both co-channel and adjacent channels operations. This mechanism requires 600 MHz mobile service licensees to register their deployment areas with a white space database administrator. The white space database can then ensure these operations are protected when a white space device makes a query for channel availability in nearby areas.

27. Since the U.S. guard band (614-617 MHz) is adjacent to channel 37, the new FCC rules only allow white space devices to operate in the guard band subject to separation distances from other services operating in the adjacent spectrum (radio astronomy, medical telemetry, and mobile service downlink). In the duplex gap, the new U.S. rules allow fixed and personal/portable white space devices to operate in the upper 6 MHz segment (657-663 MHz). Most of the remaining portion of the duplex gap is reserved for licensed wireless microphones (653-657 MHz). White space devices that operate in either the guard band or duplex gap are subject to the same power and other technical limits that apply in the rest of the 600 MHz band.

28. In Canada, a similar technical framework could be implemented in the 600 MHz mobile service frequency band as white space technology is designed to operate on an opportunistic basis, in geographic areas where licensed services are not deployed. The current framework permitted white space devices to operate at a minimum distance from the protected area of a service contour of a broadcasting transmitter identified in the database. Now that the 617-698

MHz band has been repurposed to the mobile service, the development of an appropriate protection area around mobile service deployments could be established through technical rules in the white space database.

29. However, ISED notes that the forthcoming changes in the use of the 600 MHz band by licensed services will impact the white space channel availability. The areas and amount of spectrum, which are unused in this portion of the band, will change significantly over the next several years as television stations are transitioned to frequencies below 602 MHz and mobile services begin to deploy. Notably, the availability of spectrum below 608 MHz will be more stable in terms of spectrum for use by white space devices, since the DTV transition plan and schedule have already been published. In remote areas, a significant amount of spectrum below 608 MHz will continue to be available for white space.

30. Given these considerations, ISED is proposing to limit white space devices to spectrum below 608 MHz at this time. However, international trends and developments regarding the use of white space devices in Canada will continue to be monitored.

31. Pending the outcome of the decision on this issue, ISED is now placing a moratorium on the use of this spectrum in the frequency band 614-698 MHz by white space devices. This moratorium is being implemented by directing the WSDBA currently designated in Canada (as well as any future WSDBA) to block the availability of channels 38 to 51. The capability of a WSDB to block specific channels upon direction by ISED is a requirement already specified in the current technical standard for white space databases (DBS-01). This moratorium will minimize potential changes to the number of channels available for white space systems which may be deployed between now and the release of decisions arising from this consultation.

Q3. ISED is seeking comments regarding its proposal to limit the use of white space devices to spectrum below 608 MHz at this time.

In providing comments, respondents are requested to include supporting arguments and rationale.

8. Consideration of white space devices in channel 37 (608-614 MHz)

32. In accordance with the existing regulatory framework, channel 37 is currently used by the radio astronomy service (RAS) at one facility in Canada at the Dominion Radio Astrophysical Observatory (DRAO in Penticton, British Columbia), and by licence-exempt wireless medical telemetry systems (WMTS) in hospitals and health care facilities. WMTS devices wirelessly send data to a remote unit equipped with a specialized radio receiver. These devices allow patient monitoring while facilitating some amount of movement by the patient. Currently, white space devices are not permitted to operate in channel 37.

33. In the United States, channel 37 is also used by RAS and WMTS. In its most recent rules, the FCC has taken steps to permit fixed and personal/portable white space devices to operate in channel 37, subject to appropriate operational power and separation distance conditions to

protect both radio astronomy and wireless medical telemetry systems. Radio astronomy users operate at specific and known sites, which the WSDB protects through minimum separation distances for WSDs. Users of unlicensed WMTS are required to register their areas of operation with a WSDB which then enables their protection through minimum separation distances for WSDs. Additional adjacent channel protection distances have also been introduced. In allowing WSD operation, the FCC has also taken a phased approach where operations will be the subject of trials in a select few geographic areas before being allowed country-wide. This is similar to the original phased approach taken when WSDs were first introduced in the U.S.

34. In the United Kingdom, white space device operation is not allowed in the 606-614 MHz frequency band since this band is dedicated exclusively to low power wireless microphone usage.

35. Canada and the U.S. have similar users that operate on channel 37. However, as with other licence-exempt devices, ISED has no current information regarding the precise locations where WMTS devices operate in Canada. In the U.S., WMTS users are required to register their devices with a frequency coordinator designated by the FCC.[1] This helps to prevent interference to radio astronomy sites and provides a way for WMTS users to coordinate their devices and resolve any interference issues among themselves. A similar requirement does not currently exist in Canada. In order to address this issue, additional procedures and regulatory requirements would need to be introduced to enable the registration of WMTS operations. In addition, the frequency range of channel 37 is only separated from the 600 MHz mobile downlink spectrum by a 3 MHz guard band. As a result, white space devices operating on channel 37 could also require adjacent channel separation distances from mobile areas of operation. Should ISED adopt its proposal to preclude white space devices from operating in the 600 MHz frequency band, the lack of a regulatory mechanism to protect adjacent channel mobile operations would present further technical challenges towards considering the use of channel 37 in the future.

36. With the use of white space technology still at an early stage in Canada, it is not yet clear that the benefits of enabling the use of channel 37 by white space devices outweigh the drawbacks, which include the registration burden to WMTS users. Given the risks and challenges, ISED is not proposing to change its current rules on channel 37 at this time. However, international trends and developments regarding the potential use of white space devices in channel 37 will continue to be monitored.

Q4. ISED is seeking comments on its proposal to continue to preclude the use of channel 37 (608-614 MHz) by white space devices.

In providing comments, respondents are requested to include supporting arguments and rationale.

[1] The frequency coordinator of WMTS systems designated by the FCC is the American Society for Healthcare Engineering of the American Hospital Association (ASHE/AHA). Further information on ASHE/AHA's role regarding the use of WMTS systems can be obtained on the FCC's website.

9. Technical rules for white space devices

37. Since the implementation of the initial regulatory framework in Canada in 2012, white space technology and its associated spectrum management practices have evolved in jurisdictions such as the U.S. and the U.K. These changes have included revisions to both technical and operational characteristics to improve the speed and coverage of white space networks, as well as their complexity, cost and effectiveness. Amongst others, some specific rules which have been revised include changes to power limits, channel aggregation, geo-location accuracy, separation distances, filtering of out-of-band emissions, and the rate of channel availability exchanges between WSDs and WSDBs.

38. Following the completion of this consultation process, ISED intends to review its technical and operational requirements for white space systems and consider international harmonization to the extent possible, except where Canadian interest warrants a different approach. This review will enable the adoption of updated technical rules that achieve a balance between requirements that are not overly restrictive and maximize spectrum use, while also ensuring appropriate protection for licensed systems. The revision of technical standards RSS-222, *White Space Devices(WSDs)*, and DBS-01, *White Space Database Specifications*, will be conducted in consultation with the Radio Advisory Board of Canada.

10. Next steps

39. ISED will review the comments received and publish a decision on the questions raised in this consultation paper.

11. Submitting comments

40. Respondents are requested to provide their comments (in Microsoft Word or Adobe PDF) by email.

41. In addition, respondents are asked to specify question numbers for ease of referencing.

42. All submissions should cite the Canada Gazette, Part I, the publication date, the title and the notice reference number (SMSE-018-17). Parties should submit their comments no later than January 17, 2018 to ensure consideration. Soon after the close of the comment period, all comments received will be posted on ISED's Spectrum Management and Telecommunications website.

43. ISED will also provide interested parties with the opportunity to reply to comments from other parties. Reply comments will be accepted no later than January 31, 2018.

44. Following the initial comment period, ISED may, at its discretion, request additional information if needed to clarify significant positions or new proposals. In such a case, the reply comment deadline would be extended.

12. Obtaining copies

45. All spectrum-related documents referred to in this paper are available on the Spectrum Management and Telecommunications website.

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

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