Daniel S. Goldberg
President & Chief Executive Officer

April 17, 2009

Leonard St-Aubin
Director General
Telecommunications Policy Branch
Industry Canada
16th Floor, 300 Slater Street
Ottawa, ON K1A 0C8

Re: DGTP-003-08 – Consultation Paper on the Possible Use of the Extended Ku Spectrum Bands for Direct-to-Home (DTH) Satellite Broadcasting Services

Dear Mr. St-Aubin:

Telesat is pleased to submit its comments on the consultation paper on the possible use of the Extended Ku bands for DTH satellite broadcasting services.

The use of the Extended Ku bands for DTH broadcasting is critical to the maintenance of a competitive multi-channel video distribution market in Canada and to the advancement of important public policy objectives. Telesat urges Industry Canada to effect the policy changes to accommodate the provisioning of DTH services in the Extended Ku bands and to support the orderly transition of the few (425) Fixed Service transmitters currently operating in that band to other candidate bands.

Expeditious approval of this proposed change in policy will permit Telesat to immediately commence the construction and investment in a new Extended Ku band satellite valued at several hundred million dollars. Should the department require further information regarding this Gazette Notice response, please contact:

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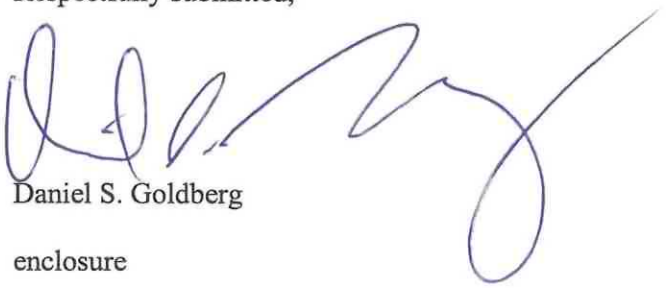
Telesat Canada claims confidentiality with respect to the contents of Appendix 4 and Appendix 5 of this submission. These documents contain sensitive commercial and technical information, the disclosure of which could reasonably be expected to confer a competitive advantage on other parties and prejudice Telesat's commercial interests. Telesat claims all protection available under the Access to Information Act. Telesat is providing an abridged version of Appendix 4 and 5 for public disclosure.

Respectfully submitted,



Daniel S. Goldberg

enclosure

Telesat Canada Comments

submitted to

Industry Canada
Spectrum Management and Telecommunications

on

Consultation Paper on the Possible Use of the Extended-Ku Spectrum Bands for Direct-to-Home (DTH) Satellite Broadcasting Services (DGTP-003-08, issued December 2008)

ABRIDGED

April 17, 2009

Telesat Canada
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Executive Summary

Telesat submits that Industry Canada's spectrum utilization policies should be changed to accommodate the provisioning of Direct to Home ("DTH") services in the Extended Ku ("xKu") frequency band and to facilitate the orderly transition of existing Fixed Service ("FS") users currently transmitting in the xKu band to the remaining portions of the 11 GHz band or to other bands and transmission modes.

The Canadian broadcasting system urgently requires more satellite DTH and broadcast signal delivery capacity in order to implement key Canadian broadcasting policies, including:

- *expansion of advanced video services, such as High Definition video, Pay-per-View and Video-on-Demand services by Star Choice and its affiliated SBS Broadcast Delivery Service (which provide TV signals on the same satellite platform to nearly one million direct subscribers and another 2,000 cable systems throughout Canada, many in rural and underserved areas);*

- *distribution to all Canadians of the Canadian television signals mandated by the CRTC's recent Broadcast Distribution Undertaking ("BDU") Framework decision;*

- *maintenance of a robust competitive multi-channel video distribution market by ensuring Star Choice has adequate capacity to compete with Bell TV, with terrestrial cable services and with grey-market U.S. DTH services, Internet broadcasting services and other media that do not provide adequate (or any) access to Canadian programming; and*

- *meeting the* Broadcasting Act*'s requirement for the efficient delivery of programming using effective technologies by providing for backup capacity so that, in case of satellite service interruption, the delivery of Canadian television programming services is not interrupted for a lengthy period or for a significant proportion of the Canadian public.*

To remain competitive in the multi-channel video services market and, in particular, relative to the other leading Canadian DTH provider, Star Choice must take immediate steps to add satellite capacity. This capacity must be added in Star Choice's own DTH neighbourhood (107.3º and 111.1º W), so that it can continue to provide services to customers via a single small dish. Star Choice would be prejudiced significantly in today's competitive marketplace if it required customers to buy two dishes or to replace their existing dishes with new, larger dishes to access satellites located in different orbital neighbourhoods. This is particularly the case in today's economic climate in which consumers are highly cost-conscious, especially in the rural communities where most of Star Choice's subscribers reside.

The xKu band is the only viable solution for near-term DTH expansion by Star Choice's DTH service. Use of this band would permit Star Choice to serve its customers using their existing small dishes – and only require changeover of a single electronic component (the Low Noise Block Downconverter, or "LNB").

The xKu band is a logical and proven choice for DTH use. It has been extensively used for DTH around the world. xKu satellite technology is proven, available in large quantities and cost-effective. Similarly, customer premises equipment ("CPE") is broadly available for use in the band now. As a significant added benefit to the Canadian broadcasting system, a new xKu satellite launched into Star Choice's DTH neighbourhood can provide critical backup capability to Star Choice's existing Ku-band DTH customers and SBS's small cable delivery services.

No other frequency bands provide a viable solution for near-term DTH expansion by Star Choice. The Ka band requires a high-powered and more expensive satellite, one that is optimally used in a spot beam configuration for services such as Internet access and local-into-local video services. It is not well-suited for single-beam national DTH coverage in a country as large as Canada, which is 20º wider in longitude than the continental United States. The RDBS band has good future potential, but its development for broadcasting services in North America will inevitably be delayed by regulatory uncertainty. Multiple competing U.S. and international filings for RDBS satellites have been made in the North American arc. Past experience indicates that it will take a considerable period of time for multilateral and bilateral negotiations to provide sufficient regulatory certainty to permit full commercial development of the RDBS orbital slots.

The Broadcasting Act *requires BDUs such as Star Choice to "provide efficient delivery of programming at affordable rates, using the most effective technologies available at a reasonable cost". With this legislative mandate in mind, Telesat has completed an analysis that indicates that, given the existing Star Choice neighbourhood, an xKu-band satellite would be far more cost-effective than one utilizing the other bands that might be considered, namely the Ka and RDBS bands.*

The 11 GHz band is currently shared between FS and Fixed Satellite Service ("FSS") users, with both theoretically having "co-primary" status in the band. However, this shared arrangement has been impractical for the FSS, and particularly for DTH use. As a result, there is little satellite use of the band today, notwithstanding satellite's co-primary status. Telesat is therefore proposing a "soft" segmentation of the band: FSS use would have priority in the upper segments of the 11 GHZ band (the "xKu" band); FS use would have priority in the lower segments of the band, except that gateway earth stations for the Mobile Satellite Service ("MSS") would continue to retain their co-primary rights. An important policy consideration related to granting priority use of the xKu band for DTH is the fact that some existing FS users of the band would have to be transferred to other bands or transmission modes. To address this matter, Telesat has commissioned a detailed study of existing FS use of the band (see attached report) which indicates that:

- *there are relatively few licensed FS transmitters in the xKu bands; and*
- *there are good alternative frequency bands and other transmission options available for these FS transmitters; in particular, retuning xKu-band transmitters to the lower portion of the 11 GHz band, FS bands below 11 GHz, the 12.7, 15, 18 and 23 GHz bands and other microwave bands, and wireline alternatives, e.g. terrestrial fibre-optic networks, which can be more efficient and reliable.*

Telesat submits that it would be in the public interest to move the relatively small number of FS transmitters in the xKu band (425) to other bands and transmission options, in order to permit a large number of DTH subscribers (approaching one million) and cable subscribers (particularly 4.5 million subscribers in smaller communities) to have access to advanced Canadian multi-channel video services.

Telesat and Star Choice have also examined the level of FS use of the xKu band in U.S. border areas and determined that it will have a negligible impact on DTH users in Canada. Thus Telesat does not believe bilateral negotiations with the United States are required to deal with potential cross-border interference issues in this band.

For the reasons set out in these Comments, Telesat submits that the xKu band should be used primarily for DTH purposes. As anticipated in Industry Canada's Consultation Paper, changes to the Department's spectrum utilization policies will be required. The specific changes proposed by Telesat are spelled out in detail in these Comments. In summary:

- *The 10.95-11.2 GHz and 11.45-11.7 GHz (xKu) portions of the 10.7-11.7 GHz band should be designated for priority use by the FSS to support provisioning of DTH and broadcast signal delivery services.*
- *The FS should have priority over the FSS in the other portions of the 10.7-11.7 GHz band, namely 10.7-10.95 GHz and 11.2-11.45 GHz. Use of the FSS in these bands would be limited to applications that pose minimal constraints on the deployment of the FS. Feeder links to the MSS would fall in this latter category and would not be subject to any additional constraints.*
- *This revised policy for the 10.7-11.7 GHz band should be established on a general and permanent basis. The operation of FS systems utilizing the xKu band should terminate within three years after issuance of this revised policy. Until then, any uncoordinated FSS deployment in these bands would receive no protection from FS transmitters licensed prior to 2009 (i.e. before the moratorium established by Industry Canada).*

Star Choice has a critical need to add DTH capacity in the near term. Addition of such capacity advances important Canadian public policy objectives. Expeditious approval of this proposed change in policy will permit Telesat to immediately commence construction of and investment in a new xKu band satellite. By enabling vigorous multi-channel video competition, driving down costs for broadcasters, programmers and the creators of their content, and sustaining follow-on installation, maintenance and servicing, this investment will further stimulate economic activity in all regions of the country.

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1. Introduction

1.01 Telesat Canada ("Telesat") welcomes the opportunity to provide these Comments on the issues raised in Industry Canada's *Consultation Paper on the Possible Use of the Extended-Ku Spectrum Bands for Direct-to-Home (DTH) Satellite Broadcasting Services*, DGTP-003-08, issued December 2008 (the "Consultation Paper").

1.02 The main questions raised in the Consultation Paper are (1) whether Industry Canada's spectrum utilization policies[1] should be changed to accommodate the provisioning of DTH services in the Extended Ku ("xKu") frequency bands, i.e. the 10.95-11.2 GHz and 11.45-11.7 GHz band, and (2) whether consequential changes should be made to the designated uses of the xKu bands and other bands to accommodate existing Fixed Service ("FS") users currently transmitting in the xKu bands. Telesat submits that the answer to these questions must be affirmative. These changes are urgently required in order to make additional satellite capacity available to meet important objectives of current Canadian broadcasting policies.

1.03 Recent broadcasting policy changes and technological developments, particularly those related to the CRTC's recent Broadcast Distribution Undertaking ("BDU") Framework Decision[2] and the rollout of High Definition video services (HDTV), will substantially increase the need for satellite capacity. There is urgent need to change the spectrum policies to reflect these policy and technology changes, since a minimum lead time of approximately 30 months is required to design, procure and launch a new satellite.

1.04 Without immediate implementation of the spectrum policy changes to accommodate more satellite capacity in the xKu band, there will be no viable means for Star Choice and Shaw Broadcast Services to procure the satellite capacity required in the near term to provide additional or advanced video services to their Direct-to-Home (DTH) and cable television system customers. This delay would frustrate the policy objectives of rolling out new HDTV services and carrying the additional new Canadian TV services mandated by the CRTC's BDU Framework Decision. The delay would also seriously jeopardize the viability of the competitive BDU distribution model that exists today.

1.05 The subsequent sections of these Telesat Comments provide information and analyses to support the following conclusions in relation to the issues raised by the Consultation Paper:

- *The Canadian broadcasting system urgently requires more DTH and satellite broadcast delivery capacity.*
    - The capacity is required in the Star Choice DTH neighbourhood.

[1] In particular, Spectrum Utilization Policy (SP 3-30 GHz) – *Revisions to Spectrum Utilization Policies in the 3-30 GHz Frequency Range and Further Consultation* (http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf05617.html).
[2] Broadcasting Public Notice CRTC 2008-100 (Regulatory policy), *Regulatory frameworks for broadcasting distribution undertakings and discretionary programming services* (30 October 2008) (http://www.crtc.gc.ca/eng/archive/2008/pb2008-100.htm)

- *The xKu Band is the only viable solution for near-term DTH expansion by Star Choice.*
    - xKu technology has been extensively used for DTH in other countries.
    - xKu satellite technology and CPE are proven, available and cost-effective.
    - An xKu satellite can back up Ku-band DTH & Broadcast Delivery services.
    - There are limited options in the Star Choice DTH neighbourhood.
    - Ka band is not suitable for national single-beam DTH use.
    - RDBS development will be delayed by regulatory uncertainty.
    - Ka or RDBS facilities would be considerably more expensive at this time.

- *There are viable alternatives for FS users currently in the xKu band.*
    - There are relatively few FS transmitters in the xKu bands.
    - Alternatives are available to accommodate the existing FS users in xKu bands.

- *FS xKu use in the United States will have negligible impact on DTH users in Canada.*

1.06 Following discussion of the points listed above, these Comments provide a concise statement of Telesat's Answers to the Questions set out in section 4 of Industry Canada's Consultation Paper.

The Canadian Broadcasting System Urgently Requires More DTH and Broadcast Delivery Capacity

2. More Satellite Capacity is Required to Implement Canadian Broadcasting Policies

2.01 Satellite networks provide the backbone of the Canadian broadcasting distribution system. Without satellite technology, it would not be possible to provide the ubiquitous access Canadians enjoy to the increasingly rich variety of video services delivered by Canada's DTH and cable broadcasting distribution undertakings ("BDUs"). The provision of an increasingly wide range of attractive and varied programming on the Canadian broadcasting system is required to meet the fundamental objectives of Canadian broadcasting policy.

2.02 Canadian broadcasting law and policy are clearly aimed at promoting the vitality and competitiveness of the broadcasting system. These legal and policy objectives are not related just to the immediate interests of television consumers, broadcasters and BDUs, but to a broader Canadian public interest. In the words of the *Broadcasting Act*:

> … the Canadian broadcasting system … provides, through its programming, a public service essential to the maintenance and enhancement of national identity and cultural sovereignty[.][3]

2.03 Responding to technological developments over the past three decades, Canadian broadcasting policy has focused on cable and DTH BDUs as the primary distribution

[3] *Broadcasting Act*, S.C. 1991, paragraph 3(1)(b).

arms of the Canadian broadcasting system. Canadian DTH BDUs have grown phenomenally since their introduction. By 2008, there were approximately 2.7 million subscriptions to Canadian DTH services, with approximately 900,000 households subscribed to Star Choice.

2.04 DTH services have become a critical component of today's Canadian broadcasting system, and have brought many benefits to Canadian TV viewers and to the broadcasting system as a whole. These benefits include ubiquitous accessibility, cost-effective distribution, provision of all-digital services and increased programming and distributor choice for consumers. DTH technology is particularly well-suited for serving Canadians in small, rural and remote communities who might otherwise not have access to the benefits associated with advancing broadcasting and telecommunications technologies.

2.05 To this end, Canadian broadcasting policy has promoted the development of an efficient market-oriented BDU industry through robust competition between cable and DTH systems, and between the two DTH operators, Bell TV and Star Choice. This competitive model has stimulated DTH services to provide an increasingly attractive number and variety of advanced video services. The model has served Canadian consumers very well, and continues to enable a full range of economic investment in high-technology design, deployment, and installation in communities across Canada. However, the competitiveness and viability of each of the DTH operators is dependent on delivering programming packages and consumer premises equipment ("CPE") that is attractive, reasonably priced and practical for its consumers to use.

2.06 In the case of CPE, today's competitive market conditions require DTH operators to provide small dish antennas that are capable of receiving an attractive range of advanced multi-channel video services. Those services must include an increasing mix of HD channels, as well as bandwidth-intensive options like Pay per View (PPV) and Video on Demand (VOD) services in both Standard Definition (SD) and High Definition (HD) formats.

2.07 Supported by careful planning and development work by Telesat, each Canadian DTH provider, Star Choice and Bell TV, uses satellites located in its own unique orbital "neighbourhood". This neighbourhood approach permits each company's DTH customers to use a single small dish antenna to access a broad range of programming services, transmitted *in the same range of frequencies* from more than one satellite *in the same orbital neighbourhood*. Bell TV uses the 12 GHz Broadcast Satellite Service (BSS) band[4] and satellites located in the neighbourhood around 91.1ºW, 82ºW and, following launch of Nimiq 5, 72.7ºW longitude. Star Choice uses the Ku band on satellites located in the neighbourhood around 107.3ºW and 111.1ºW.

2.08 The ability for DTH consumers to access satellite programming (1) transmitted in the same range of frequencies and (2) from satellites located in the same orbital

[4] The BSS band is also referred to as the Direct Broadcasting Satellite (DBS) band.

neighbourhood is of critical importance. This ability enables consumers to access their programming services with a single small (45-70 cm) dish antenna.

2.09 In today's competitive video distribution marketplace, a DTH operator that tried to persuade consumers to use a second dish or one new larger dish to maintain their DTH service would be placed at a competitive disadvantage. Customers would consider migration to the other DTH operator, to cable BDUs, to U.S. DBS operators and increasingly to Internet-based video distribution systems. The latter two forms of market share loss are of broader concern to the Canadian broadcasting system, since there is no way of ensuring that consumers of U.S. DBS offerings or Internet video distribution systems have access to Canadian programming services.

2.10 This type of Canadian programming market share loss is of increasing concern to Canadian broadcasting policy makers and regulators.[5] Canadian DTH services have played a major role in providing an attractive Canadian programming alternative to U.S. DBS services. Black and grey-market use of U.S. DBS systems provide little or no Canadian programming and no benefit to the Canadian broadcasting system; in fact, they threaten to undermine it. Continuing improvement and expansion of Canadian DTH services in a manner consistent with international standards are of critical importance if Canadian satellite services are to continue to offer a competitive option.

2.11 Adding xKu band satellite capacity to serve Star Choice's roughly 900,000 DTH customers will provide an important additional benefit to Canadian cable subscribers, particularly those served by small cable systems that receive a substantial portion of their programming from Star Choice's affiliate, SBS. SBS uses the same satellite platform that provides Star Choice's DTH services for:

- a licensed Satellite Relay Distribution Undertaking (SRDU) which delivers off-air television and radio signals to BDUs,

- an uplink (signal transport) business which delivers satellite pay and specialty signals to BDUs on behalf of programmers, and

- head-end-in-the-sky (HITS) services that allow small cable systems to offer satellite-delivered digital services directly to cable subscribers' set-top boxes.

Nearly every Canadian cable television subscriber depends on SBS's Broadcast Delivery services to receive at least one channel. However, this dependence is particularly marked in rural and remote regions. SBS's SRDU service alone provides up to 115 signals to 400 BDUs in 2,000 Canadian communities, accounting for some 35 million television channel subscriptions[6] received by an estimated 4.5 million

[5] See, for example, the CRTC's currently ongoing "New Media" proceeding. (http://www.crtc.gc.ca/eng/archive/2008/n2008-11.htm)

[6] A channel subscription is one subscription to one television channel. The 35 million channel subscriptions therefore represents the sum of all subscribers to each television channel. For instance, where one subscriber receives 5 television channels delivered by SBS and a second subscriber receives 12 such signals, they account for 17 channel subscriptions.

subscribers. The pay and specialty services that SBS distributes through its uplink service account for many more channel subscriptions—enabling Canadians to access discretionary television services, while facilitating better distribution of these services and the content creators whose works they broadcast.

2.12 The ability for Star Choice and SBS (together, the "Shaw Companies") to provide DTH and Broadcast Delivery services over the same platform provides significant economies of scale. This, in turn, reduces costs to the Canadian public and content creators and distributors, which is vital in a market, like Canada, characterized by a relatively low number of households spread across a large geographic area. Therefore, provision of more satellite capacity that maintains the viability of Star Choice's DTH services will also expand the video capacity used by the SBS Broadcast Delivery services. By providing medium and small cable companies with a cost-effective digital pass-through service, the Shaw Companies' technology permits cable subscribers in some of the most remote parts of the country to receive digital television offerings comparable to those received by subscribers in major urban centres. The expansion of SBS's Broadcast Delivery service, which operates on the same satellite platform as Star Choice's DTH service, is therefore important to support the viability of the smaller cable BDUs and to the maintenance of a competitive BDU environment in rural and remote parts of Canada.

2.13 In recognition of the essential role that BDUs play in delivering broadcasting services to Canadian households and businesses, the *Broadcasting Act* mandates that:

> distribution undertakings … (ii) should provide efficient delivery of programming at affordable rates, using the most effective technologies available at reasonable cost[.][7]

2.14 Since satellite networks provide the backbone transmission network for the delivery of programming to DTH and Broadcast Delivery customers, both the Shaw Companies as distribution undertakings and Telesat as their satellite service provider have a responsibility to ensure that they utilize the most effective technologies available at reasonable cost.

2.15 Telesat respectfully submits that Industry Canada's spectrum policies should also support compliance with this legislative mandate by granting equal measure to the technological and cost effectiveness of BDU programming delivery in the weighing of spectrum policy options. There is significant consumer demand for HD services, both among subscribers served directly by Star Choice and those whose cable systems depend on SBS's Broadcast Delivery services. Further, the BDU Framework Decision requires that Star Choice add numerous additional signals to its line-up in 2011, many of which will be HD. Without additional capacity, Star Choice and SBS will not have the ability to meet these consumer and regulatory requirements. As demonstrated in these Comments, xKu technologies are indisputably the most effective and reasonable-cost means of providing the additional delivery capacity critically required by the Shaw

[7] *Ibid.*, paragraph 3(1)(t)(ii).

Companies to expand both their DTH and Broadcast Delivery services in the near-term and meet these requirements.

2.16 This is an important time in the evolution of the competitive DTH industry. Star Choice must add satellite capacity in order to maintain a level playing field in the DTH industry. Both Star Choice's ability to deliver advanced video services, such as HDTV, PPV and VOD, and to add the services mandated by the CRTC's BDU framework decision, depend on immediate action to add satellite capacity. To maintain its competitiveness, Star Choice must add such capacity in its own DTH neighbourhood and in a frequency compatible with its installed CPE base, so that its customers can continue to be served with a single small dish.

3. Capacity is Required in the Star Choice Orbital Neighbourhood

3.01 As discussed in the previous section of these Comments, Star Choice urgently requires additional satellite capacity in the near term – and such capacity must meet two criteria. The capacity must be provided

(1) within the Star Choice DTH neighbourhood, and

(2) transmitted in a frequency band that allows its DTH customers to continue to receive its services using cost-effective CPE, including a single small dish antenna.

Reliance on any satellites located outside of the Star Choice DTH neighbourhood would require that all of Star Choice's customers either install a second, separate DTH antenna or replace their current antenna with a larger dish capable of incorporating a feed horn for the satellite outside the neighbourhood. Such other solution would not be economically viable.

3.02 As previously indicated, the Star Choice DTH neighbourhood consists of the orbital positions 107.3°W and 111.1°W, served by the Anik F1R and Anik F2 satellites, respectively. This is where all Star Choice customer antennas are pointed. New capacity for Star Choice must be added in that DTH neighbourhood in order for its customers to continue to be served with a single small dish antenna. If capacity is added in these locations and at a compatible frequency, it would be possible for customers to retain their existing dishes. If additional Ku-band capacity were available in that neighbourhood, no changes would be required to customers' CPE. However, no such capacity is available in Star Choice's DTH neighbourhood.

3.03 To date, Telesat has met demand for growth in Star Choice's satellite capacity requirements by allocating additional Ku-band transponders within its DTH neighbourhood. Over the past five years, Telesat has undertaken a number of initiatives to free up such additional Ku-band capacity for Star Choice. These initiatives have included:

- consolidation of other Ku-band traffic to free up transponder capacity for Star Choice; and

- transfer of some telecommunications network traffic to the C band, thereby making more Ku-band capacity available for DTH.

In addition, Star Choice has introduced ground segment enhancements that expand the throughput and capacity of the existing transponders.

3.04 There is no remaining opportunity to free up or consolidate meaningful Ku-band capacity within the Star Choice DTH neighbourhood. At the end of 2008, Ku-band utilization stood at 100% for Anik F1R and 104.3% for Anik F2. Neither Telesat nor any other North American satellite operator is in a position to provide Star Choice with additional Ku-band capacity in Star Choice's orbital neighbourhood.

3.05 In short, given current market, policy and technical constraints, no satellite operator can meet the satellite capacity growth required in Star Choice's orbital neighbourhood by using the conventional Ku-band. Given the need to provide capacity in that neighbourhood, it must be added in another frequency band.

3.06 The most compelling solution, from a cost and timing perspective, is that the xKu band be used to deliver the additional capacity required in Star Choice's orbital neighbourhood. By using the xKu band, only a relatively simple change to the LNB[8] used with customer antennas would be required in order to provide customer access to the additional TV channels mandated by broadcasting policy.

The xKu Band is the Only Viable Solution for Near-term DTH Expansion by Star Choice.

4. xKu Technology has been Extensively used for DTH in other Countries

4.01 Telesat and Star Choice have undertaken extensive work over the past several years and have determined that the xKu band is the best solution to provide the broadcasting services Star Choice must add. Indeed, it is clear that the xKu band is the only viable solution to add DTH capacity for Star Choice in the near term.

4.02 In sections 4, 5 and 6 of these Comments, we review the major considerations supporting the use of the xKu band. In sections 7, 8, 9 and 10, we review the factors that have led us to the conclusion that there are no other viable near-term options.

4.03 The xKu band is used extensively for DTH purposes in Europe, South America, the Middle East and Asia. Appendix 1 to these Comments lists 46 satellites that have been launched around the world since 1996 to provide DTH service using the xKu band.

4.04 A particularly strong precedent for the use of the xKu bands for DTH purposes is the Western European video market. The two most important European satellite video neighbourhoods are 13.2ºE and 19.2ºE. The 13.2ºE slot is home to three Eutelsat "hot birds" that broadcast over 1,200 video channels. The 19.2ºE slot houses five SES Astra

[8] Low Noise Block Downconverter.

satellites that broadcast over 800 video channels. Several other examples of cases where xKu spectrum is used for DTH purposes include Intelsat's satellites at 43ºW (Intelsat 3R and 11) and at 95ºW (Galaxy 3C). Numerous other examples of satellites using the xKu bands for DTH purposes are listed in Appendix 1.

5. xKu Satellite Technology and CPE are Proven, Available and Cost-Effective

5.01 Since a large number of satellites currently in service around the globe have operated in the xKu band for many years, the related xKu-band satellite technology is proven, available and cost-effective. As Appendix 1 indicates, xKu-band satellites have been manufactured by many of the world's leading satellite manufacturers. These manufacturers and a host of component manufacturers around the world can and do provide xKu band systems on a competitive and cost-effective basis today.

5.02 The xKu spectrum band is located immediately adjacent to the conventional Ku-band, which is the 'bread-and-butter' band of today's commercial satellite industry. As a result, both space segment and ground segment equipment designed for conventional Ku-band use may easily be adapted for xKu-band use. This factor also contributes to the availability of proven and cost-effective satellite technology for xKu band purposes.

5.03 In addition, xKu-band CPE (dish antennas and associated electronics, etc.) is readily available in commercial quantities from a number of different manufacturers today. The fact that a large number of satellite operators use the xKu band for DTH purposes ensures that xKu-compatible CPE will remain widely available at reasonable prices.

5.04 The only change that is required to make existing Star Choice Ku-band CPE compatible with xKu-band services is to swap the LNBs in that CPE. This is a relatively modest change compared to the cost of installing a second dish or replacing existing dishes with completely new dishes and associated electronics. These latter, fundamental changes would be required if any band other than the xKu band were used to add DTH satellite capacity for Star Choice.

6. An xKu-Band Satellite Can Backup Ku-band DTH and Broadcast Delivery Services

6.01 As previously noted, Telesat provides all of its satellite services to support the Shaw Companies' DTH and Broadcast Delivery services using two satellites, Anik F1R and Anik F2, located at 107.3ºW and 111.1ºW, respectively. While Telesat takes all reasonable measures to maintain and protect the services provided on those satellites, past experience in the satellite industry makes it clear that future service interruptions are possible, up to and including the loss of all transmission capacity on one or both of these satellites.

6.02 If such a Ku-band satellite service interruption were to occur, Telesat would not have the capacity to provide backup or replacement capacity to ensure continuity of service to Star Choice's 900,000 DTH subscribers and to the additional subscribers served by SBS's Broadcast Delivery services. Telesat's Ku-band capacity is currently fully utilized. As a result, the delivery of Canadian television programming services would be interrupted, potentially for a lengthy period for a significant proportion of the Canadian

public. Provision of backup capacity for DTH and broadcast delivery service would be consistent with the efficiency and effectiveness goals set out in the *Broadcasting Act.*[9]

6.03 Any interruption of Star Choice service could cause customers to migrate to the competitive DTH provider, to cable, to U.S.-based grey-market DTH services or to Internet-based viewing options. In the latter two cases, customers would drop off the Canadian broadcasting system. In any of these cases, a robust competitive Canadian DTH and multi-channel video services market would be seriously and materially undermined, particularly for Canadians living in rural and remote communities.

6.04 The launching of a new xKu-band satellite in Star Choice's current DTH neighbourhood would not only provide necessary DTH expansion capacity, but would provide critically important backup capacity for existing Ku-band DTH and Broadcast Delivery customers. In case of a failure of Ku-band capacity, Telesat could transfer some or all of Star Choice's existing Ku-band programming services to the xKu-band capacity available on the new satellite, including certain redundant capacity that Telesat and Star Choice intend to put in place as a further backup measure aboard the new satellite.

6.05 Telesat proposes to design its new xKu-band satellite in such a way that the spare amplifiers could be used to back up the xKu transponders on the same satellite or the conventional Ku transponders on a collocated satellite. Since Star Choice would have already configured its customer CPE to receive both Ku-band and xKu-band signals, the transfer would be seamless from a DTH customer perspective. The same would be true for the cable BDUs who are Shaw's Broadcast Delivery customers.

6.06 Thus, the launch of a new xKu-band satellite in Star Choice's DTH neighbourhood would provide critical backup capacity for a significant proportion of the viewers in the Canadian broadcasting system—including 900,000 DTH subscribers, 4.5 million cable subscribers who receive over-the-air signals via SBS Broadcast Delivery services and, in respect of at least one channel, nearly every other cable subscriber in Canada.

7. There are a Limited Number of Options in the Star Choice DTH Neighbourhood

7.01 In Question 7 of its Consultation Paper, the Department asks for comment on how near-term DTH capacity requirements can be met. At this point, Star Choice urgently requires DTH capacity in the near term. Telesat has considered the available options for providing near-term additional capacity in Star Choice's orbital neighbourhood in a manner that will not require subscribers to add a second or larger dish which, as discussed above, would place Star Choice at a competitive disadvantage and undermine competition in this important market.

7.02 For the reasons set out in these Comments, Telesat believes that the xKu band offers the only viable solution to meet Star Choice's near-term DTH expansion requirements. In arriving at this conclusion, Telesat examined all available options, including conventional Ku-band, C-band, Ka-band, 12 GHz BSS, and 17 GHz BSS (otherwise known as Reverse DBS or RDBS). For the reasons set out below, none of these options

[9] Subparagraph 3(1)(t)(ii).

meet Star Choice's near-term DTH requirements. Additional technical details supporting these conclusions are contained in Annex 5.

7.03 ***Conventional Ku band:*** As discussed in section 3, Star Choice has requested, and Telesat has undertaken, a number of initiatives over the past five years to free up additional conventional Ku-band capacity for Star Choice in its DTH neighbourhood. No further opportunities remain to free up such capacity.

7.04 No other suitable conventional Ku-band transponders are available to Star Choice from either Telesat or any other satellite operator, Canadian or foreign, within the Star Choice DTH neighbourhood. Any conventional Ku-band transponders that might be available outside the Star Choice neighbourhood could not be used for Star Choice's DTH service without costly redesign and replacement of customer dishes and related CPE electronics.

7.05 ***C band:*** C-band satellite capacity is available. However, as demonstrated in Appendix 5,[10] using it for DTH purposes would require that customers use dishes of over 2 metres in diameter. DTH consumers will not accept such large dishes.

7.06 ***12 GHz BSS:*** The 12 GHz planned BSS band[11] capacity in the North American arc has been fully utilized by Bell TV, EchoStar and DirecTV. In particular, the planned BSS orbital positions in the Star Choice neighbourhood are assigned to the United States rather than Canada, and have been fully utilized by DirecTV and EchoStar. Bell TV, EchoStar and DirecTV currently have access to substantially more DTH satellite capacity using the 12 GHz BSS frequencies than does Star Choice using the conventional Ku-band frequencies, and they can currently offer a broader array of services using an attractive single-dish solution.

7.07 ***Ka band:*** The Ka Band is not appropriate for single-beam, full-Canada DTH use, as required by Star Choice, for the reasons set out in sections 8 and 10 of these Comments and as further detailed in the technical analysis included in Appendix 5.[12]

7.08 ***17 GHz band (Reverse DBS or RDBS):*** Aside from the xKu band, the RDBS band was the only band suitable for DTH services which was licensed for use by Canadian satellites in the recent Industry Canada orbital slot licensing process. The potential use of the RDBS band is discussed in detail in sections 9 and 10 below. For the reasons indicated in those sections, the RDBS band does not provide a viable near-term solution to meet Star Choice's DTH requirements.

7.09 Telesat believes that the RDBS band offers good longer-term prospects for DTH use. To that end, Telesat has applied for Industry Canada licences to use the RDBS band at 111.1ºW and 113ºW. However, for the reasons set out in the following sections, during the near term the RDBS band is not a viable option and, in any event, will remain meaningfully more expensive.

[10] Section A5.03 and Figures A5.04 and A5.05, below.
[11] Planned in accordance with ITU AP30/30A.
[12] Section A5.04 and Figures A5.06 and A5.07, below.

8. Ka Band is Not Suitable for National Single-Beam DTH Use

8.01 Use of the Ka band to provide full-Canada DTH coverage poses technical problems and would be inefficient, even with the high-power satellite and large consumer antennas that such use would require.

8.02 Due to the higher frequencies and atmospheric losses associated with Ka-band transmission, most commercial Ka satellites use concentrated spot beams. For example, the Canadian Ka-band capacity on Telesat's Anik F2 satellite, located at the 111.1°W orbital position, is provided in 15 relatively small spot beams. This approach allows the same spectrum to be used at the same time in different spots, maximizing its use, and focusing the power needed to meet the Ka band's higher Effective Isotropic Radiated Power ("EIRP") requirements to deliver higher-bandwidth transmissions within each spot. Ka-band satellites are therefore most efficiently used for applications such as broadband Internet and the transmission of local television signals into local markets.

8.03 For these reasons, Anik F2's Ka-band spot beams are uniquely designed to support Internet services. The same is true of many U.S.-focussed Ka-band spot beams. Certain U.S. satellite operators also make localized use of Ka-band broadcast distribution to transmit local broadcast programming on a per-spot-beam basis, satisfying FCC regulatory requirements.

8.04 Star Choice requires a single-beam solution for expanding its DTH capacity, in order that it be able to transmit a signal to the satellite which can then be received anywhere within Canada using a relatively small dish. This is precisely how existing DTH satellites serving Canada are designed. As mentioned above, however, in light of its physical properties, the Ka band works best with multiple, smaller beams, and to date has been used in that manner in Canada, the United States and Asia. The Europeans plan to use it in this same manner. What is more, Canada's land mass is a full 20 degrees wider than that of the continental United States, making it more difficult to create a single national DTH beam using Ka-band spectrum in Canada than in the United States.

8.05 DTH use of a Ka-band satellite therefore precludes better uses of the same capacity for broadband or local applications, such as local signals delivery. As described in section 10 (below), a single-beam Ka-band satellite would also require considerably more power than an equivalent xKu satellite, making it very costly. Finally, a Ka-band DTH satellite would remain susceptible to high levels of interference both within Canada generally, resulting from use of the Ka band on Anik F2 to provide Internet connectivity, and in border areas, resulting from neighbouring U.S. satellites that, positioned at close spacing of approximately 2 degrees, also employ higher-power spot beams.

9. RDBS Development will be Delayed by Regulatory Uncertainty

9.01 Telesat and Star Choice have concluded that the RDBS band does not provide a solution to meet Star Choice's near-term DTH capacity requirements. A major reason for this conclusion is that the deployment of an RDBS satellite will inevitably be delayed, most

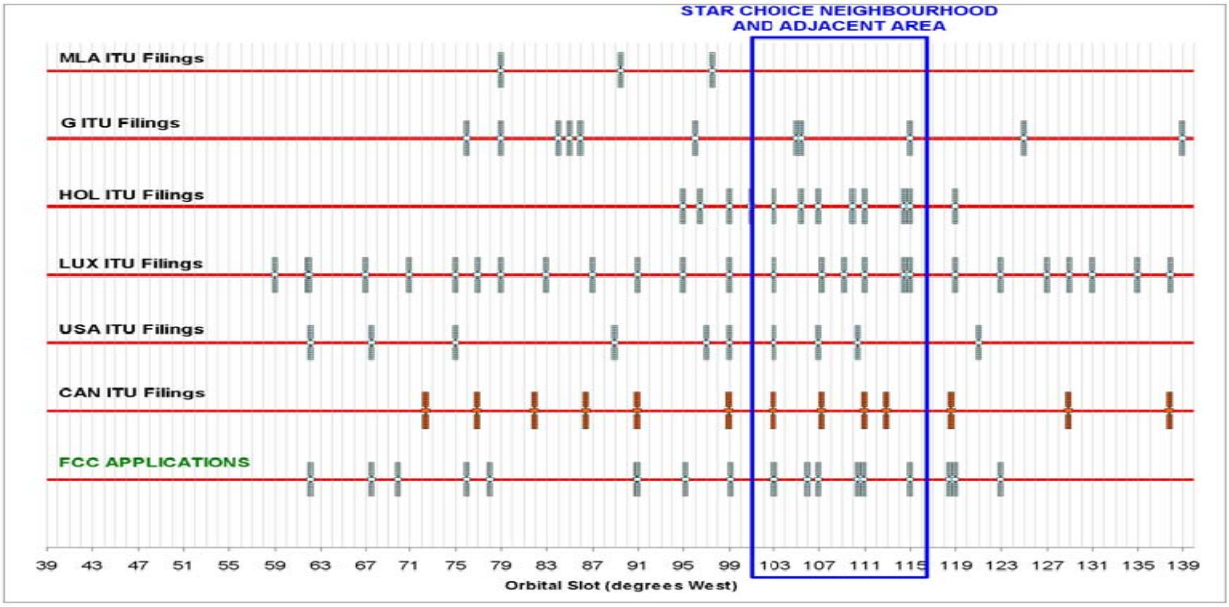
likely for a number of years, due to outstanding international coordination issues and related regulatory uncertainties.

9.02 The RDBS band was first allocated for use by the Broadcasting Satellite Service in ITU Region 2 (the Americas) at the World Administrative Radio Conference in 1992 (WARC-92). The WARC determined that this allocation would come into effect on 1 April 2007.

9.03 As the Department is aware, access to frequencies at an orbital location is normally available to different countries at the international level on a first-come, first-served basis. Applications receive priority based on the date certain required technical filings are submitted by national administrations to the ITU.

9.04 Most of the initial RDBS filings made with the ITU were for orbital slots in the U.S. broadcasting arc of 101-119ºW. A number of subsequent RDBS filings have since been made with the ITU in the same U.S. broadcasting arc, including a large number by the Luxembourg administration on behalf of SES, further complicating the international filing situation in the arc. As illustrated in Figure 1, there are now a significant number of RDBS filings that overlap with the Star Choice orbital neighbourhood (around 107-111ºW). Furthermore, in the United States, the FCC domestic satellite licensing process has resulted in a number of applications to serve the United States from orbital slots in this neighbourhood. The result is a very complex and contentious regulatory environment, at the ITU level and also in terms of Canada-U.S. coordination.

Figure 1. Overlapping RDBS Filings in the North American Arc



9.05 In May 2007, the FCC adopted a Report and Order[13] intended to promote efficient use of the RDBS spectrum. The Report and Order dealt, among other things, with the processing of RDBS band licensing applications. Under the Report and Order, routine processing of licensing applications to use the spectrum is to take place on a first-come, first-served basis. However, the FCC also indicated that it would process applications for access to 35 orbital locations between 43ºW and 179ºW at four-degree orbital separations for satellite networks designed within the constraints of clearly-defined technical parameters. As a transitional measure, a number of pre-2007 "original" applicants to the FCC were granted an opportunity to re-align their submissions to this "4 degree grid". Subsequently the FCC invited new "post-freeze" applications in September 2008. There are currently a large number of applications for RDBS orbital positions before the FCC.[14] No licenses have yet been issued.

9.06 The Star Choice DTH service area in Canada is directly adjacent to the continental United States (CONUS) satellite service areas. There is inevitably some overlap of satellite footprints into adjacent service areas, due to the inability to stop propagation of satellite signals precisely at the Canada-U.S. border. Consequently, implementation of RDBS services from an orbital slot in either Canada or CONUS could directly impact, or even sterilize, the possibility of implementing a service to the other service area.

9.07 This potential interference between Canadian and U.S. satellites licensed in adjacent service areas presents a number of well-recognized problems that historically have been resolved in the case of previously-developed frequency bands (C, Ku and Ka) by means of lengthy multilateral negotiations between the national administrations involved, including Canada, the United States and, in some cases, Mexico. Such a process has yet to be initiated, but is expected to be required, for the RDBS band.

9.08 The regulatory delays and risks associated with launching an RDBS satellite are exacerbated in the case of the potential launch of a Canadian RDBS satellite in the Star Choice DTH neighbourhood. As reflected in Figure 1 and in Appendix 2, there are several U.S. domestic applicants for orbital positions that are precisely the same as those which have been developed as the Star Choice neighbourhood (107ºW and 111º W). If the FCC licenses satellites for these RDBS slots prior to an application to the FCC for landing rights from a Canadian-licensed satellite, that will lead to a very difficult coordination situation. Moreover, if bilateral consultations are commenced on this issue between the FCC and Industry Canada, past experience suggests it may take considerable time to coordinate use of the RDBS spectrum between Canada and the United States. Under either scenario, use of RDBS is likely to encounter regulatory complexities and delays that use of the xKu band is not.

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[13] *In the Matter of the Establishment of Policies and Service Rules for the Broadcasting-Satellite Service at the 17.3-17.7 GHz Frequency Band and at the 17.7-17.8 GHz Frequency Band Internationally, and at the 24.75-25.25 GHz Frequency Band for Fixed Satellite Services Providing Feeder Links to the Broadcasting-Satellite Service and for the Satellite Services Operating Bi-directionally in the 17.3-17.8 GHz Frequency Band*, Report & Order and Notice of Proposed Rulemaking, FCC 07-76, IB Docket No. 06-123 (May 4, 2007).

[14] Appendix 2 lists the orbital requests from both "original" and "post-freeze" applicants in the FCC's process.

9.09 A new satellite represents a very substantial investment for which financing and other legal commitments cannot be made by operators or their customers without regulatory certainty. In particular, certainty is required that proper authorizations will be issued for a satellite's designed transmission frequencies and related power and footprint parameters. Certainty is also required on the issue of potential interference with the satellite's transmissions. In the case of the RDBS band, such certainty does not exist today, and may not exist for some time. Regulatory delays appear inevitable before there will be sufficient certainty to allow a new RDBS satellite to be financed and construction initiated.

9.10 Telesat is committed to pursuing access to the RDBS band for future satellites. However, given past experience and the practical problems associated with international coordination of new satellite bands in the North American arc, it is unrealistic to assume that RDBS coordination issues and subsequent satellite design and procurement issues can be resolved in time to meet Star Choice's near-term DTH expansion requirements. Moreover, even if Star Choice were to wait for resolution of these issues, Star Choice's customers would still be faced with a new, economically prohibitive requirement for acquisition and installation of two dish antennas, or of a completely new dish. Both the delay in waiting for clarity on the international coordination arrangements for the RDBS band and a two-antenna, or new-antenna, requirement would severely prejudice Star Choice's competitive situation in the Canadian BDU market.

10. Ka or RDBS DTH Systems Would be Considerably More Expensive at this Time

10.01 The costs of procuring expanded DTH satellite capacity will be borne by the DTH industry and, ultimately, by Canadian DTH subscribers and the broadcasters, programmers, and content creators that rely on the Star Choice platform. Accordingly, the resulting costs of both the space and earth segments must be taken into account in determining which band offers the most efficient means of delivering the additional capacity required by the Canadian broadcasting system. In this context, it should be recalled that the *Broadcasting Act* requires BDUs like Star Choice to "provide efficient delivery of programming at affordable rates, using the most effective technologies available at reasonable cost".[15]

10.02 Telesat undertook an analysis to compare the cost of procuring a satellite with 16 xKu-band transponders with that of procuring an RDBS or a Ka-band satellite with the same number of transponders and with similar link availability performance. Appendix 4 compares these costs, including satellite procurement, launch and insurance costs. Notably, the major factors that drive the differences in costs between an xKu and either an RDBS or Ka satellite are:

(a) *Power-related Costs:* Propagation impairments are much higher in the RDBS band than in the xKu band. Consequently, more than double the power would be required for each transponder to achieve comparable availability of service. Propagation impairments in the Ka band are still higher than in the RDBS band;

[15] *Broadcasting Act*, S.C. 1991, subparagraph 3(1)(t)(ii).

the additional transponder power required to compensate for the even higher frequencies (20 GHz) and associated propagation loss is nearly triple that of the xKu equivalent. In order to double or triple transponder power, additional travelling-wave tube amplifiers (TWTA) would be required in phase-combined operation. Solar panel and battery size would in turn need to be increased in order to operate the additional amplifiers.

(b) *Launch Cost:* Additional TWTAs, larger solar panels and a larger battery significantly increase satellite mass. The cost of launch services for an RDBS or Ka-band satellite would increase accordingly.

(c) *Hardware Qualification:* xKu-band hardware has in-orbit heritage and is readily available. In the case of an RDBS satellite, the TWTAs are the only hardware presently in use, and even they would require modification to operate in the 17 GHz range. RDBS receivers and input/output multiplexers would have to be designed and qualified, which requires developing and testing an engineering qualification model before a flight model is manufactured, tested and delivered to the satellite manufacturer. These design, development and testing activities add to an RDBS satellite's cost and lengthen its procurement schedule. While Ka hardware has in-orbit heritage, qualification of the TWTA phase-combining circuitry to achieve the power levels required to satisfy a National Canadian DTH application would be crucial and difficult, again adding to cost and lengthening the procurement schedule.

10.03 In addition to these, further cost differences are likely due to higher insurance rates due to a lack of flight-qualified components; the more complex system design required by an RDBS or Ka satellite, particularly related to higher power requirements; and program costs, such as increased monitoring and additional design reviews, related to the longer and more complex schedule for designing, developing and testing an RDBS or Ka DTH satellite.

10.04 Taking the foregoing factors into account, a 16-transponder RDBS satellite would be the most expensive option, followed by a Ka-band satellite. In either case, however, the costs of launching, insuring and operating an RDBS or Ka band satellite are, at this time, substantially higher than the costs associated with an xKu band satellite (see Appendix 4).

10.05 Apart from space facilities, Telesat notes that Star Choice has examined the availability, costs and other considerations relevant to procuring CPE (dish antennas and related electronics) for an xKu-band satellite as compared to an RDBS satellite. Star Choice's analysis has concluded that it will cost $67.5 million to replace the LNBs in its DTH customers' CPE in order to accommodate xKu transmissions as well as Ku-band transmissions. In comparison, the costs of procuring RDBS CPE are far less certain and are likely to be far more expensive. RDBS CPE is not yet available on the market. There is significant doubt as to when it will be available and at what cost. Star Choice's analysis indicates that, even were it possible to obtain RDBS CPE in the near term, the

cost of procuring and installing it would be $160 million *more* than the equivalent cost for xKu-band CPE, or over $225 million in total expense.

10.06 Telesat has not undertaken its own study of the cost of procuring RDBS CPE, nor those of procuring Ka-band CPE. However, Telesat has reviewed Shaw's analysis and confirmed that this order of magnitude variance in procuring RDBS CPE is reasonable. While the cost of procuring and equipping customers with appropriate CPE for a Ka-band satellite are likely to be lower than in the case of RDBS, it should be noted that this equipment would include a significantly larger antenna (85 cm or larger).[16] These cost differentials are another significant reason why the xKu band provides a more cost-effective near-term solution for DTH and Broadcast Delivery requirements.

10.07 The costs of procuring expanded DTH satellite capacity will be borne by the DTH industry and, ultimately, by Canadian DTH subscribers and the broadcasters, programmers and content creators that rely on the Star Choice platform. These costs must be taken into account in determining which band offers the most efficient means of delivering the additional capacity required by the Canadian broadcasting system.

10.08 In this context, it should be recalled that the *Broadcasting Act* requires BDUs like Star Choice to "provide efficient delivery of programming at affordable rates, using the most effective technologies available at reasonable cost".[17] For the reasons set out in this section, the xKu band is plainly the right solution to the current DTH satellite capacity shortage, and the solution that is most consistent with the requirements of the *Broadcasting Act*.

There are Viable Alternatives for FS Users in the xKu Band

11. There can be an Orderly Transfer of FS Users from the xKu Bands

11.01 Telesat proposes that the xKu bands be designated by Industry Canada for exclusive use by the FSS. Telesat further proposes that existing FS transmitters operating in those bands be provided a three-year period to retune their transmitters or otherwise switch to alternative frequencies or other telecommunications transmission modes.

11.02 In order to assist Industry Canada in the analysis and development of a revised spectrum utilization policy, Telesat commissioned Lemay-Yates Associates Inc. to undertake a detailed study of the options for moving FS licensees operating in the xKu band to other frequencies or transmission modes. A copy of the Lemay-Yates report is attached as Appendix 6 to these Comments. The main conclusions of the report are that:

- there are relatively few FS transmitters licensed in the xKu bands; and
- alternative frequencies and other transmission options are available for these FS licensees.

[16] Appendix 5, section A5.04, below.
[17] *Broadcasting Act*, S.C. 1991, subparagraph 3(1)(t)(ii).

11.03 The alternatives available to FS licensees are discussed in detail in the Lemay-Yates report. The main points of the report's findings are summarized in the following sections of these Comments.

11.04 Before reviewing these points, it is noted that one of the major alternatives outlined in the report for FS licensees involves the establishment by Industry Canada of "soft segmentation" of the 11 GHz sub-bands between FS and FSS users. Such soft segmentation would not have meaningful adverse licensing or technical impacts on FS users in the band. No changes would be required in Industry Canada technical requirements for incumbent FS users.

11.05 Soft segmentation does not change the Industry Canada technical requirements. It simply re-allocates 50 percent (500 MHz) of the 11 GHz band for priority use by satellite services—instead of the impractical current "equal priority" use—and the other 50 percent (500 MHz) of the band for priority use by fixed services, with a provision to accommodate the small number of MSS feeder-link earth stations. As a result, the equipment used by FS licensees will continue to be readily available on the market and can continue to be manufactured in accordance with the FCC's channel plan and technical specifications for use in the 500 MHz of the 11 GHz band that would not be allocated for DTH use.

12. There are Relatively Few FS Transmitters in the xKu Bands

12.01 Based on Industry Canada data, it appears that only 425 terrestrial transmitters are licensed to operate in the xKu bands. It is not certain how many of these transmitters are actually in use. Details of the licensees, locations and licensed transmitters are provided in the Lemay-Yates report. Table 1 (below) provides a breakdown of the FS transmitters in the full 11 GHz band, including the xKu sub-bands (i.e. 10.95-11.2 GHz and 11.45-11.7 GHz) and what the report refers to as the 'lower' 11 GHz sub-bands (i.e. 10.70-10.95 GHz and 11.20-11.45 GHz).

Table 1. FS Transmitters in the 11 GHz Band

	10.70 – 10.95 GHz	10.95 – 11.20 GHz	11.20 – 11.45 GHz	11.45 – 11.70 GHz	11 GHz
Rogers	249	33	249	33	564
Telus	97	38	94	40	269
Bell*	52	55	52	58	217
TeraGo	35	15	35	15	100
BC Hydro	17	22	18	22	79
Navigata	16	14	16	14	60
MTS Allstream	14	4	14	4	36
TBayTel	14	1	14	1	30
RM of Wood	14	-	14	-	28
Shaw	-	10	-	18	28
Top 10 Licenses	508	192	506	205	1,411
Other	45	14	45	14	118
Total	553	206	551	219	1,529

* Including Northwestel & Bell Aliant

12.02 As indicated on Table 1, the majority of licensed FS transmitters operate in the lower

sub-bands (553 + 551 = 1104) in which Telesat proposes the fixed service enjoy priority use. Only a minority (206 + 219 = 425) operate in the xKu sub-bands. The total number of FS transmitters operating in the xKu bands is relatively small, compared either to the lower 11 GHz bands or to other bands.

13. Alternatives for Existing FS Users in xKu Bands

13.01 A number of viable alternatives are available for FS users presently using the xKu sub-bands. If Industry Canada decides to reserve future use of the xKu band for DTH purposes, Telesat proposes that the current FS users in the bands could migrate to these alternatives in an orderly fashion over a three-year period before a new xKu band satellite would be launched. Some of these alternatives, such as migration to fibre-optic systems, are likely to replace xKu use by some FS users in any event. This will represent more efficient use of scarce spectrum resources, by freeing up the xKu band for a purpose such as DTH, which cannot move to fibre-optic systems.

13.02 The major alternatives available to current FS users in the xKu band, which are summarized below, are considered and discussed in detail in the Lemay-Yates report. These alternatives include:

(i) in-band options - in particular, retuning xKu-band transmitters to the lower portion of the 11 GHz band,
(ii) fixed-service bands below 11 GHz,
(iii) the 12.7 GHz range,
(iv) the 15 GHz range,
(v) the 18 GHz range,
(vi) the 23 GHz range,
(vii) other microwave licences, and
(viii) wireline alternatives, particularly terrestrial fibre-optic networks.

(i) In-band Options

13.03 Some of the FS transmitters operating in the xKu portion of the 11 GHz band (namely, the 10.95-11.2 GHz and 11.45-11.7 GHz paired bands) could readily be retuned to operate in the lower 500 MHz of the 11 GHz band (namely, the 10.7-10.95 GHz and 11.2-11.45 GHz paired bands). This would require reassigning frequency channels and, in a minority of cases, swapping out FS transmitters. However, link spacing would not change and most equipment could be readily retuned. A case study of 85 transmitters operating in Vancouver, Toronto, Ottawa and Montreal, representing two-thirds of upper-band transmitters deployed in those areas, indicates that at least 60% of FS transmitters operating in the upper band could likely be retuned to the lower portion of the band.

13.04 A limited number of MSS gateways[18] are deployed in the lower portion of the band. Retuning FS transmitters to the lower portion of the band is not likely to affect these

[18] The TAFL database identifies four such earth station locations: at Skyterra's offices in Ottawa; at SED Systems in Saskatoon; at Allan Park, Ontario; and at Lake Cowichan, BC. The latter two sites were specifically selected many years ago to be in rural locations and are shielded by terrain from FS installations.

MSS gateways, which use large antennas with good discrimination against terrestrial interference, as existing gateways—and new gateways coordinated with existing FS users—would continue to be protected from interference from any subsequent FS installations. Site-by-site frequency coordination of MSS gateways in the lower portion of the 11 GHz band would therefore continue.

(ii) Fixed-Service Bands Below 11 GHz

13.05 A number of frequency bands used for fixed-service point-to-point applications below 11 GHz could be used by FS transmitters as an alternative. The 4 GHz, "lower" 6 GHz (5925-6425 MHz), "upper" 6 GHz (6425-6930 MHz), 7 GHz and 8 GHz ranges could be an attractive alternative for some FS users. These bands have similar channelization (i.e. channels of 5, 10, 20, and 30 MHz) and separation to that of the xKu bands. They also have similar capacity (i.e. 500 MHz) and could accommodate medium and high capacity systems—altogether, they have about five times the capacity of the xKu portion of the 11 GHz range. Further, they are licensed on a site-by-site basis, just as is the xKu band. Equipment costs and deployment characteristics would be similar, although due to the lower frequency, available link lengths would typically be longer than those deployed in the xKu band.

13.06 Consideration of options for the case study of FS transmitters focused on the upper 6 GHz band.[19] There are two main constraints on the use of the 6 GHz bands by FS transmitters currently operating in the xKu bands. However, both constraints appear manageable and would not detract from the use of the upper 6 GHz bands by some FS users.

13.07 First, use of the upper 6 GHz band for short-haul applications currently operating in the 11 GHz range would require that Industry Canada relax its reservation of the 6 GHz range for long-haul systems. This should be acceptable from a spectrum policy perspective, since the need for long-haul microwave systems is likely to continue to decrease due to migration to fibre networks.

13.08 Second, a limited number of the links currently operated in the xKu range (14%, or 58 of 425 transmitters) use bandwidths of more than 30 MHz. Since the current channelization in the 6 GHz range tops out at 30 MHz, other alternatives would have to be used for this relatively small minority of current xKu transmitters. Most of the other alternatives listed in the Lemay-Yates report would be good candidates for such use.

(iii) 12.7 GHz Range

13.09 The 500 MHz range between 12.7 and 13.2 GHz is used for Very High Capacity Microwave (VHCM) applications to transmit multiple television channels to cable distribution systems. This band is close to the 11 GHz band and it provides an attractive alternative for xKu band transmitters. There are two principal difficulties associated

[19] The 7 GHz and 8 GHz bands have overlapping government-use allocations, thus availability of capacity for migration of 11 GHz transmitters cannot be readily assessed. Information on government use of bands is not available from public sources.

with migration of FS transmitters to the VHCM band. However, each can be resolved in a relatively straightforward manner.

13.10 First, there are over 3400 transmitters in service using the VHCM application; 94% of them are in two provinces, British Columbia and Ontario. However, the number of unique deployments is markedly smaller: many of these transmitters are repeaters used to facilitate multiple hop routes. Most (close to 80%) use long-in-service equipment used to gap long distances to feed cable systems with *analog* television services. Analog TV services are to be phased out by 2011 and therefore it is anticipated that these technologies may also be phased out coincident with Telesat's proposed three-year period to migrate FS transmitters out of the xKu band. New, more efficient digital transmitters, terrestrial fibre and satellite distribution would provide good alternatives to many of these analog VHCM transmitters.

13.11 Second, VHCM is typically used for one-way applications, so this block is contiguous and has no separation, unlike the paired 250 MHz blocks in the 11 GHz range. However, Industry Canada spectrum policy changes could resolve this issue by simply channelizing the range into paired, separated blocks.

(iv) 15 GHz Range

13.12 The range between 14.5 and 15.35 GHz represents 750 MHz of FS capacity. Of this, 320 MHz (42%) is subject to a moratorium recently issued by Industry Canada to facilitate Department of National Defence (DND) security usage. In addition, 810 users of the designated Industry Canada portion are required to move to the remaining 380 MHz (58%) of the band.

13.13 The remaining 380 MHz is therefore likely to be crowded, particularly in the Windsor-Quebec City corridor which hosts about three-quarters of the users required to relocate. Especially outside that corridor, however, the non-DND portion of the 15 GHz band represents a viable alternative for 11 GHz licensees that operate low- or medium-capacity links.

(v) 18 GHz Range

13.14 Links in service on the 18 GHz range (17.8-18.3 GHz and 19.3-19.7 GHz) are generally less than 10 km, and often still shorter (5 km in Montreal and Toronto, 7 km in Vancouver), partly due to the rain fade to which this band is susceptible. However, channel sizes range from 2.5 to 50 MHz, paired channels are available and, as in the 11 GHz range, low, medium and high capacity links can all be accommodated.

(vi) 23 GHz Range

13.15 Like the 18 GHz range, the 23 GHz range (21.8-22.4 GHz and 23.0-23.6 GHz) has short link lengths (often 3 kilometres) and susceptibility to rain fade. However, paired channels are available with 1.2 GHz separation, and low, medium, and high-capacity links can be accommodated.

(vii) Other Microwave Licences

13.16 The radio links described above are point-to-point links. However, a number of applications used in the 11 GHz range, especially the mobile backhaul application that is driving growth in that band, can likely be deployed in a point-to-multipoint FS range. A number of the largest users of 11 GHz FS applications already control point-to-point Fixed Wireless Access (FWA) spectrum, including spectrum held by Bell and Rogers in their Inukshuk venture, a significant portion of which is likely to be unused. Such spectrum could be used by its licensees for some links that would otherwise use xKu band spectrum.

(viii) Wireline Alternatives

13.17 Fibre optic cable is an alternative to higher-capacity microwave point-to-point and backhaul. Although information on the location of fibre is not readily available, the three largest 11 GHz licensees (Rogers, Telus, and Bell Canada) each have extensive fibre assets. They are in a good position to self-supply fibre transmission capacity on some routes currently served by 11 GHz microwave. Additional fibre transmission facilities are available from other cable companies, such as Cogeco Inc. as well as former utility fibre systems, such as those operated by Atria Networks.

13.18 For lower-capacity links which cannot justify the expense of fibre, access circuits can be leased in many areas from the Incumbent Local Exchange Carrier as well as other telecom carriers, such as Atria Networks.

14. Different Alternatives are Optimal for Different FS Uses

14.01 Having reviewed the above alternatives in detail, the Lemay-Yates report concludes that there are viable alternatives available for all FS users of the xKu band. In arriving at this conclusion, Lemay-Yates conducted case studies of the xKu-band users in the top four[20] market areas, the areas where there is the most spectrum congestion, and thus the ones where finding alternatives for existing FS users would be most challenging.

14.02 The Lemay-Yates study found that at least 60% of the existing links in the xKu band can be retuned to the lower portions of the 11 GHz band (53 of the 85 transmitters covered by the case studies). Of the 32 remaining transmitters that do not appear to be ready candidates for re-tuning, alternative microwave bands were considered. Based on the fit, considering link distance, two-thirds of the xKu-band transmitters would be candidates for the 12.7 GHz band, assuming the spectrum utilization policy is modified as discussed above. Others could be accommodated in other bands.

14.03 The case studies demonstrate that at least one microwave alternative is always available for FS transmitters in the xKu band. The alternative is not always the same, since some markets are more congested than others, but microwave alternatives are clearly available. In addition, for many locations, fibre optic facilities should also be available, through self-supply by the major FS xKu licensees, or through service offerings of the

[20] Lemay-Yates initially looked at the top six market areas, Toronto, Montreal, Vancouver, Calgary, Edmonton and Ottawa. To define the market areas, a 50-60 km radius was drawn around the core area of each of these markets. Using this approach, no xKu FS links were found in the Calgary or Edmonton area, so the study dropped these two markets and focused on the other four.

Incumbent Local Exchange Carriers, cable companies and utility-built fibre networks. Satellite services also provide a viable option in some cases.[21] Thus there are a variety of viable alternatives available for FS users in the xKu band.

15. FS Utilization in the United States will have Negligible Impact on DTH

15.01 If Industry Canada adopts Telesat's proposal to allocate the xKu band for the exclusive use of the FSS, Telesat has proposed that Canadian FS users in the band should migrate to other bands and transmission modes over a three-year period. This will remove the risks of interference to DTH signals in the xKu band from Canadian FS users at the time an xKu-band satellite comes into service. However, given the proximity of the U.S. border to some parts of Canada, there remains a risk of some interference with the reception of xKu-band signals due to FS transmitters in the United States. Telesat and Star Choice have assessed this risk and determined that it will be negligible.

15.02 In assessing this risk, it should first be kept in mind that the xKu band has been allocated to the Fixed-Satellite Service (FSS) in both Canada and the United States for many years. In the United States, the xKu band is shared between FS and FSS.

15.03 Telesat has consulted with Lemay-Yates Associates Inc. and Star Choice to assess the risk of harmful interference to Canadian DTH reception from FS transmitters in the United States located near the Canadian border. Locations of all existing U.S. xKu-band FS transmitters within 100 km of the Canadian border were considered, together with these transmitters' power and antenna characteristics. This analysis demonstrates that potential interference from xKu transmitters in the United States as of January 2009 could affect only 0.03% of Star Choice subscribers. Indeed, most of the potential interference is from one FS tower in Detroit. Potential interference is therefore very small. Moreover, it should be emphasized, this estimate is based on a conservative prediction of propagation characteristics. In practice, due to building and terrain blockage, the number of Star Choice customers affected would be less.

15.04 In September 2007 the FCC issued a Report and Order[22] that modified the technical characteristics for FS deployments in the 11 GHz band to effectively reduce the allowed minimum antenna size. Although this is a departure from the previous technical characteristics that dictated a larger antenna size, this new Ruling is not expected to significantly impact the distribution of FS networks in most border areas. Comments made by parties throughout the FCC proceeding indicated that the intent of the Commission was to promote fuller utilization of the 11 GHz band in metropolitan and urban areas, and the Report and Order makes it clear that most of the newly permitted small antennas will likely be used for *shorter links in urban or suburban areas*. It is not anticipated that such use for short links will have any more than a negligible impact on Canadian DTH users in the xKu band.

[21] For example, a large proportion of Hydro-Québec's telecom network is already satellite-based.
[22] *Report and Order* released September 10, 2007, Amendment of Part 101 of the Commission's Rules to Modify Antenna Requirements for the 10.7 – 11.7 GHz Band, WT Docket No. 07-54, FCC 07-163, accessed at: http://www.radiolicensing.com/downloads/FCC-07-163A1%2010SEP07.pdf

15.05 Accordingly, Telesat does not believe bilateral negotiations with the United States are required to deal with any potential cross-border interference issues in the xKu band.

Telesat's Answers to the Consultation Questions

This section provides a concise response by Telesat to each of the questions set out in the Consultation Paper. These responses should be treated as summaries only, and read together with the more detailed submissions made in previous sections of Telesat's submission.

1. (a) The Department seeks comments as to whether the spectrum utilization policy of the Ku frequency band 10.7-11.7 GHz should be changed to accommodate the provisioning of DTH services and, if so, what the designated use for each of the sub-bands should be.

Telesat submits that the 10.95-11.2 GHz and 11.45-11.7 GHz portions of the 10.7-11.7 GHz band should be designated for priority use by the Fixed Satellite Service (FSS) to support provisioning of Direct-to-Home (DTH) and broadcast signal delivery services.

This designation is required immediately to ensure additional satellite capacity can be made available to Star Choice in 2011 to meet the requirements of Canadian broadcasting policy and demand for High Definition video services ("HDTV"). Recent broadcasting policy and technological developments, primarily those related to the Canadian Radio-television and Telecommunications Commission (CRTC)'s recent decision in Broadcasting Public Notice CRTC 2008-100 (the "Broadcasting Distribution Undertaking (BDU) Framework Decision") and the rollout of HDTV, substantially increase the need for satellite capacity to serve Star Choice and Shaw customers. Spectrum policy change to support delivery of these services using the 10.95-11.2 GHz and 11.45-11.7 GHz bands is the only viable means for Star Choice and Shaw to deliver the required additional and advanced video services to its DTH and broadcast signal delivery customers in the required timeframe and on an economical basis. No other FSS or BSS band is suitable for reasons of unmarketable dish size (C band), lack of availability in the required orbital arc (conventional Ku band and planned BSS), dramatically higher satellite and consumer premise equipment costs, or inability to meet the timing requirement due to technological and/or regulatory reasons (Ka band, 24/17 GHz RDBS).

Telesat submits that the FS should have priority over the FSS in the bands 10.7 – 10.95 GHz and 11.2 – 11.45 GHz. FSS applications in these bands that pose minimal constraints on FS deployment—in particular, the four gateways[23] that support MSS feeder links in accordance with footnote C16C, and which use large antennas that have good discrimination against terrestrial interference—would remain protected from any FS installations. Site-by-site frequency coordination of additional MSS gateways in these bands would therefore also remain feasible, and these new gateways would be protected once successfully coordinated with existing FS installations.

(b) More specifically, should the designation be as requested in section 3.1 above, namely that the extended-Ku bands 10.95-11.2 GHz and 11.45-11.7 GHz be designated only to the fixed-satellite service, and the bands 10.7-10.95 GHz and 11.2-11.45 GHz continue to be designated to the fixed-satellite and fixed services under the current policy stipulations?

[23] The TAFL database identifies four earth station locations licensed to operate in those bands: at Skyterra's offices in Ottawa; at SED Systems in Saskatoon; at Allan Park, Ontario; and at Lake Cowichan, BC. The latter two sites were specifically selected many years ago to be in rural locations and are shielded by terrain from FS installations.

Yes, in accordance with the proposals set out in the response to question 1(a).

If these designations are made as described in 1(b) above:

2. Should they (a) be for a limited duration, and (b) be made conditional on the bringing into use the extended-Ku bands for DTH services within a specified period of time?

The revised Industry Canada spectrum utilization policy for the 10.7-11.7 GHz band should be established following a three-year transition period on a permanent basis and not restricted to any specific geostationary orbital position. The intention is to build and launch a satellite within this time period. If a condition on bringing the xKu band into use is required, it should allow for the worst-case scenario of a launch failure, in that a provision should be incorporated for a three-year extension in such a case.

3. Comments are sought as to the disposition of the current fixed service licensees in the extended-Ku bands. Should they be permitted to continue operating in these bands and, if so, under what conditions?

Telesat submits that the 10.95-11.2 GHz and 11.45-11.7 GHz bands should be designated for priority use by the Fixed Satellite Service (FSS). Three years after issuance of the Department's new spectrum policy to implement the foregoing approach, the operation of fixed service (FS) systems utilizing the bands 10.95-11.2 and 11.45-11.7 GHz should terminate. Until then, any uncoordinated FSS deployment in these bands would be on a no-protection basis with respect to FS transmitters licensed prior to 2009 (i.e. before the moratorium).

Telesat submits that the FS should have priority over the FSS in the bands 10.7 – 10.95 GHz and 11.2 – 11.45 GHz. FSS applications in these bands that pose minimal constraints on FS deployment—in particular, the gateways that support MSS feeder links in accordance with footnote C16C, and which use large antennas that have good discrimination against terrestrial interference—would, once coordinated, remain protected from any FS installations. Site-by-site frequency coordination of MSS gateways in these bands would therefore remain feasible.

4. Comments are sought as to whether the future capacity requirements of the fixed service can be accommodated in other fixed service allocations at 6, 15, 18 GHz and the remaining portions of the 11 GHz Ku band. Are these bands suitable and is there sufficient spectrum to accommodate any potentially displaced fixed service systems from the extended-Ku bands?

As detailed in Annex 6 to this submission, a number of viable alternatives are available for FS users that are currently licensed in the xKu band. The three-year time period roughly associated with the design, build and launch of an xKu-band satellite would provide a substantial transition window in which FS users could migrate to these alternatives.

5. Comments are sought on the coordination requirements with fixed systems in the U.S. and coordination with other FSS systems.

Telesat does not believe that it would be necessary for Industry Canada to seek a new bilateral arrangement to address U.S. FS networks. There are very few FS transmitters in the United

States that are sufficiently close to the border and pointing in the direction of the border to cause interference to DTH subscribers in Canada. Geometric and geographic conditions are such that very few U.S. FS links could be deployed in such a way that they could negatively impact FSS DTH subscribers. Telesat has consulted with Lemay-Yates Associates Inc. and Star Choice, and found that potential interference from xKu transmitters in the U.S. as of January 2009 could affect only 0.03% of Star Choice subscribers, and that most of the potential interference is from one FS tower in Detroit. Moreover, this estimate is based on a conservative prediction of propagation characteristics. In practice, due to building and terrain blockage, the number of Star Choice customers affected would be even less. Although recent initiatives by the FCC to allow the FS to use smaller dishes in the band 10.7-11.7 GHz are expected to increase the density of FS stations in urban or suburban areas within the United States, this is not expected to significantly increase the potential for interference into Canada.

Protection to FS networks in the United States from FSS networks is afforded by ITU Radio Regulations Article 21 power flux density limits, with which any xKu-band satellite must comply. Coordination with other xKu-band FSS systems can be undertaken following the normal ITU process.

If these designations are not made as described in 1(b) above:

6. Should consideration be given to authorizing the use of the extended-Ku bands to provide DTH services on a non-standard basis (i.e. receive-only earth stations shall not claim protection from harmful interference from any current and future authorized fixed service stations)?

Telesat is strongly opposed to authorizing use of the xKu band to provide DTH services on a non-standard basis. This would be unworkable, both from a commercial and a consumer perspective. The level of interference originating from transmitters in close proximity to the FSS DTH terminals would change over time in an uncontrollable and unpredictable manner. The interference caused by future FS links could impact existing, hitherto unaffected, DTH customers and their service could cease to function at some point after months or even years of good reception. This would not be acceptable for Canadian consumers receiving a ubiquitous broadcasting service such as DTH.

7. Comments are sought on how the near-term DTH capacity requirements can be met.

Extensive analyses undertaken by Telesat shows that for technology, cost-effectiveness, redundancy and regulatory reasons, the xKu band is the only viable option for the delivery in the near term of new DTH and broadcast signal delivery services in the Star Choice neighbourhood.

It is critically important that DTH consumers be able to access programming that is transmitted using satellites located in the same orbital neighbourhood. This allows a single small-dish (60-70 cm) solution on the customer premises. In today's competitive video distribution marketplace, if a DTH operator tried to persuade consumers that they needed two dishes or one larger unwieldy dish, the operator would be placed at a distinct competitive disadvantage. Such alternatives are not commercially viable solutions because they are both consumer-unfriendly and significantly more expensive. The Star Choice orbital neighbourhood consists of the orbital positions

107.3°W and 111.1°W, served by the Anik F1R and Anik F2 satellites, respectively. This is where all Star Choice customer antennas are pointed.

The main reasons that Telesat has concluded that the xKu band is the only solution to allow delivery of new DTH services in the required timeframe are as follows:

a) **Proven technology**: The xKu band is already used for DTH services throughout many parts of the world, including Europe (and Asiatic Russia), South America, Asia, and Africa. An xKu band satellite can be built now, and the associated earth terminal equipment is already being produced and is available for purchase in commercial volumes.

b) **Cost-effectiveness**: Manufacturers are already producing consumer-market earth terminal equipment in volume so that roll-out of an xKu-band DTH system would be simple to implement and cost-effective for Star Choice customers. The only change that would be required for Star Choice to utilize the xKu-band capacity would be the replacement of the consumer terminal Low Noise Block Downconverter (LNB). An xKu-band satellite would also be considerably less expensive to manufacture than a satellite that could achieve comparable performance through the use of a higher frequency band.

c) **Redundancy**: A new xKu-band satellite can be designed with an integrated conventional Ku-band back-up capability because the Ku-band and xKu-band frequencies are contiguous and the components can therefore be shared or switched. This would provide back-up protection in the Star Choice orbital neighbourhood for existing broadcasting services provided to DTH subscribers and broadcast signal delivery customers via existing Ku-band satellites.

d) **Regulatory certainty**: The regulatory situation and ITU coordination processes for Canadian xKu-band filings is well understood and straightforward.

There are no other frequency bands available in the Star Choice orbital neighbourhood that meet the company's DTH requirements. Other satellite bands that have been considered include conventional Ku-band, C-band, Ka-band, 12 GHz BSS, and 17 GHz BSS (otherwise known as reverse DBS or RDBS). However, for the reasons set out below, none of these meet Star Choice's near-term requirements. A detailed technical analysis for each of these bands is also provided in Appendix 5.

Conventional Ku band

Star Choice has requested, and Telesat has undertaken, a number of initiatives over the past five years to free-up additional conventional Ku-band capacity for Star Choice in the Star Choice orbital neighbourhood. No further opportunities remain. No other conventional Ku-band transponders are available to Star Choice from any other satellite operator, whether Canadian or foreign, within the Star Choice orbital neighbourhood. Any conventional Ku-band transponders that might be available outside that arc cannot be used by Star Choice without a costly redesign and replacement of the dish as well as the LNB.

C band

While C-band satellite capacity is available, it requires the use of very large dishes that consumers will not accept.

Ka band

The Anik F2 Ka-band satellite at the 111.1ºW orbital position is designed with spot beam technology to support Internet services and is currently deployed for that purpose. In general, due to higher frequencies and atmospheric losses, the Ka-band has been used in conjunction with spot beam technology and used either for Internet services, or, in the case of the United States, to transmit local broadcast programming on a per-spot-beam basis, satisfying a U.S. Federal Communications Commission regulatory mandate that is not reflected in Canadian regulation. Using the Ka band to deliver a Canadian DTH service whose signal could be received anywhere in Canada using a relatively small dish would require covering all of Canada in a single beam. To do so at an acceptable cost would require lower-power EIRP levels than are commonly achieved on spot beam satellites. In addition to the considerable opportunity cost of foregoing spot beam applications such as Internet connectivity, a Ka DTH satellite would therefore be susceptible to interference from adjacent spot beam satellites serving Canada or border areas in the United States and operating at a higher power level.

12 GHz BSS

The Planned (ITU AP30/30A) BSS bands in the North American arc have been fully utilized by Bell TV, along with EchoStar and DirecTV who share the same service area. In fact, the Planned BSS orbital positions in the Star Choice neighbourhood are assigned to the United States and have been fully utilized by DirecTV and EchoStar.

Bell TV, EchoStar and DirecTV currently have access to substantially more satellite capacity using the 12 GHz BSS frequencies than does Star Choice using the conventional Ku-band frequencies, and these service providers can currently offer a broader array of services using the attractive single-dish solution.

17 GHz BSS band (Reverse DBS)

The 17 GHz BSS band (RDBS) is not a viable alternative for Star Choice due to time to market constraints. There is currently no operational network using the RDBS band so that components and technology for both ground and space segment are only in the developmental stages. Moreover, the deployment of an RDBS satellite will inevitably be delayed due to international coordination issues and related regulatory uncertainties associated with numerous competing filings through the ITU and the FCC. Given past experience, these issues will be resolved only following protracted bilateral or multilateral negotiations. To achieve the same level of service availability as in the Ku band, an RDBS satellite would require higher power and therefore be more costly than an xKu-band satellite. In addition, the CPE would be significantly more expensive.

APPENDIX 1

Global Usage of xKu Band for DTH

Global Usage of Extended Ku (xKu) band for Direct-to-Home (DTH) service

Satellite Name	Orbital Position	Opera-tor	Manu-facturer	Service Area (xKu)	Type of Service	Launch Year	TPs in 10.95-11.2 GHz	TPs in 11.45-11.7 GHz	Active TV channels in xKu [24]
Telstar 14 (Estrela do Sul 1)	63ºW	Telesat	Loral	South America	DTH	2004	N/A	12	11
Amazonas 1	61ºW	Hispasat	EADS Astrium	Brazil	DTH	2004	12	N/A	29
Intelsat 801	31.5ºW	Intelsat		Europe	DTH	1997	[2]	[2]	6
Hispasat 1D	30ºW	Hispasat	Alcatel Space	Europe	DTH	2002	N/A	8	31
Intelsat 905	24.5ºW	Intelsat		Europe	DTH	2002	[4]	[10]	31
NSS-7	22ºW	SES New Skies	Lockheed-Martin	Europe Africa Middle East	DTH	2002	[6]	[8]	23
Intelsat 901	18ºW	Intelsat		Europe Middle East North Africa	DTH	2001	[4]	[4]	10
Telstar 12	15ºW	Telesat	Loral	Europe Middle East South Africa	DTH	1999	6	8	35
Express A4	14ºW	Russian Satellites Comm. Company		North Africa Europe Middle East	DTH	2002	N/A	5	6
Atlantic Bird-1	12.5ºW	Eutelsat	Alenia Spazio	Europe South America Middle East Central Asia North Africa	DTH	2002	6	4	26
Atlantic Bird-2	8ºW	Eutelsat	Alcatel Space	Europe Middle East Central Asia North Africa	DTH	2001	6	12	35
Atlantic Bird-3	5ºW	Eutelsat	Alcatel Space	Europe Middle East Central Asia North Africa	DTH	2002	12	12	53
Intelsat 10-02	1ºW	Intelsat		Europe	DTH	2004	[5]	[2]	5

[24] LyngSat Info, February 2009.

Global Usage of Extended Ku (xKu) band for Direct-to-Home (DTH) service

Satellite Name	Orbital Position	Opera-tor	Manu-facturer	Service Area (xKu)	Type of Service	Launch Year	TPs in 10.95-11.2 GHz	TPs in 11.45-11.7 GHz	Active TV channels in xKu [24]
W3A	7ºE	Eutelsat	EADS Astrium	Europe Middle East Central Asia Africa	DTH	2004	6	11	40
W1	10ºE	Eutelsat	EADS Astrium	Europe Atlantic Islands Middle East North Africa Central Asia	DTH	2000	6	8	26
Hot Bird-6	13ºE	Eutelsat	Alcatel Alenia Space	Europe North Africa Middle East Central Asia	DTH	2002	12	7	247
Hot Bird-8	13ºE	Eutelsat	EADS Astrium	Europe North Africa Middle East	DTH	2006	12	12	141
Hot Bird-9	13ºE	Eutelsat	EADS Astrium	Europe North Africa Middle East	DTH	2008	[N/A]	[3]	30
W2	16ºE	Eutelsat	Alcatel Space Industries	Europe North Africa Madagascar	DTH	1998	6	10	106
Astra 1KR	19.2ºE	SES Astra	Lockheed Martin	Europe	DTH	2006	16	16	23
Astra 1L	19.2ºE	SES Astra	Lockheed Martin	Europe	DTH	2007	16	16	106
W6	21.5ºE	Eutelsat	Alcatel Space Industries	Europe North Africa Middle East Central Asia	DTH	1999	6	10	19
Astra 3A	23.5ºE	SES Astra	Boeing Satellite Systems	Central Europe	DTH	2002	N/A	12	82
EuroBird 2	25.5ºE	Eutelsat	EADS Astrium	S. E. Europe Turkey E. N. Africa Middle East Caucasus	DTH	1998	10	7	72
Astra 2C	28.2ºE	SES Astra	Boeing Satellite Systems	Europe	DTH	2001	16	N/A	2
EuroBird 1	28.5ºE	Eutelsat	Alcatel Space Industries	Europe	DTH	2001	N/A	12	77
EuroBird 3	33ºE	Eutelsat	Boeing Satellite Systems	4 Spot beams in Europe	DTH	2003	4	12	26

Global Usage of Extended Ku (xKu) band for Direct-to-Home (DTH) service

Satellite Name	Orbital Position	Opera-tor	Manu-facturer	Service Area (xKu)	Type of Service	Launch Year	TPs in 10.95-11.2 GHz	TPs in 11.45-11.7 GHz	Active TV channels in xKu [24]
Sesat-1	36ºE	Eutelsat	Alcatel Space / NPO-PM	Europe Middle east Central Asia Russia/Siberia Africa	DTH	2000	6	6	23
Hellas Sat 2	39ºE	Hellas Sat	Astrium	Europe Middle East Central Asia West Russia	DTH	2003	[6]	[6]	28
Express-AM1	40ºE	Russian Satellites Comm. Company	NPO PM	Europe Middle East Central Asia West Russia North Africa	DTH	2004	[7]	[6]	45
Turksat 3A	42ºE	Turksat		Europe Middle East Central Asia West Russia	DTH	2008	[9]	[4]	106
Intelsat 12	45ºE	Intelsat		Europe India	DTH	2000	[N/A]	[6]	19
Sesat-2 / Express AM22	53ºE	Eutelsat	Alcatel Space / NPO-PM	Europe Middle East Africa Central Asia	DTH	2003	[6]	8	39
Intelsat 904	60ºE	Intelsat		Central Asia West Russia East Europe Middle East	DTH	2002	[5]	[7]	46
Intelsat 902	62ºE	Intelsat		Middle East	DTH	2001	[5]	[6]	58
Insat-4CR	74ºE	Insat		India	DTH	2007	[N/A]	[12]	7
Express-AM2	80ºE	Russian Satellites Comm. Company	NPO PM	Russia	DTH	2005	[4]	[3]	10
Insat-4A	83ºE	Insat		India	DTH	2005	6	6	12
Yamal-201	90ºE	Gascom	RSC Energia	Russia North Asia Central Asia	DTH	2003	3	3	34
Measat-3	91.5ºE	Measat	Boeing	Malaysia	DTH	2006	[3]	[5]	8
Insat-4B	93.5ºE	Insat	Indian Space Research Org.	India	DTH	2007	[7]	[6]	95
NSS-6	95ºE	SES New Skies	Lockheed-Martin	India Australia Middle East East-Europe South Africa	DTH	2002	[5]	[13]	28

Global Usage of Extended Ku (xKu) band for Direct-to-Home (DTH) service

Satellite Name	Orbital Position	Opera-tor	Manu-facturer	Service Area (xKu)	Type of Service	Launch Year	TPs in 10.95-11.2 GHz	TPs in 11.45-11.7 GHz	Active TV channels in xKu [24]
Express-AM33	96.5ºE	Russian Satellites Comm. Company	NPO PM	Russia	DTH	2008	[5]	[4]	17
Palapa-C2	113ºE	Indosat		South East Asia	DTH	1996	1	2	2
Vinasat-1	132ºE	Vietnam Posts and Telecom municatio ns Group (VNPT)	Lockheed Martin	Vietnam, Cambodia, Laos, Myanmar, Thailand, part of China	DTH	2008	[1]	[N/A]	9
Measat-2	148ºE	Measat	Boeing Satellite Systems	Vietnam Cambodia Laos Thailand	DTH	1996	[N/A]	[2]	23

Note 1: TP stands for Transponder.

Note 2: In the columns "TPs in 10.95-11.2 GHz" and "TPs in 11.45-11.7 GHz", if the numbers appear in brackets, it means that those numbers have been obtained from LyngSat. Otherwise, they have been obtained from the relevant operator's web site.

APPENDIX 2

FCC Applications for 24/17 GHz "Grid" Slots

Submissions to the FCC to Access the 24/17 GHz "Grid" Slots (with Star Choice Neighbourhood highlighted)

Status ("Original" applicant or "Post-freeze" applicant	File Number	Applicant Name	FCC GRID Slot (°W)	Requested Slot (°W)	Offset (deg)
		none	**43**		
		none	**47**		
		none	**51**		
		none	**55**		
		none	**59**		
Original	SAT-AMD-20080114-00021	EchoStar Satellite operating L.L.C.	**63**	62.15	0.85
		none	**67**		
Post-freeze (10 Sep 08)	SAT-LOA-20080910-00173	SES Americom	**67**	67.5	0.5
Post-freeze (10 Sep 08)	SAT-LOA-20080910-00174	Skynet Satellite Corp	**71**	70	1
Original	SAT-AMD-20080114-00022	EchoStar Satellite Operating L.L.C.	**75**	76	1.0
Original	SAT AMD-20080114-00018	EchoStar Satellite Operating L.L.C.	**79**	78.0	1.0
		none	**83**		
		none	**87**		
Original	SAT-AMD-20080114-00008	Intelsat North America LLC	**91**	90.9	0.1
Original	SAT-AMD-20080114-00025	Pegasus Development DBS Corporation	**91**	91	0
Original	SAT-AMD-20080114-00009	Intelsat North America LLC	**95**	95.15	0.15
Original	SAT-AMD-20080114-00012	Intelsat North America LLC	**99**	99.1	0.1
Original	SAT-AMD-20080114-00013	DIRECTV Enterprises, LLC	**99**	99.175	0.175
Original	SAT-AMD-20080114-00014	DIRECTV Enterprises, LLC	**103**	102.85	0.15
Post-freeze (10 Sep 08)	SAT-LOI-20081119-00217	Spectrum Five	**103**	103.15	0.15
Original	SAT-AMD-20080114-00015	DIRECTV Enterprises, LLC	**107**	107.0	0.0
Original	SAT-AMD-20080114-00020	EchoStar Satellite Operating L.L.C.	**107**	106.0	1.0
Original	SAT-AMD-20080114-00024	Pegasus Development DBS Corporation	**107**	107	0
Original	SAT-AMD-20080114-00016	DIRECTV Enterprises, LLC	**111**	110.9	0.1
Original	SAT-AMD-20080114-00019	EchoStar Satellite Operating L.L.C.	**111**	110.4	0.6
Original	SAT-AMD-20080114-00023	Pegasus Development DBS Corporation	**115**	115	0
Original (with drawn)	SAT-AMD-20080114-00017	DIRECTV Enterprises, LLC	**119**	118.4	0.6
Post-freeze (10 Sep 08)	SAT-LOI-20080910-00178	Spectrum Five (2 spacecraft)	**119**	119	0
Original	SAT-AMD-20080114-00011	Intelsat North America LLC	**123**	122.9	0.1
		none	**127**		
		none	**131**		
		none	**135**		
		none	**139**		
		none	**143**		
		none	**147**		
		none	**151**		
		none	**155**		
		none	**159**		
		none	**163**		
		none	**167**		
		none	**171**		
		none	**175**		
		none	**179**		

APPENDIX 3

RDBS ITU Filings in North American Arc

ADM	ITU Network Name	Orbital Slot °W	Protection Date dd.mm.yy	Expiry Date dd.mm.yy
LUX	LUX-G6-49	59.0	18.06.08	18.12.14
LUX	LUX-G4-67	61.9	29.11.06	08.02.12
LUX	LUX-G6-48	62.0	18.06.08	18.12.14
USA	USABSN-16	62.15	28.04.08	08.03.14
LUX	LUX-G5-66	67.0	12.03.07	09.06.13
USA	INTELSAT KAEXT 67.5W	67.5	13.09.05	14.03.12
LUX	LUX-G6-46	71.0	18.06.08	18.12.14
CAN	CAN-BSS-72.5	72.5	18.03.04	01.04.09
CAN	CAN-BSS16	72.5	08.05.06	08.11.12
CAN	CAN-BSS24	72.5	26.03.08	26.09.14
LUX	LUX-G5-64	75.0	25.05.07	09.06.13
USA	USABSN-15	75.0	28.04.08	08.03.14
G	UKSAT-KU-4	76.0	29.02.08	30.08.14
CAN	CANBSS-17	77.0	09.11.06	30.01.13
LUX	LUX-G4-64A	77.0	23.08.06	08.02.12
G	AM-SAT-79W	79.0	28.01.03	11.07.09
LUX	LUX-G5-63	79.0	06.07.07	09.06.13
LUX	LUX-G6-45	79.0	18.06.08	18.12.14
MLA	MEASAT-ROUTE-79W	79.0	11.06.04	24.09.10
CAN	CAN-BSS8	82.0	18.11.05	18.05.12
CAN	CAN-BSS27	82.0	26.03.08	26.09.14
LUX	LUX-G5-62	83.0	06.07.07	09.06.13
LUX	LUX-G6-44	83.0	18.06.08	18.12.14
G	UKSAT-KU-5	84.0	29.02.08	30.08.14
G	AM-SAT-85W	85.0	28.01.03	11.07.09
G	UKSAT-KU-6	86.0	29.02.08	30.08.14
CAN	CAN-BSS9	86.5	18.11.05	18.05.12
CAN	CAN-BSS29	86.5	26.03.08	26.09.14
LUX	LUX-G6-43	87.0	18.06.08	18.12.14
USA	INTELSAT KAEXT 89W	89.0	14.09.05	14.03.12
MLA	MEASAT-89.5W	89.5	31.12.04	11.06.11
CAN	CAN-BSS10	91.0	18.11.05	18.05.12
CAN	CAN-BSS31	91.0	26.03.08	26.09.14
LUX	LUX-G6-42	91.0	18.06.08	18.12.14
HOL	BSSNET2-95W	95.0	09.11.07	09.05.14
LUX	LUX-G5-60	95.0	06.06.07	09.06.13
G	AM-SAT-96W	96.0	28.01.03	11.07.09

ADM	ITU Network Name	Orbital Slot °W	Protection Date dd.mm.yy	Expiry Date dd.mm.yy
HOL	BSSNET96.5W	96.5	17.01.07	17.07.13
USA	INTELSAT KAEXT 97W	97.0	13.09.05	14.03.12
MLA	MEASAT-ROUTE-97.5W	97.5	13.12.04	11.06.11
CAN	CAN-BSS18	99.0	09.11.06	30.01.13
HOL	BSSNET2-99W	99.0	09.11.07	09.05.14
LUX	LUX-G4-59A	99.0	23.08.06	08.02.12
LUX	LUX-G5-59	99.0	29.05.08	09.06.13
USA	USABSN-13	99.0	02.04.07	02.10.13
HOL	BSSNET101W	101.0	17.01.07	17.07.13
CAN	CAN-BSS11	103.0	18.11.05	18.05.12
CAN	CAN-BSS19	103.0	09.11.06	30.01.13
HOL	BSSNET2-103W	103.0	09.11.07	09.05.14
LUX	LUX-G4-58A	103.0	23.08.06	08.02.12
LUX	LUX-G6-41	103.0	18.06.08	18.12.14
USA	USABSN-12	103.0	02.04.07	02.10.13
G	GIBSAT A1	105.0	27.11.02	26.04.09
G	USAT-S1	105.5	27.11.02	26.04.09
HOL	BSSNET105.5W	105.5	17.01.07	17.07.13
HOL	BSSNET2-107W	107.0	09.11.07	09.05.14
USA	USABSN-9A	107.0	28.04.08	21.11.13
CAN	CAN-BSS12	107.3	18.11.05	18.05.12
CAN	CAN-BSS36	107.3	26.03.08	26.09.14
LUX	LUX-G5-56	107.3	29.05.08	09.06.13
LUX	LUX-G4-57A	109.2	23.08.06	08.02.12
LUX	LUX-G5-57	109.2	08.01.08	09.06.13
HOL	BSSNET110W	110.0	17.01.07	17.07.13
USA	USABSN-10A	110.4	28.04.08	21.11.13
HOL	BSSNET2-111W	111.0	09.11.07	09.05.14
CAN	CAN-BSS21	111.1	10.08.07	30.05.13
LUX	LUX-G4-56A	111.1	23.08.06	08.02.12
LUX	LUX-G6-40	111.1	18.06.08	18.12.14
CAN	CAN-BSS13	113.0	18.11.05	18.05.12
HOL	BSSNET114.5W	114.5	17.01.07	17.07.13
LUX	LUX-G4-55	114.5	29.11.06	08.02.12
G	IOMBSN-A	115.0	07.03.08	24.08.14
HOL	BSSNET2-115W	115.0	09.11.07	09.05.14
LUX	LUX-G6-39	115.0	18.06.08	18.12.14
CAN	CAN-BSS14	118.7	18.11.05	18.05.12
CAN	CAN-BSS40	118.7	26.03.08	26.09.14
HOL	BSSNET119W	119.0	17.01.07	17.07.13
HOL	BSSNET2-119W	119.0	09.11.07	09.05.14

ADM	ITU Network Name	Orbital Slot °W	Protection Date dd.mm.yy	Expiry Date dd.mm.yy
LUX	LUX-G6-38	119.0	18.06.08	18.12.14
USA	INTELSAT KAEXT 121W	121.0	13.09.05	14.03.12
LUX	LUX-G5-54	123.0	25.05.07	09.06.13
G	AM-SAT 125W	125.0	21.07.04	12.11.10
LUX	LUX-G5-53	127.0	25.05.07	09.06.13
CAN	CAN-BSS-129.0	129.0	18.03.04	01.04.09
CAN	CAN-BSS15	129.0	18.11.05	18.05.12
LUX	LUX-G3-26-A	129.0	24.05.04	01.08.10
LUX	LUX-G5-52	131.0	25.05.07	09.06.13
LUX	LUX-G5-51	135.0	25.05.07	09.06.13
CAN	CAN-BSS-138.0	138.0	29.03.04	01.04.09
LUX	LUX-G4-50A	138.0	23.08.06	08.02.12
G	GIBSAT-5	139.0	27.11.02	26.04.09

Note: this list is current as of IFIC 2639

APPENDIX 4

Wide-beam DTH Satellite Cost Comparison for xKu, RDBS, and Ka Bands

This Appendix contains confidential and proprietary information related to the design and costing of Telesat's satellites, and accordingly is filed in confidence with Industry Canada pursuant to the provisions of the *Access to Information Act* (Canada) and is not included in the "abridged" version of this submission, which may be placed on the public record.

APPENDIX 5

Comparative Link Designs

This Appendix contains confidential and proprietary information related to the design and costing of Telesat's satellites, and accordingly is filed in confidence with Industry Canada pursuant to the provision of the *Access to Information Act* (Canada) and is not included in the "abridged" version of this submission, which may be placed on the public record.

APPENDIX 6

Report of Lemay-Yates Associates

Extended-Ku Band:

Options for Fixed Service Licensees

DGTP-003-08

Report presented to

TELESAT CANADA

April 15, 2009

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1. Introduction

This Report was prepared by Lemay-Yates Associates Inc. (LYA) for Telesat Canada to assist in addressing questions raised in Industry Canada's Gazette Notice DGTP-003-08, issued January 10, 2009, "Consultation on the Possible Use of the Extended-Ku Spectrum Bands for Direct-to-Home (DTH) Satellite Broadcasting Services".

In particular this Report is focused on the nature of terrestrial fixed service (FS) usage in the Extended-Ku portion of the 10.7-11.7 GHz band ("11 GHz band").

The 11 GHz band currently allows for shared FS and fixed satellite service (FSS) use. The FS links in the band are point-to-point engineered links that are coordinated channel by channel with other FS licensees as well as with the FSS users within the band.

The use of this band for satellite, particularly for DTH, is not practical with the current sharing arrangements as the consumer terminals must be ubiquitously deployed across the country, and cannot be frequency coordinated on an individual basis. The potential for interference from FS in to the FSS DTH terminals risks could render a DTH service in this band unusable.

Hence, Industry Canada is considering by way of DGTP-003-08 whether the spectrum utilization policy of the frequency band 10.7-11.7 GHz should be changed to accommodate the provisioning of DTH services in the 10.95-11.2 and 11.45-11.7 GHz portion and whether there are alternatives for FS licensees currently using that sub-band.

Therefore, rather than continuing to make use of the entire 11 GHz range, FS applications could be limited to a portion of the band, leaving the remainder open for DTH. Other fixed microwave bands or other options could be available to satisfy current and future

FS applications. The DTH service provider in the XKu band would be Star Choice, which currently operates its service in the adjacent Ku band.

1.1 Note on scope of technical analysis

It should be kept in mind that the FS links in the 11 GHz band are all engineered and coordinated link-by-link. Licenses are issued for each transmitter that is used in this band and each link comes with its own technical characteristics, based on analyses and engineering briefs filed with Industry Canada prior to licensing.[1]

Any change to an 11 GHz installation would require an engineered solution. It is not the purpose of this Report to re-engineer the 11 GHz links currently in service or to suggest technical solutions for specific sites or links.

The approach adopted by LYA was to investigate the range of available options for 11 GHz licensees in various situations and geographic areas, considering deployment characteristics, availability of other bands, etc. The assessment herein of "fit" of 11 GHz links with other bands is limited to consideration of available channel capacity and link distance. The conclusions illustrate that there should be ample room to move licensees within the band and to other bands.

Detailed engineering studies would be required to confirm which of the options would be the best choice in any specific situation. The analyses presented in this Report do not supplant the normal technical studies and coordination activities that would be required by licensees prior to changing frequency assignments or applying for licenses in other bands. In particular before making any change to licensed systems, the licensee would

[1] Frequency coordination procedures are set out in Industry Canada Radio Standards Procedure RSP-113, "Application Procedure for Planned Radio Systems Above 960 MHz in the Fixed Service", Issue 6, October 2007

have to perform technical and coordination studies to ensure lack of interference with other radio licensees within the relevant coordination zones.

Frequency coordination studies would also involve participation by the other radio licensees to assess the impact of new frequency assignments.

"Prior to initiating a request for frequency coordination the applicant must first conduct appropriate studies and analyses in order to select sites, transmitters, receivers, antennae, and frequencies that will avoid harmful interference to other microwave radio operators. All applicants and licensees must cooperate fully and make reasonable efforts to resolve technical problems in order not to inhibit efficient use of the radio frequency spectrum."[2]

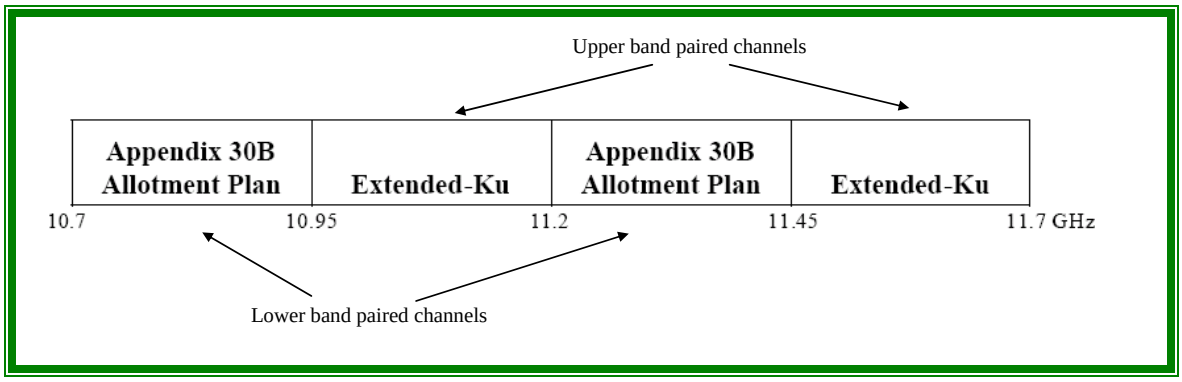
[2] "Frequency coordination procedures & Database maintenance responsibilities manual", Frequency Coordination System Association, February 20, 2006

2. Characterization and usage of the 11 GHz band

The "11 GHz band" refers to the frequency range 10.7-11.7 GHz. Within the 11 GHz band, the term "upper band" in this report refers to the portion that the satellite industry refers to as the Extended-Ku (XKu) band, meaning the range of 10.95-11.2 GHz paired with 11.45-11.7 GHz. The "lower band" refers to the portion that the satellite industry refers to as the Ap30B allotment portion, i.e. the range of 10.7-10.95 GHz paired with 11.2-11.45 GHz.

Thus of the 1 GHz of spectrum capacity represented by the 11 GHz band, half can be considered to be upper band – i.e. 250 MHz of channels paired with 250 MHz – and half can be considered to be lower band – i.e. the remaining 250 MHz of channels paired with 250 MHz, as illustrated below.[3]

Figure 1 – 11 GHz band overview



Within the upper and lower band portions of the 11 GHz band, there are a variety of fixed service (FS) channel types available, most notably with capacities of 10, 20, 30 or 40

[3] Band plan per Industry Canada shown in DGTP-003-08, page 2, annotated to show upper band and lower band pairing

MHz each.[4] When a licensee is assigned a "channel" by Industry Canada, this then refers to the paired equivalent in spectrum.

For example, there are 12 paired channels defined for the 11 GHz band that can accommodate up to 40 MHz each, accounting for 960 MHz in total.[5] One of them would be the 40 MHz of spectrum covering 10715 MHz to 10755 MHz for one direction of transmission and 40 MHz of spectrum covering 11205 MHz to 11245 MHz for the other direction. A licensee using this 40 MHz channel would therefore have one transmitter using 10715 to 10755 MHz at one end of its link and another transmitter using 11205 to 11245 MHz at the other end of its link.

Each transmission link has two transmitters, one at each end, and by inference two receivers, "listening" to the corresponding frequency range at the other end. The difference in frequency between the two transmitters is 490 MHz – i.e. the difference between 10715 and 11205 MHz in the above example – which is the frequency "separation". All of the paired channels in the 11 GHz band have 490 MHz separation.[6]

2.1 Drivers for use of microwave links and expected evolution

Fixed microwave links serve a variety of purposes and different microwave bands are organized in ways to serve these. One way of distinguishing applications in fixed microwave is to consider long haul versus short haul service.

[4] These are the channels for high capacity radio systems. Industry Canada also provides for channels for low capacity systems, below 5 MHz. Technical aspects of the 11 GHz band are set out in Industry Canada SRSP-310.7, Issue 2, September 29, 2001, "Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 10.7-11.7 GHz."

[5] Channels do not start and end exactly at the band edges 10.7 GHz and 11.7 GHz to allow for a mix of channel types in integer multiples across the range.

[6] See SRSP-310.7, op. cit. There are some one-way systems as well as links that do not respect the standard separation.

Long haul typically meant applications such as the cross-Canada microwave systems, now mostly replaced by fiber, linking city to city. Short haul refers to "metro" applications connecting points around an urban or suburban area.

Long haul links would typically require significant capacity between two points – i.e. essentially providing inter-city trunking – whereas short haul would be expected to be lower capacity linking different locations around a local area – essentially "access" links. Much of the long haul need for radio systems has been replaced by fiber facilities that now crisscross Canada. Fiber is also now prevalent in and around urban areas, reducing urban requirements for microwave links.

However, microwave provides a solution in cases where geography may limit fiber deployment or where facilities are required quickly or on a temporary basis. Microwave also plays a role in providing redundancy – i.e. some microwave links may simply run in parallel to fiber routes to provide an alternate communications path in the case of a fiber cut or other failure.

2.2 Use of 11 GHz links across Canada and potential for growth

Based on Industry Canada license data, there are 1,529 licensed transmitters operating in the 11 GHz band.[7] Of these, 425 are in the upper band portion and 1,104 are in the lower band portion.

[7] Industry Canada license data is per the "Technical and Administrative Frequency Lists (TAFL)". This is an extensive database of license information that is updated continually by Industry Canada. The TAFL excludes frequencies assigned to public security and national defense users. The analyses contained in this report use TAFL data as of December 11, 2008. Note: the TAFL data contained 12 transmitters with US addresses and one station with only 2.8 kHz bandwidth. These were removed for analysis purposes. Also, the number of transmitters in the lower and upper portions of the band would be expected to be equal since channels are always assigned in pairs with 490 MHz separation. However, five links in the TAFL data do not seem to follow this rule – four Telus links and one Bell link.

The breakdown of the transmitters by upper and lower band and by licensee is shown below.

Table 1 – Upper and Lower 11 GHz Band Transmitters by Licensee

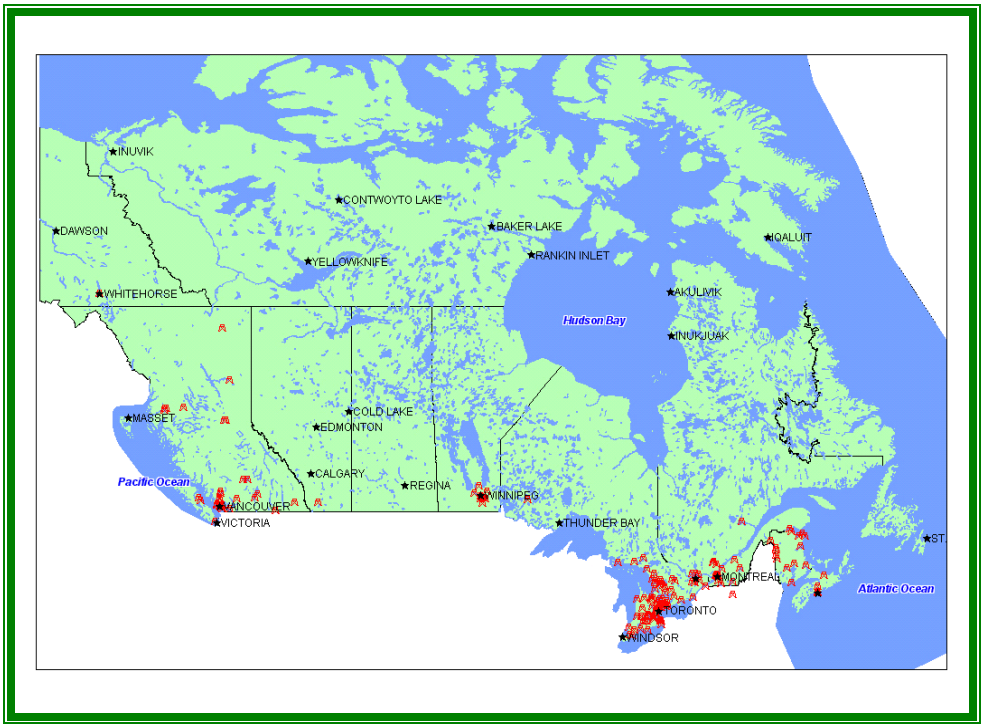
	10.70 - 10.95 GHz	10.95 - 11.20 GHz	11.20 - 11.45 GHz	11.45 - 11.70 GHz	11 GHz
Rogers	249	33	249	33	564
Telus	97	38	94	40	269
Bell*	52	55	52	58	217
TeraGo	35	15	35	15	100
BC Hydro	17	22	18	22	79
Navigata	16	14	16	14	60
MTS Allstream	14	4	14	4	36
TBayTel	14	1	14	1	30
RM of Wood	14	-	14	-	28
Shaw	-	10	-	18	28
Top 10 Licensees	508	192	506	205	1,411
Other	45	14	45	14	118
Total	553	206	551	219	1,529

* Including Northwestel & Bell Aliant

The 425 transmitters in the upper portion are spread across Canada with more significant concentrations in Southern Ontario and Southern BC.[8]

[8] Map per Telesat Canada, shown for the 11.45-11.7 GHz transmitters only.

Figure 2 – Map of transmitters in the 11 GHz band upper portion



In total numbers the current usage of the 11 GHz band is relatively low. As points of comparison:

- There are typically more than twice as many links in other fixed service bands – there are 3,000-4,000 transmitters in each of the 6, 12.7, 15, 18 and 23 GHz bands,

- Star Choice, the potential user of the XKu band, has close to 900,000 customer terminals in service and also services many more customers indirectly via its distribution of broadcast signals to small cable head-ends across Canada.[9]

From a spectrum policy perspective:

- Given that usage is relatively low, the capacity represented by the XKu links should be relatively easy to "fit" either into the lower band portion of the 11 GHz range or into other bands that could provide for the same application. This is the focus of the analyses in this report, discussed in the context of several case studies as well as through an overall general analysis.

- The mobile carriers account for the bulk of the growth in use of the upper portion of the 11 GHz band. Most of mobile carriers' capacity needs focus on core urban areas. In these areas, the need is for relatively short, high capacity links. This is more a characteristic of other frequency bands such as 18 or 23 GHz. Sudden traffic demand can be addressed via quick deployment of microwave links. But for future needs and to accommodate even more explosive growth in mobile backhaul needs (i.e. due to take-up of 3G and later 4G data devices), fiber is likely a better alternative to microwave radio for mobile backhaul applications in many areas.

- The potential inconvenience and cost associated with moving existing licensees out of the upper portion of the 11 GHz band is confined to 425 individual transmitters. Lack of XKu capacity for Star Choice, on the other hand, would have an impact on almost 900,000 DTH receivers as well as on customers of cable companies that rely on the Star Choice signals.

The following sections discuss characteristics of other microwave bands that could serve as alternatives for licensees in the upper portion of the 11 GHz band, and the results of a case study analysis conducted by LYA to assess viability of alternatives.

[9] Per Shaw Communications (Star Choice's parent company), Investor Presentation November 13, 2008, Star Choice had 893,000 customers at August 31, 2008

Consideration of alternatives focuses on the more-congested urban areas, where potentially re-assigning frequencies could be more problematic. Alternatives in non-urban areas would generally be more readily available, subject to hop length and geographic considerations rather than to occupancy of the various bands.

3. Microwave alternatives

In considering alternatives to use by the FS of the XKu portion of the 11 GHz band, one has to take account of the applications that licensees have when deploying systems in that range. The 11 GHz band is for point-to-point radio systems of relatively high capacity.

There are many different radio frequency bands that are licensed for different purposes and with varying technical characteristics.

Some bands would be unsuitable alternatives for 11 GHz licensees, in particular bands that are used for mobile or broadcasting purposes or bands with very low capacity.

There are a number of license-exempt bands – e.g. for WiFi hotspots – but these would not likely have the reliability required for high capacity point-to-point applications, particularly in congested urban areas.

It should also be kept in mind that government users occupy spectrum resources. Bands used by government agencies, military, public safety and other users of this nature are not included in the assessment in this Report. Government use of microwave frequencies is not included in public information on spectrum licensing in Canada.

There are, however, a variety of bands set out for fixed microwave applications and these are the most likely candidates as immediate alternatives to 11 GHz frequencies. Overall the microwave options for licensees can be considered in three categories.

- In-band options – i.e. retuning of systems that presently occupy the 11 GHz XKu upper band range to the non-Xku lower band portion of the band,

- Out-of-band FS options – consideration of other bands that are allocated and licensed for fixed point-to-point service, which could provide a direct replacement for links in the 11 GHz range. In addition to available capacity, one key factor in this context is the link distance, since higher frequencies typically have a shorter range than lower frequencies. Ideally, 11 GHz links would be relocated into bands without impacting the location of transmission towers.

- Other microwave bands – although not necessarily allocated for point-to-point high capacity service, there are many other microwave bands that could be considered as alternatives, particularly for the cell site backhaul application, which is driving much of the recent demand for 11 GHz links.

In addition there are wireline alternatives and satellite services available. In many cases fiber-based alternatives could be considered rather than microwave links (although some microwave use may be to provide redundancy with fiber).

There are often also leased alternatives, i.e. fiber or other broadband capacity, available from local exchange carriers or other providers. In fact, the CRTC has forborne from regulation on 2,900 inter-city routes in Canada[10], meaning that alternative providers offer service on those routes. Thus in many parts of the country, leased point-to-point capacity should be available for licensees as an alternative to use of 11 GHz links.

The following sections discuss each of the microwave options for licensees in the XKu portion of the 11 GHz band.

[10] To the end of 2007, per Communications Monitoring Report, CRTC, 2008, Section 2.4

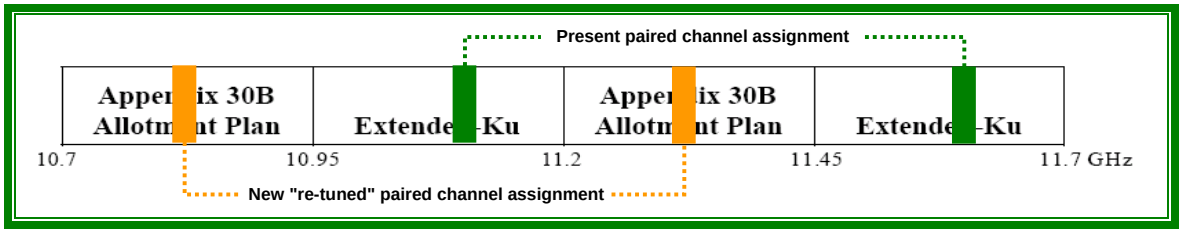
3.1 In-band options – limiting FS to the lower part of the 11 GHz band

Rather than continuing to make use of the entire 11 GHz range, FS applications could be limited to a portion of the band, 500 MHz, leaving the remaining 500 MHz open for DTH. As shown in Figure 1, above, this would imply that FS applications would only make use of the lower portion of the band.

Existing licensees in the upper portion of the band could be "moved" to the lower portion, assuming there are adequate channels available.

There are a number of technical options for moving licensees within the band, from the upper to the lower portion. The simplest way of doing this is to re-assign frequency channels from the upper to the lower portion of the band.[11] In this way the existing equipment can use the same channel size and spacing, but simply have the transmit frequencies "re-tuned" at each end of the link.

Figure 3 – Re-tuning paired channel assignments



Re-tuning of the paired channel assignments means that the transmitters would have to be changed out and a new set installed. This could be done without affecting other licensees assuming there are unused channels available in the lower portion.

Moving all of the paired channel assignments from the upper portion to the lower portion of the band would liberate up to 500 MHz of spectrum – i.e. 250 MHz in the lower portion and 250 MHz in the upper portion.

3.2 Out-of-band FS options

Subject to technical considerations and coordination with other licensees, the in-band option of retuning licensees within the 11 GHz range is likely the simplest solution to freeing up the XKu portion of the band. In most geographic areas, retuning or re-banding alternatives should be readily available. However, in some congested urban areas the lower portion of the 11 GHz band may already be fully occupied and therefore other fixed service ("FS") band options could be considered. There is a broad range of options open to FS applications to relocate to alternate frequency bands.

The out-of-band options that are of the most immediate relevancy would be those where the same application can be supported as used in the 11 GHz band – i.e. low, medium or high capacity, fixed point-to-point links.

Any recommendation to move 11 GHz licensees to other bands of course means that engineering studies would be needed and coordination activities would have to take place with licensees in those other bands.

Two policy considerations should also be kept in mind.[12] First, in general, higher frequencies are used for shorter hops (link lengths) and lower frequencies for longer hops. Put another way, in considering a candidate band for relocation of an 11 GHz link,

[11] Changing channel assignments also means that links would have to be re-coordinated with other licensees to ensure non-interference.
[12] See SP 1-20 "Revisions to Microwave Spectrum Utilization Policies in the Range of 1-20 GHz", January 1995, Part A, Section 2.1

the highest frequency band that can support the deployed link length should be considered first.

The distribution of the average and maximum distances deployed is summarized below.[13]

Table 2 – FS service link lengths – 11 GHz compared to other bands

	Deployed link distance (km)	
	Average	Maximum
6 GHz	36.1	69.2
11 GHz - lower band	12.8	38.4
11 GHz - upper band	14.5	36.4
12.7 GHz	25.3	42.7
15 GHz	10.7	29.5
18 GHz	8.0	41.5
23 GHz	3.4	15.9

Canadian averages based on TAFL information

While the average of the 11 GHz upper band portion is 14.5 km, this varies by area across Canada and there are links that are considerably shorter. For example, shorter-than-average 11 GHz links may "fit" into higher frequency bands such as 18 GHz.

Secondly, recommendations for moving to other bands should also take account of the policy that the 4 GHz and 6 GHz bands should be primarily used for high capacity long haul systems. Most of the licenses available in these bands are for high capacity links. Use of 4 GHz or 6 GHz bands as a replacement for 11 GHz would thus imply a change to the Industry Canada policy for these bands.

[13] Per Industry Canada TAFL data.

3.2.1 Fixed service bands below 11 GHz

There are a number of bands below 11 GHz that are used for fixed service point-to-point microwave radio applications. These are in various bands from 3700 MHz up to 10 GHz.[14]

Below 3700 MHz, there were many bands that accommodated fixed point-to-point links, however these have been overtaken either by mobile applications (e.g. 1710-1755 MHz paired with 2110-2155 MHz AWS service) or by point-to-multipoint access service applications (e.g. 3450-3650 MHz range). There are also bands for more specialized applications, such as is designated for low-capacity and very low-capacity links in the 1700-1710, 1780-1850 and 1800-1830 MHz ranges.[15] These 1.8 GHz range links are used for example for smart grid applications in the electrical utility industry.

Above 3700 MHz, there are a number of bands that could be considered as alternatives to 11 GHz, but many would require considerable change to the Industry Canada policies associated with their use – i.e. they are designated for fixed service, but they either share the band with other applications and/or are used for different applications from those in 11 GHz.[16] Longer term, any or all of these bands could likely be considered as potential

[14] There are other bands in the same range that provide for point-to-multipoint services, e.g. 10.5-10.68 MHz.

[15] See "Decision on Consultation SMSE-008-08 – Proposed revisions to the technical requirements for fixed services in the Bands 1700-1710 and 1780-1850 MHz", Industry Canada, December 12, 2008

[16] The 4540-4900 MHz range was for FS but is now used by Government services – see Industry Canada SRSP-304.5, in which a moratorium was put in place in 2004 for licensing of non-government systems. The 5850-5925 MHz range allows for FS service, but priority is given to dedicated short range communications applications (DSRC) for public safety and vehicle-related communications – see Industry Canada SP3-30 GHz. The 6590-6770 MHz and 6930-7125 MHz ranges are designated for one-way service for auxiliary television transmission – TV-studio links, relaying from off-air pick-up sites to cable head-ends, etc. – see Industry Canada SRSP-306.5. The 8275-8500 MHz range is for video channels – see Industry Canada SRSP-308.2. The 10.55-10.68 GHz range shares multipoint and point-to-point services, where the dedicated portion for point-to-point applications is for maximum 5 MHz channels and only 20 MHz capacity in total; an additional 25 MHz is shared with multipoint – see Industry Canada SRSP-310.5.

candidates for displaced 11 GHz links, hence in theory there is considerable capacity available.

On the other hand, for a near-term solution, frequency bands that already have similar channelization (i.e. channels of 5, 10, 20, 30 MHz) and similar frequency separation to the 11 GHz band are the most appropriate candidates. These are notably portions of the 4, 6, 7 and 8 GHz ranges. These are the ranges that bear closest similarity to 11 GHz in terms of applications and are the 3700-4200 MHz (4 GHz), 5925-6425 MHz ("lower" 6 GHz), 6425-6930 MHz ("upper" 6 GHz), 7125-7725 MHz (7 GHz)[17], and 7725-8275 MHz (8 GHz) bands.

These bands have similar capacity per band to the XKu portion of the 11 GHz range – i.e. 500 MHz or more, can accommodate medium and high capacity systems, and are licensed on the same basis (site by site).[18] In total the 4 GHz, 6 GHz, 7 GHz and 8 GHz ranges have about five times the capacity of the XKu portion of the 11 GHz range.

To assess possible use of these bands, to compare usage across Canada via the case studies discussed in the next section the upper 6 GHz band was considered as a possible candidate for licensees currently using the 11 GHz range, although the others are potentially available as well.[19] Equipment costs and deployment characteristics would be similar in any of them and in all cases the available link lengths would be expected to be typically longer than those used in 11 GHz (due to the lower frequency).

Use of the upper 6 GHz band for many of the applications currently seen in 11 GHz – i.e. short distance access links of medium or high capacity – would imply a change to the

[17] A portion of the 7125-7725 MHz range is reserved for use by power utilities – see Industry Canada Notice no. DGTP-001-97/SMSE-001-97, January 18, 1997

[18] For example, for the Upper 6 GHz band, see "Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 6425-6930 MHz", Industry Canada, SRSP-306.4, Issue 6 December 2006

[19] The 7 GHz and 8 GHz bands could also be considered, however there are overlapping government-use allocations whose usage cannot be assessed.

Industry Canada policy reserving the 6 GHz range for long haul systems.[20] One difference is that the maximum channel size is 30 MHz whereas in the 11 GHz range 40 MHz channels are available. In the XKu portion of the 11 GHz range, 58 transmitters out of 425, or 14%, use bandwidths of more than 30 MHz.

3.2.2 12.7 GHz range

The 12.7 GHz range refers to the 550 MHz band of spectrum from 12.7 to 13.25 GHz. There are two terrestrial applications covered by the Industry Canada policies for this band: Very High Capacity Microwave (VHCM) in 12.7 to 13.2 MHz, and TV "pick ups" in 13.15 to 13.25 GHz.[21]

The 12.7 GHz band is used by cable television companies, with the VHCM portion employed to transmit multiple cable television channels to cable distribution systems (i.e. one-way broadcast links, often repeating the same frequency to bring distant signals to cable head-ends).

The TV pick-up portion is for temporary links to connect remote television cameras to a studio location. TV pick ups are authorized on a case by case basis provided they do not interfere with the VHCM systems in the same area.

Confining the range to the VHCM portion, the 12.7 GHz band thus has 500 MHz of bandwidth, similar in total to the XKu portion of the 11 GHz band. However, the 11 GHz band is structured as two blocks of 250 MHz with 490 MHz separation between the two.

[20] This consideration would also apply to the 4 GHz and the lower 6 GHz bands. The upper 6 GHz channel plan does not currently permit use of protection channels, which are in place in some 11 GHz deployments. See Industry Canada SRSP-306.4, *op. cit.*, Section 4.8.1.

[21] Technical Requirements for Radio Systems Operating in the Fixed Service in the Band 12.7-13.25 GHz, Industry Canada, SRSP-312.7, Issue 1, August 30, 1986. TV Pick ups in the 13.15-13.2 portion that overlaps with VHCM are only authorized on a case-by-case basis.

The same channel structure and pairing used in the 11 GHz band could not be accommodated in the 12.7 GHz range under the present approach to VHCM licensing.

Use of the 12.7 GHz range for the same applications as currently seen in the 11 GHz range would imply a change to the Industry Canada policies for the 12.7 GHz range and a restructuring of the channel plan to accommodate bi-directional systems with a minimum separation between transmit and receive. For example, the band could be structured to accommodate 8 channels of 30+30 MHz each – i.e. using 480 MHz of the 500 MHz in the range, assuming systems could operate with the lower frequency separation implied compared to the 11 GHz band. One possible channel plan is shown below.[22]

Table 3 – Possible new channel plan for 12.7 GHz range

Frequency (MHz)	Channel size (MHz)	Center Frequency	Channel
12,700	30	12,715	1
12,730	30	12,745	2
12,760	30	12,775	3
12,790	30	12,805	4
12,820	30	12,835	5
12,850	30	12,865	6
12,880	30	12,895	7
12,910	30	12,925	8
12,940	30	12,955	n/a
12,970	30	12,985	9
13,000	30	13,015	10
13,030	30	13,045	11
13,060	30	13,075	12
13,090	30	13,105	13
13,120	30	13,135	14
13,150	30	13,165	15
13,180	30	13,195	16

[22] Note: the channel plan is based solely on "stacking" 30 MHz channels within the frequency range and not based on any technical analysis. Note – under this channel plan, there would likely be somewhat less capacity available for TV Pick-up applications.

It should also be kept in mind that there are over 3,400 transmitters in service in the 12.7 GHz range across Canada using the VHCM application. The split of transmitters by licensee is summarized below.

Table 4 – Split of VHCM transmitters by licensee and geography

	No. transmitters *	% of total	Geographic distribution			
			Ontario	BC	Other	Note
Cogeco	1,684	49%	100%	0%	0%	n/a
Bragg	791	23%	96%	4%	0%	n/a
Shaw	647	19%	10%	87%	4%	Other = Alberta, Manitoba
Other	239	7%	1%	61%	38%	Other = Alberta, Nova Scotia
Rogers	82	2%	20%	0%	80%	Other = Newfoundland
Subtotal cable VHCM	3,443	100%	73%	21%	5%	

** per Industry Canada TAFL information, including repeaters*

A detailed study would be required to determine if 11 GHz users could be accommodated in the range and/or if incumbents in 12.7 GHz would be able to either retire their systems or accommodate their needs in a different fashion. The majority of the VHCM links in service are in Ontario and BC.

Also, close to 80% of the licenses in the 12.7 GHz range have an authorization date pre-2001, some dating back to the mid 1970s. The original application for VHCM – transporting analog TV channels over long distances – is likely becoming out dated in any case. Television is becoming fully digitized and there is now extensive availability of fiber links and digital satellite services to support the transport of digital video feeds to head-ends.

VHCM in 12.7 GHz as an application is no doubt diminishing in importance and in many cases fiber or satellite could surely provide a reasonable alternative and likely will in the near future.

3.2.3 15 GHz range

The 15 GHz range covers the spectrum from 14.5 to 15.35 GHz, representing 750 MHz in total FS capacity and 100 MHz for TV Pickup applications.[23] There are approximately 3,300 transmitters that have been deployed across Canada, about 1,500 by Rogers, 1,000 by Telus, 300 by Bell and 350 by other licensees.

The 15 GHz range supports various channel sizes – 5, 10, 20, 40 MHz – and link lengths can be 10 km or more, similar to a number of those deployed in 11 GHz. Systems can only be low or medium capacity, however, whereas 11 GHz range provides for low, medium or high capacity links.

From 2007, however, the Department of National Defense (DND) has identified that it intends to use part of the 15 GHz range for intelligence, surveillance and reconnaissance (ISR) applications to improve national security – referred to as Tactical Common Data Link applications. This application is already deployed in the 15 GHz by a number of other NATO countries.[24]

Based on the DND request, Industry Canada recently issued a moratorium on authorization of fixed service systems in a portion of the band, 14.66-14.82 GHz and 15.135-15.295 GHz, representing 320 MHz or 38% of the band.[25]

According to Industry Canada the re-allocation would affect 810 of the 15 GHz links nationally – about 25% of the total, of which 600 are in the Windsor-Quebec City corridor.[26]

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[23] See "Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Band 14.5-15.35 GHz", Industry Canada SRSP-314.5, Provisional Issue 2, August 19, 1995.
[24] "Consultation Paper on Using a Portion of the Band 14.5-15.35 GHz for Tactical Common Data Link (TCDL) Systems", Industry Canada DGTP-004-08, January 10, 2009
[25] The moratorium is included in SAB-001-08, Industry Canada, December 2008

From a technical perspective, the 15 GHz presents an alternative to the 11 GHz band. With the likelihood of the DND requirement taking a portion of the band, moving new users into it would make it more crowded, given the present level of deployment as well as the potential for the 810 affected links to be moved which may have to be relocated within the band as well. That said the moratorium and potential re-allocation, still leaves 62% of the band available for FS and TV Pickup applications.

This remaining capacity can presumably continue to be used. Since the existing level of deployment varies market by market, the 15 GHz band may represent a viable alternative for 11 GHz licensees in some cases, particularly outside of the Windsor-Quebec City corridor. An in-depth study would be required to understand the utilization levels of the band across the country.

3.2.4 18 GHz range

The 18 GHz range covers the spectrum from 17.8 to 18.3 GHz and 19.3 to 19.7 GHz.[27] There are some 3,000 transmitters that have been deployed across Canada, about 1,000 by Rogers, 760 by Telus, 300 by Bell and the remainder by other licensees.

The 18 GHz range comes with various channel sizes – from 2.5 MHz to 50 MHz – although link lengths are often less than 10 km, somewhat shorter than is typical of the 11 GHz range. Much of the 18 GHz deployment is in fact for even shorter links – in Montreal and Toronto in the range of 5 km, and in Vancouver 7 km.[28]

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[26] "Consultation Paper on Using a Portion of the Band 14.5-15.35 GHz for Tactical Common Data Link (TCDL) Systems", *op cit*, Section 5

[27] See "Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Bands 17.8-18.3 GHz and 19.3-19.7 GHz", Industry Canada, SRSP-317-8, Issue 2, December 2006

[28] Based on link distances estimated from Industry Canada TAFL information.

The 18 GHz range is also somewhat more susceptible to rain fading than lower bands, and thus the distance of links will vary depending on the region of the country being considered. Systems can be low, medium or high capacity as in the 11 GHz range. The 18 GHz range has both paired and unpaired channels.

3.2.5 23 GHz range

The 23 GHz range covers the spectrum from 21.8 to 22.4 GHz and 23.0 to 23.6 GHz.[29] There are about 2,600 transmitters that have been deployed across Canada, about 2,000 by Rogers, 135 by Bell and the remainder by other licensees.

The 23 GHz range comes with various channel sizes – from 2.5 MHz to 50 MHz – although link lengths are often in the range of 3 km, considerably shorter than is typical of the 11 GHz range.[30] It would thus be expected that very few of the 11 GHz links could be redeployed in the 23 GHz range without incurring the expense of relocating and/or adding transmission towers.

The 23 GHz range is even more susceptible to rain fading compared to 18 GHz, and thus the distance of links will vary depending on the region of the country being considered. Systems can be low, medium or high capacity as in the 11 GHz range. Channels are paired with 1.2 GHz separation.

3.3 Other microwave licenses

For some applications used in the 11 GHz range, it is possible that frequency bands other than those that are specifically designated as fixed point-to-point could also be considered. In particular, the case of the mobile backhaul application – which is notably

[29] See "Technical Requirements for Fixed Line-of-Sight Radio Systems Operating in the Bands 21.8-22.4 GHz and 23.0-23.6 GHz", Industry Canada, SRSP-321.8, Provisional, Issue 1, July 19, 1997
[30] Based on link distances estimated from Industry Canada TAFL information.

driving the growth in the use of the 11 GHz band – uses links in a point-to-point fashion but is really more of a "hub and spoke" application.

In other words, multiple cell sites around a metropolitan area are connected back to a central point (switching center) for purpose of traffic routing, interconnection, billing, etc.

A long haul band such as 11 GHz is structured to provide for multiple channels connecting two points in a linear fashion. Multiple channels are often used between the same two points in a 1:N configuration – i.e. where "N" channels carry traffic and one is available on standby for protection purposes. This type of network structure is not required for more "meshed" local access backhaul in a cellular network.

Amongst licensed bands there is considerable capacity available for point-to-multipoint fixed service applications, generally referred to as fixed wireless access (FWA) which in principle is somewhat more akin to the hub and spoke cellular network.

The majority of licenses have already been issued in the FWA bands, notably in the 2.3 GHz, 2500-2690 MHz and 3.5 GHz ranges. The most important FWA licensees are Inukshuk Wireless (partnership of Rogers and Bell) and Telus, which are also the largest licensees in the 11 GHz range.[31] Thus for purpose of migrating off of the 11 GHz frequencies, these licensees in particular could consider using their own point-to-multipoint spectrum as an alternative for at least a portion of their needs.

Inukshuk Wireless in particular holds 96 MHz of MCS spectrum (2500-2596 MHz) in all parts of the country except Manitoba, Saskatchewan and the Territories. In addition,

[31] The 2500-2690 MHz range is under review in Industry Canada consultation DGRB-005-09.

resulting from Bell and Rogers pooling their other fixed spectrum resources Inukshuk Wireless actually has 200 MHz of capacity covering much of the country.[32]

Rogers and Bell do not disclose how many customers they have that make use of Inukshuk spectrum for their portable Internet services. The portable Internet service is provided via the MCS portion of Inukshuk's spectrum, thus even if it is highly utilized (which is unlikely), about half of Inukshuk's spectrum (i.e. in the 2.3 and 3.5 GHz ranges) likely has virtually no utilization at all.

Another opportunity for local access spectrum would be to consider higher frequency bands – notably in the 24 GHz, 28 GHz and 38 GHz ranges. Although link lengths are typically very short compared to those at 11 GHz, often less than 3 km, there is considerable capacity available.

Much of this spectrum was originally licensed for point-to-multipoint applications. In 1999, 400 MHz of capacity in the 24 GHz range was auctioned along 800 MHz of capacity in the 38 GHz range. There are also a number of 50 MHz frequency blocks available on a first-come-first-served basis remaining in the 38 GHz range.[33] The 28 GHz range has 1 GHz of capacity and was awarded in 1996, but the spectrum was returned to Industry Canada in 2002, so presumably it is potentially available for other applications.[34]

It should also be kept in mind that government itself occupies considerable spectrum resources for use by government agencies, military, public safety and other users. The

[32] Inukshuk's MCS spectrum was awarded based on Provincial license areas whereas other FWA licenses were awarded in auction market by market. Thus the amount of spectrum held by Inukshuk in total varies depending on which licenses were acquired by Rogers or Bell in specific markets across Canada.
[33] 38 GHz Licensing Process and Application Procedure, Industry Canada, CPC-2-1-17, Issue 3, February 1, 2001
[34] Letter to Ernst&Young regarding the revocation of the MaxLink LMCS licenses, Industry Canada, January 21, 2002

use of these spectrum assets is not part of the information available via the Industry Canada TAFL database. In addition to considering bands such as 6 GHz, 15 GHz and 18 GHz, as suggested in DGTP-003-08, Industry Canada could also investigate what options there could be to free up spectrum currently allocated to but underutilized by government agencies.

4. Case studies

To assess the availability of microwave alternatives for FS users of the 10.95 – 11.2 and 11.45 – 11.6 GHz portion of the XKu band, case studies were conducted by LYA. A summary of the methodology and conclusions of the case studies are provided in this section.

4.1 Methodology

XKu band FS transmitters are present across Canada. The top six market areas – Toronto, Montreal, Vancouver, Calgary, Edmonton and Ottawa – account for about one third of them.

Considering that the top six areas are the most congested in general for spectrum, the options for 11 GHz XKu retuning or displacement those six markets would be the most challenging.

So while the top markets do not represent the majority of the links in service, they do represent the areas where the various technical options would be more tested. For the two thirds of the transmitters that are scattered across the rest of Canada, the technical options would be expected to be the same as in the largest markets, but alternative microwave radio solutions such as retuning to the lower sub-band would be more readily available and easier to implement.

To assess the options for 11 GHz licensees, case studies were thus done looking at the largest markets by considering the deployment of 11 GHz links within the geographic area surrounding each.

To define each market, a 50km-60km radius around the core urban area was considered. On this basis, there are no XKu FS links present in Calgary and Edmonton, thus only four cases were considered – Toronto, Montreal, Vancouver, and Ottawa.

Within each geographic market, the approach was to first identify all of the transmitters within each of the upper and lower band portions of the 11 GHz band.

For the most important licensee in the upper band in each case – i.e. the one with the most transmitters in service – its deployment was compared to the total lower band deployment for the same area in order to assess whether the upper band links can be reasonably accommodated in the lower band portion.

Also, keeping in mind that 11 GHz links in these areas are typically in the 10-12 km range in terms of link length, the 50-60 km radius around each market was then further subdivided.

For example, a link that starts and finishes north of Whitby, Ontario can be treated relatively independently, subject to frequency coordination, of a link that starts and finishes in Burlington, Ontario even though both are located within a 60 km radius around Toronto.

Therefore the geography of each of the cases was subdivided into large enough pieces so the links can be treated independently in each area.[35]

While there are many options available for licensees, the simplest solution to free up the upper band portion is to maintain the same channel plan for the band, and "fit" the upper band channels into the lower band (i.e. with the same channel size and separation).

[35] This is the case for typical hop lengths, but any change to links would require engineering analysis and coordination with other licensees operating in the region.

In this way, systems can be retuned from the upper to the lower band with no impact on other licensees.

Of course moving the channels to the lower band reduces the total bandwidth available in the band. In some cases, this is relatively unimportant since the lower band is not overly utilized to begin with, but in other cases the lower band would become filled due to this retuning. In the latter case, either another option could be considered for the upper band licensee, or growth could simply be capped in the 11 GHz lower portion and future needs would have be accommodated in another way.

The cases first look at whether the upper band channels can simply be reassigned to available lower band channels (not considering the possibility of overlapping with existing channel usage in the lower band). If this is not possible then other options are considered for that area.

Other microwave options are considered primarily on the basis of whether the 11 GHz link length could be accommodated by the other bands. More detailed analysis would be required to assess the technical feasibility of any of the options identified herein.

4.2 Results

The case studies considered 85 transmitters located in the four markets, Toronto, Montreal, Vancouver, and Ottawa, representing two thirds of the upper band transmitters currently deployed in those areas.

At least 60% of the existing 11 GHz links in the upper band can be retuned to the lower band, subject to detailed engineering analysis and coordination with other licensees. Out of the 85 transmitters covered by the cases, 53 would appear to be eligible for retuning.

This assumes that the fill in the lower band post re-tuning is at less than 100% keeping room for some growth and also to be conservative, leaving open the possibility that on a practical basis some of the links might not be conducive to retuning due to equipment or other considerations.

Of the 32 transmitters that do not appear to be ready candidates for retuning in the case studies, there are alternative microwave bands that could be considered.

Based on the “fit” considering link distance only (and starting with the highest frequency band first), two thirds of the XKu transmitters needing an alternative band would be candidates for the 12.7 GHz band, assuming that the spectrum utilization policy for that band is changed as discussed above. Some 22% of the remaining transmitters could be accommodated in higher frequency bands assuming channels are available.

5. Conclusions

Based on the analyses presented in this Report there are viable alternatives available to existing FS licensees that currently use the upper portion of the 11 GHz band.

5.1 Microwave alternatives are available in all cases

In the cases studied, there is always at least one microwave alternative available. The alternative is not always the same – some markets are more congested than others. In one part of the country, licensees can be retuned to other channels within the 11 GHz range, whereas elsewhere they may have to look to other bands for capacity.[36]

The characteristics of the various microwave band options considered are summarized below.

Table 5 – Different band characteristics and options

	Total bandwidth (MHz)	Current usage (transmitters)	Channel Structure	Tower Spacing *	Note
11 GHz XKu portion	500	425	40 MHz max	up to 15 km	
In-band retuning	500	1,104	40 MHz max	up to 15 km	Insufficient capacity available in some urban areas
Alternative bands					
Upper 6 GHz **	500	2,600	30 MHz max	30+ km	Some 11 GHz channels (14%) are 40 MHz
12.7 GHz VHCM	500	3,400	One way	up to 25 km	Would requires new policy and channel plan
15 GHz ***	850	3,300	40 MHz max	10 km	Moratorium on new FS licensing in portion of the band
18 GHz	1,000	3,000		8 km	Relatively short hop distance compared to 11 GHz
23 GHz	1,200	2,600		3-4 km	Relatively short hop distance compared to 11 GHz

** Spacing based on average deployment per TAFL information*

*** Other bands below 11 GHz would be similar*

**** Total bandwidth before considering TCDL use*

[36] All alternatives would have to be subject to detailed engineering design and coordination activities with other licensees.

While the cases discussed in this report focus on congested urban areas, the alternatives cited above would likely be readily available in non-urban areas.

Lower frequency bands, such as the upper 6 GHz range, would enable link lengths that are typically longer than those deployed in 11 GHz. Thus 11 GHz links could be redeployed in lower bands without changing tower spacing, assuming channels are available. This would also apply to channels in other portions of the 6 GHz range as well as the 4 GHz, 7 GHz and 8 GHz bands.

In higher frequency bands, the link lengths are typically shorter than those of 11 GHz. However, in some cases, the deployed link length of the 11 GHz licensee could be accommodated by a 15 GHz, 18 GHz or possibly even a 23 GHz radio system. These require assessment case by case.

As one alternative, Industry Canada could change its policies for the 12.7 GHz range to enable the same applications as currently deployed in 11 GHz.

The 12.7 GHz range has similar deployment characteristics to 11 GHz, has sufficient capacity to replace the upper portion of the 11 GHz band, and is lightly used in most parts of the country.

The present use of 12.7 GHz is long haul one-way transport of analog television channels, with some licenses for systems dating back to the 1970's. This application is likely to be supplanted by the need to transport digital signals – already available nationwide via satellite and inter-city backbone fiber facilities.

The channel plan for the 12.7 GHz range would have to be redone in order to accommodate the applications used in 11 GHz. Notably, this would mean providing for

two-way links via paired channels, and making available channel capacities to accommodate different needs (i.e. range of 10 to 40 MHz capacities).

5.2 Wireline options for lower capacity links

While some of the 11 GHz deployment supports up to 200 Mbps on one link[37], a fiber system can support many multiples of bandwidth greater than that. For example, an OC-48 fiber system, commonly deployed for long haul applications replacing microwave, transmits 2.5 Gbps, and higher rate systems carry up to 40 Gbps.

For lower speeds such would be addressed by medium capacity microwave, DS3 (45 Mbps) access circuits can be leased in many areas from the local exchange carrier – Telus, Bell Canada and the other phone companies.[38]

These circuits come with a monthly tariff rate, regulated by the CRTC, and are widely available. For carriers using broadband access circuits leased from other carriers (e.g. Rogers leasing a circuit from Bell), the service is known as "CDN", or Competitor Digital Network, service.

Rates are available for T1 (1.544 Mbps) or T3 (45 Mbps) speeds, and in fact these have declined very significantly. For example, a 45 Mbps access circuit from Bell Canada's retail tariff in 2001 cost $1,300 per month. With the revised rates for CDN service, available to other carriers on a wholesale basis, this same circuit is now available for some 60% less at below $500 per month.[39]

[37] Ceragon, for example, provides systems that transport 200 Mbps on 40 MHz channels available in the 11 GHz range.
[38] Industry Canada considers low capacity radio systems to be those with 1.544 Mbps or less of capacity, medium capacity to be 18.936 Mbps or more and high/very high capacity to be greater than 89.472 Mbps.
[39] Bell Digital Network Access (DNA) tariff, 2001 and Telecom Decision CRTC 2005-6, rates including access and link charges.

5.3 Mobile backhaul applications address a different need

Mobile backhaul is a growth segment of the industry and accounts for the bulk of recent additions to 11 GHz links. Most of mobile carriers' need for capacity focuses on core urban areas. In these areas, the application is for relatively short, high capacity links. This is a characteristic of other frequency bands such as 18 GHz or 23 GHz, which ideally should be used instead of long haul bands such as 11 GHz. Mobile backhaul is typically "short haul" not long haul.

In addition, mobile backhaul is hub and spoke in nature. Hence, using 11 GHz links for this application is misusing it – the 11 GHz range is not meant for "hub and spoke" access applications but for applications where nailed-up capacity between two points is needed. Hub and spoke applications can be addressed via multiple short haul access links in 18 GHz or 23 GHz, or even possibly using point-to-multipoint bands… most notably in the 2500 MHz range as well as 2.3 GHz and 3.5 GHz. Mobile carriers – particularly Rogers and Bell via their Inukshuk partnership – are themselves the largest licensees of point-to-multipoint spectrum.

In any case use of conventional point-to-point microwave links for cell site backhaul is likely a transitional network strategy to provide quick overlay capacity.

The mobile carriers may have deployed new 11 GHz links (and links using other frequencies) in recent years in a rush to respond to sudden new traffic demand associated with the increased take up of data services and the introduction of 3G mobile services and handsets. Microwave has the advantage of supporting quick deployment in areas where fiber facilities may not be immediately available, and this may account for the apparent growth in microwave licensing.

And even in areas where fiber is generally available, there may not be a fiber "spur" into the specific buildings or to sites where antennae are being deployed. In these cases a microwave backhaul link is only effectively addressing the last 100 m of the network. In other words, a transmitter used for a microwave link of many km in length may in fact only be 100 m from a fiber backbone facility.

The mobile carriers are expected to migrate to an all-IP "long term evolution" (LTE) infrastructure.

LTE implies integration of voice and data from the subscriber handset through the backhaul and into the network. To implement this, other types of backhaul equipment are likely required. For example, in the case of Harris, the next generation backhaul product is Eclipse, which is a product that allows for full management of voice and data over the same backhaul pipes.[40]

5.4 Fiber facilities as an alternative to microwave

An alternative to using microwave facilities for point-to-point and backhaul applications is fiber optic access. For many locations served by microwave, fiber optic facilities should also be available.

However, information on the location of fiber, particularly from the incumbent telecom carriers, is not readily available. And while there has been some competitive deployment of fiber facilities in markets across Canada, "the fact remains that a significant portion of business locations is still only accessible via the fiber optic facilities of incumbent carriers."[41]

[40] The FibeAir product from Ceragon is similar to this in that it provides a microwave version of a MetroEthernet network, as deployed by Terago.

[41] Next Generation Network Access: A Canadian and international perspective on why wholesale services should be regulated as essential facilities, Lemay-Yates Associates Inc., March 11, 2009, page 3. Report

The top three 11 GHz licensees are Rogers, Telus and Bell Canada, all three of which are incumbents with significant fiber assets.

Rogers also has extensive fiber assets. In addition to that used by Rogers Wireless to interconnect its wireless network across Canada, Rogers Cable has a "continental" fiber backbone of 21,000 route-km extending from Vancouver to St. John's.[42] Rogers Cable has deployed fiber facilities throughout its cable service areas, in a fiber-to-the-feeder architecture serving groupings of 350 homes.[43]

Bell Canada has a similar strategy, deploying "fiber-to-the-node" and in some cases directly to customer premises. Bell Canada also has extensive national backbone fiber facilities, including coverage of Western Canada.[44]

In its core operating areas, Bell has been heavily "fibered" for many years. For example, in the largest urban area in the country – the Greater Toronto Area (GTA) – Bell's extensive fiber deployment is used to promote the competitiveness of locating businesses in the Toronto area, since: "All Bell Canada switching centers use fiber to communicate with each other. Bell has installed fiber under most major Metro Toronto roads and installs fiber entrance cables in new buildings requiring 300 or more phone lines."[45]

Similarly Telus has a national fiber backbone as well as presence in major cities including those in Eastern Canada.[46]

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filed by MTS Allstream as Appendix 4 to Petition to the Governor in Council in the Matter of Telecom Decision CRTC 2008-118 and Telecom Decision CRTC 2008-17.

[42] Rogers Annual Report 2008, page 39

[43] Ibid, page 36

[44] See for example, "Bell Canada buys Canadian assets of 360networks", BCE press release, May 26, 2004

[45] Web site of the Greater Toronto Marketing Alliance, www.greatertoronto.org

[46] See for example, "Telus announces construction of Canada's largest metropolitan fibre network", Telus press release, October 11, 2000

While only Rogers, Telus and Bell Canada would know exactly where their own fiber passes relative to the 11 GHz links that they have deployed, it is clear that they are in a good position to consider self-supply via fiber rather than using microwave links for their backhaul needs.

5.5 Summary

- Overall, in the cases studied, one can conclude that at least 60% of the existing 11 GHz links in the upper band can be retuned to the lower band, subject to detailed engineering analysis and coordination with other licensees. Out of the 85 transmitters covered by the cases, 53 would appear to be eligible for retuning. The case studies considered 85 transmitters located in the four most congested markets, Toronto, Montreal, Vancouver, and Ottawa, representing two thirds of the upper band transmitters currently deployed in those areas.

- The remainder can be redeployed in other bands, where the channel capacity and link length fits with the present deployment in 11 GHz. One notable opportunity would appear to be the 12.7 GHz range, which has similar propagation characteristics and total capacity. There would have to be a change to the Industry Canada policy and band plan for the 12.7 GHz range to facilitate this, notably to re-channelize it to provide for similar channel size and frequency spacing to the 11 GHz range.

- Since the conclusions on retuning and alternative bands are based only on the four largest and most congested markets, it is very conservative. Retuning systems or identifying other banding options in the rest of Canada would be relatively straight forward. In fact, in two major markets – Calgary and Edmonton – there are no links deployed in the upper band portion of the 11 GHz range at all.

- Fiber alternatives should also be available, largely via self-supply. The incumbent mobile carriers – Rogers, Telus and Bell Canada – are the largest licensees of 11 GHz transmitters, and also the largest owners of fiber cable facilities both in access as well as backbone networks across the country.

- As the mobile carriers evolve to LTE, this implies that they will be changing their backhaul networks to provide integrated IP systems based on microwave or fiber. Telus anticipates operating based on LTE in the 2011-2012 timeframe[47]. This timing is assumed to be the same for Bell given their joint network deployment plans with Telus. Rogers has not announced a specific date for its transition to LTE, although it intends to "be in the lead position in terms of determining the timing on LTE".[48] Thus Rogers' LTE deployment can be expected in the same or earlier timeframe as that of Telus and Bell. Since migrating to LTE implies an equipment change for the backhaul facilities, this event could provide a natural "trigger" for incumbents to release the 11 GHz upper band links they have in service.

- Telesat has proposed a three-year transitional period for FS users to migrate to facilities other than the upper portion of the 11 GHz band. This is coincidentally consistent with the timetable for mobile carriers' migration to LTE. Any inconvenience associated with releasing 11 GHz spectrum would thus be mitigated by the fact that a change to mobile backhaul facilities would likely be required at that time anyway.

- To broaden the set of options available to mobile carriers – considering incumbents as well as new entrants in the mobile market – Industry Canada could initiate a follow-on consultation to focus on key areas including government use

[47] Telus Investor Conference Call, October 10, 2008, page 4
[48] Rogers Communications Inc. Q4 2008 Earnings Conference Call – transcript page 8

of microwave bands such as 7 GHz and 8 GHz that could be freed up for commercial use, availability of point-to-multipoint spectrum, use of smaller antennas in the remaining portion of the 11 GHz band, etc. The growth in demand for backhaul facilities in particular for mobile carriers will no doubt be increasing – possibly for a transitional period as discussed above – as use of mobile data increases and as new licensees begin deploying their networks.[49]

[49] In 2008, the Industry Canada auction of licenses for "advanced wireless services" (AWS) resulted in 15 winning bidders, 10 of which are potential new entrants in the Canadian mobile market.