Government of Canada
Department of Communications

Gouvernement du Canada
Ministère des Communications

(1)

Proposed Utilization of the Radio Spectrum in the Range 10.68 - 31 GHz by the Fixed and Fixed-Satellite Services.

Canada

March 1984

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1. INTENT

The intent of this policy review is to develop a spectrum utilization policy for the fixed and fixed satellite services from 10.68 to 31 GHz. Two stages are envisaged in this review. Stage 1, this paper, contains a mixture of policy proposals and policy alternatives for public comment. After the evaluation of public comment on this paper and the formulation of a final position, stage 2 will consist of the publication of final policy. It should be noted that this spectrum utilization policy review does not affect or alter in any way the Canadian table of frequency allocations; changes to that document, resulting from international conferences or domestic need, will be dealt with as necessary in future and separate proceedings.

2. INTRODUCTION

This proceeding is a continuation of the policy review of the utilization of the radio spectrum by the fixed service above approximately 1 GHz begun in 1979. The first phase of this review resulted in the Policy for the Utilization of the Radio Spectrum in the Range 0.890-10.68 GHz by the Fixed Service, published in December 1982. The policy, known herein after as the 1-10 GHz policy, did not include the fixed satellite service in detail as those matters had already been concluded in policy and practice. The national interest above 10 GHz for fixed satellite, in terms of spectrum utilization policy has yet to be fully determined. Another factor bearing on the scope of this current policy development phase is that the existing and potential uses of the spectrum by the fixed and fixed-satellite services is relatively well known below 15 GHz, while above that limit, the uses and technology are just emerging.

3. SPECTRUM UTILIZATION CONCEPTS ABOVE 1 GHz

During the 1-10 GHz policy development, a number of conclusions were drawn regarding the concepts of spectrum utilization above 1 GHz. Some of these are:

1. existing and new demands will be accommodated to the extent possible

2. increased spectrum efficiency is to be achieved without constraining designers to the use of specific methods or techniques

3. increased sharing of bands by services and system capacities is required

4. non-radio alternatives are encouraged

5. blanket exceptions to system standards are impractical in remote areas

6. the high level of spectrum utilization at about 1 GHz made the practice of frequency diversity no longer acceptable (see Appendix 1)

7. specific identification of protection periods is made for non-standard systems (see Appendix 1)

8. the designation of specific overflow bands to solve coordination problems at crossovers or spurs is not desirable.

9. frequencies assigned to the main route should be re-used on branching or spur routes

10. two frequency plans are standard above approximately 4 GHz.

These concepts will be followed in this current proceeding except where it can be clearly shown that a particular difference is more conducive to the effective and efficient use of the spectrum above 10 GHz. Items 6-10 are applicable to all the bands covered in this review.

4. WORLD ADMINISTRATIVE RADIO CONFERENCES - 1985 AND 1988

WARC-ORB '85, the World Administrative Radio Conference on the Planning of the Geostationary Orbit, to be held in Geneva in 1985 and the second session WARC-ORB '88 in 1988, may have a major impact on future domestic usage. Canadian proposals to the WARC-ORB '85 will be formulated within the same time frame as this policy proceeding. Canada must ensure its domestic policy for terrestrial systems does not prohibit any essential flexibility at the future space conference, and conversely Canada must determine the broad objectives of its domestic policy for terrestrial and satellite systems to the extent possible, as a basis for the formulation of the conference proposals. At this time, the Department does not believe it would be beneficial to delay the review of the 10-30 GHz frequency range, pending either the finalization of Canadian proposals to, or the completion of the two significant WARC's-ORB in 1985 and 1988. Within the first phase of this review, emphasis should be placed on the optimization of domestic needs in the fixed service. The needs of Canada for WARC-ORB'85 will be at least partially determined in another forum prior to the proposed finalization of this policy review. Should significant factors arise during that process, they will be duly taken into account.

5. PUBLIC RESPONSE

Over a period of time, the Department has received correspondence on the use of the various bands above 10 GHz. These comments and proposals are re-stated in this paper with the intent that interested parties confirm or otherwise state their current need.

In order to evaluate various proposals which make up the substance of this review, the factors mentioned in Section 3, Spectrum Utilization Concepts, will be used to assess the various alternatives. In addition to these, the following factors should be preferably used by respondents to support their submissions, as applicable.

- the current usage, including the degree of use and scale of investment in each band;
- clarification of the need for the various types of usage;
- alternative frequency bands where a given service could be accommodated;
- assessment of the adequacy of the band under consideration to satisfy the demand, technical and policy issues;
- growth projections and future technical and operational factors;
- system capacities and related matters such as RF channel bandwidth, information throughput/Hz, spectral efficiency, cross-polarization, etc;
- alternative delivery methods for providing a given service;

- network issues and policies pertinent to this proceeding;

- sharing constraints on various combinations of services;

- Canadian proposals for future Administrative Radio Conferences and the decisions taken by such Conferences which would affect Canadian usage.

In the pages that follow, each band of interest is reviewed under the headings of:

Current Status and Usage
Potential Demand
Policy Options
Discussion
Spectrum Utilization Proposal

As it implies, Current Status and Usage outlines the existing Canadian and ITU Region 2 allocations; any utilization policy, technical standard or present usage. Potential Demand presents a summary of various possibilities for the use of the bands which have been expressed by interested parties over the years. In that many of these possibilities are competitive in terms of spectrum space, a series of policy options have been prepared in order to provide a framework for the analytical discussion which follows. One purpose of Policy Options is to gather in point form, the common factors of the various alternative uses together, so that these common factors can be dealt with one at a time. A further purpose is to describe the range of possible action available to the Department in dealing with the factors, and finally, there is an intention to involve the reader as completely as possible in the thought process of the 10-30 GHz policy review. The Discussion briefly reviews the substance of the issues

identified in Policy Options, and states or implies conclusions. The conclusion most favoured by the Department at this time is contained in the part entitled "Spectrum Utilization Proposal". The final issue of the 10-30 GHz policy will likely be in the format of these Proposal pages and will be of the substance shown, unless the public response to this paper strongly indicates that other alternatives are clearly preferable. Respondents should therefore carefully consider the Proposal portions of this document.

The Proposals contained in this document embody the Department's proposed spectrum utilization policy for the bands under review for the forseeable future, based and predicated to a large degree on known user needs, sharing criteria and technological development. Accordingly, as specified in the associated Gazette Notice, a copy of which is contained in Appendix 3, comment is invited from all interested parties concerning the particulars contained in this document. Copies of these submissions will be made available for public inspection at the Department of Communications' Library, Room 1420, 300 Slater Street, Ottawa and at all of the Department's Regional Offices as given in the Gazette Notice.

6. BAND BY BAND ANALYSIS

6.1 10.7-11.7 GHz

CURRENT STATUS AND USAGE

1. Allocation (see Appendix 2)

2. Current Utilization Policy

There is no formal utilization policy for this band in Canada, but there was mention of the band in a now superceded 1976 public document which briefly discussed the use of this and the 12.7-12.95 GHz band for transcontinental digital systems. To date, the Department has not encouraged use of this band in order to retain spectrum, to the extent possible, for the eventual development of a high capacity digital systems.

3. Technical Standards

A guideline was issued by the Department on June 1, 1968 for single or multi-hop, two-way or one-way Medium or High Capacity analogue or television systems using four-frequency plans, single-polarized antennas and 40 MHz wide channels. Although a growth pattern is shown, no minimum growth requirement is stated.

CCIR Recommendation 387-3 contains a 40 MHz analogue channelling plan; CCIR Report 728 considers hybrid analogue/digital planning with bit rates of 140 Mbits/s (HC digital).

4. Current Canadian Usage

The greatest concentration of fixed systems is in British Columbia with 15 systems with a total number of 24 hops in operation. Link distances are mostly below 13 km, but vary from 0.3 to 22 km. In all of Alberta, Saskatchewan, Manitoba and Ontario only 3 systems are in use. There are 8 systems in Quebec and two in the Atlantic provinces. Outside of B.C., the average hop lengths are greater, varying from 10 to 47 km.

Teleglobe Canada operates earth stations using 10.95-11.2 and 11.45-11.7 GHz at three locations in Canada.

5. Bilateral Protection

Appropriate action is taken to ensure Canadian stations do not receive harmful interference from nor cause harmful interference to U.S. microwave or space system stations.

POTENTIAL DEMAND

1. An 18 km wide corridor for a digital system across Canada, except possibly in the prairies where fibre optics might be used. In general, the system would not enter metropolitan areas.

2. Digital systems with capacities ranging from LC to VHC, without distance restriction.

3. Microwave systems to link CATV systems.

4. Future expansion of Canadian domestic satellite services including feeder links to MSAT in 11.65-11.7 (paired with 13.2-13.25 GHz).

5. Future expansion of international satellite systems including direct metropolitan access for international "business" services.

POLICY OPTIONS

1. Future Use

A. Reserve the band for the eventual development of inter-regional systems with a large number of RF channels to satisfy predicted post-1990 network growth and thus limit new system etnry.

B. Manage the band on a first-come first-served basis to satisfy immediate demands and conduct a further policy review of this band at a time when the forecast need becomes fully defined

2. Transmission capacities

A. Permit a wide range of capacities for analogue and/or digital systems.

B. Orient the band for higher capacity systems or conversely, lower capacity systems.

3. Type of Use

A. Establish minimum RF channel growth requirements.

B. Require relatively balanced go and return traffic levels.

C. Allow one-way only systems in band.

D. Establish system minimum and/or maximum length restrictions to encourage the use of this or other bands as the case may be.

4. Fixed-Satellite

A. Give priority to international space systems or to domestic space systems or to fixed systems.

B. Require sharing on a first-come, first-served basis.

DISCUSSION

In 1976, the 10.7-11.7 GHz band was paired with the 12 GHz band. Subsequently, in 1977, the Department issued a spectrum utilization policy for fixed systems in the band 12.7-12.95 GHz[1]. The objective of the policy was to ensure spectrum availability to meet the needs of common carriers for transcontinental high capacity digital systems which could be best and most economically fulfilled in the bands 10.7-11.7 and 12.2-13.25 GHz. Since that time WARC 1979 has reallocated the band 12.1-12.7 GHz to include the broadcasting-satellite service (the decisions of RARC 1983 have effectively made the fixed service secondary in the band 12.2-12.7 GHz) producing a situation where the fixed service is unable to use all of the original frequencies.

The need to supplement the existing high capacity analogue and digital transcontinental systems will result in the construction of additional capacity in the late 1980's. At one time it had been considered that a 18 km wide 11 and 12 GHz "corridor" across Canada would fulfill this demand. It is now planned to handle near term growth by over-building the existing 4 GHz route by use of the 4400-5000 MHz band (upper 4 GHz), which will avoid the additional sites required at 11 GHz. Should it be decided to follow this course of action, the bands above 10 GHz would not likely be needed for this purpose until post-1995.

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1. For a more complete discussion of the policy, see page 20.

An early decision to reserve the band for inter-regional wide cross-section systems would presuppose that non-spectrum or other spectrum solutions will not occur for those long term demands and that growth does proceed as foreseen. It would also force near term systems into other bands, which could generally increase frequency congestion in the remaining bands and might increase system costs which would eventually be passed to the public.

At this frequency range and above, it appears technically practical to permit the development of limited distance (one or few hop) systems in the near term and to require geographical adjustments, if necessary, for later entry of inter-regional systems. This should result in only minor geographical displacement of some sites for new systems.

Generally, it is difficult to devise standards which are spectrum efficient over a wide range of systems capacities. This is a result of the need to provide more guardband spectrum for narrow (lower capacity) channels and the problem of a lower capacity channel blocking the use of a higher capacity channel. Given the existing 40 MHz wide RF channels, a high degree of spectrum efficiency would only be achieved with HC or VHC systems. On the basis that the number of existing MC systems is small, it seems reasonable to grandfather these as an exception.

With regard to whether digital systems should be given specific preference over analogue, the general tendency towards digital in higher capacity systems suggests the adoption of digital as the standard in this band.

High spectrum efficiency can be obtained through the use of a two frequency plan compared to that possible with a four frequency plan. It is therefore proposed to permit only two frequency plan systems.

The Department has established certain bands in which new microwave systems are required to have a minimum number of RF channels. Traffic forecasts which show a high probability that the system will grow to the minimum within a reasonable period of time are required by the Department in cases where the initial installation does not meet the minimum number. The purpose is to limit the use of certain bands below 10 GHz to systems with a large number of RF channels, and to ensure that their certain growth can occur. Additionally, relatively balanced two-way traffic systems have characterized these bands below 10 GHz to ensure the available spectrum is used intensively. Since we are not proposing the 10.7-11.7 GHz band to be used exclusively for the trunk type of system, there does not appear to be a need to establish a minimum number of RF channels per system. There does appear to be a need to prohibit systems with a large number of RF channels one-way or unbalanced two-way however, because of their lower spectrum efficiency and the resulting impact on the future uses of this band. This type of use can be accommodated in other bands.

As frequencies increase radio path links tend to decrease in distance because of attenuation by rainfall and absorption in the atmosphere. As the bottom of the 10-30 GHz frequency range (10.7-11.7 GHz) is the most attractive for multi-hop or long-hop systems, it is proposed to require each applicant to demonstrate that use of the highest available frequency band is not technically or economically feasible.

It can be expected that many systems in this band will consist of a single working channel, some of which will require quite high reliability. Although this is not a congested band, it is still desirable to avoid frequency diversity (i.e., one working channel and one back-up channel on an end to end basis) in order to promote efficient use of the band. It does however, seem reasonable to consider frequency diversity on a standard basis for high capacity digital systems where it can be demonstrated that hot standby and space diversity will not provide the required degree of reliability.

Fixed and Fixed Satellite

As stated earlier, this band (10.7-11.7 GHz) is also shared with the Fixed Satellite Service and is available for both domestic and international satellites.

Some of the satellite frequency pairing possibilities which would use the 10.7-11.7 GHz band are:

- 500 MHz of 10.7-11.7 GHz (space-to-Earth) paired with 500 MHz or 12.7-13.25 GHz (Earth-to-space).

- 10.95-11.2 and 11.45-11.7 GHz (space-to-Earth) paired with 14.0-14.5 (Earth-to-space). This is current Intelsat usage. Anik C uses 11.7-12.2 GHz (space-to-Earth) with 14.0-14.5 GHz (Earth-to-space).

Only the 11.7-12.2 GHz and 14-14.5 GHz bands are exclusive to the fixed-satellite service, and the band 11.7-12.2 is further limited to domestic and sub-regional systems although it is noted that international systems are permitted on a secondary basis in the U.S. Pfd limits are not imposed in the 11.7-12.7 GHz band.

Alternatives might include future expansion of a lower power domestic satellite system in the frequency range 11.2-12.2 GHz down, 12.7-13.2, 14-14.5 GHz up or some other sub-band in 10.7-11.7 GHz taking into account the pfd limit. Obviously, with the shared usage of these bands, systems using 10.7-11.7 GHz and 12.7-13.25 GHz would be more likely be subject to geographical constraints similar to those at the 6 and 4 GHz, than the existing 14/12 GHz Anik C system which is not geographically restricted because of the exclusivity of the frequency band in which it operates.

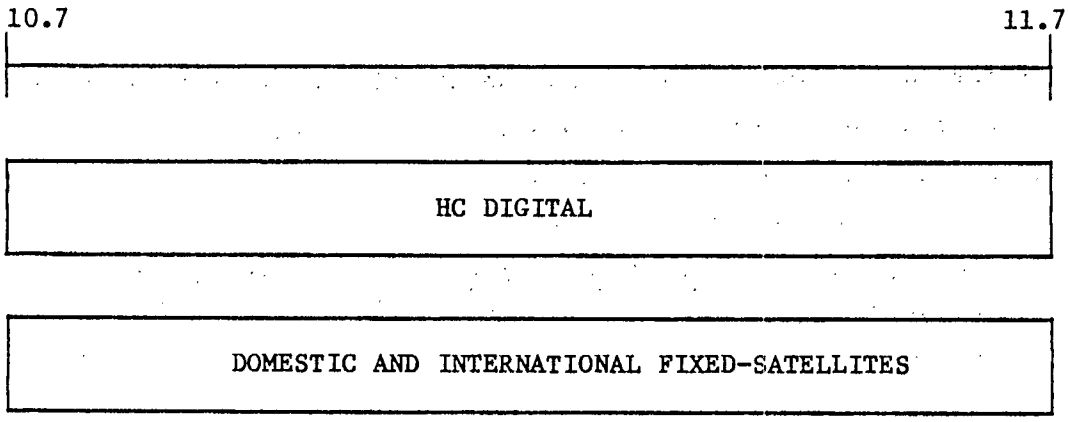
It is a reasonable assumption that the bulk of the Intelsat traffic to and from Canada will remain largely as is, i.e., trans-oceanic, whereas the majority of domestic and trans-border traffic will be carried by domestic satellite. Some respondents may wish to comment on the domestic spectrum utilization impact of ITU footnote 839 which limits fixed satellite systems in the band 11.7-12.2 GHz to national and sub-regional systems, particularly with regard to the impact of the above limitation on Intelsat systems.

One of the potential demands is for feeder links for Canada's mobile satellite demonstration project, MSAT, which, if approved, might use the bands 11.65-11.7 and 13.2-13.25 GHz. This might not be a long term use of these bands since the available bandwidth may not satisfy a second generation system.

On the basis that "planning" for space services will take place in 1988, based on decisions at WARC-ORB-85, and that there has not been a significant domestic discussion on this subject, the proposal maintains the status-quo approach, i.e., first-come, first-served in terms of priority and sharing. Arguments to support or refute this approach are requested.

10.7-11.7 GHZ

SPECTRUM UTILIZATION PROPOSAL



1. There is no distance restriction or minimum number of RF channels for systems operating in this band.

2. Medium capacity digital systems utilizing the channelling plan of the technical guideline and analogue systems adhering to the technical guideline issued in 1968 and which are licensed as of the date of this policy will become non-standard 5 years after the issue of this policy.

3. Frequency diversity is standard only if the applicant has successfully demonstrated that the desired level of reliability cannot be achieved by hot standby on the same frequency and space diversity.

4. This band is primarily for two way balanced voice and data transmission systems. VHCM systems are not permitted in this band.

5. Users of this band will have successfully demonstrated that the use of a higher band is not practical.

6. Domestic fixed satellite systems will have equal access to spectrum vis a vis international systems.

7. Terrestrial and space systems have equal priority.

8. MSAT feeder down-links in the band 11.65-11.7 GHz might be operated in several yet unspecified metropolitan areas.

9. Items 7-10 in section 3 (page 2) apply equally to this band.

6.2 11.7-12.7 GHz

CURRENT STATUS AND USAGE

1. Allocation (see Appendix 2)

2. Current Utilization Policy.

The fixed service is not allocated domestically in the band 11.7-12.2 GHz (Canada decided not to adopt footnote 837 domestically), and although it is allocated in the band 12.2-12.7 GHz, it shall not cause harmful interference to broadcasting satellite systems. Canada has not licensed fixed systems in the 11.7-12.7 GHz band.

3. Technical Standards

As Canada does not license fixed systems in this band there are no standard radio system plans nor technical guidelines published.

4. Current Canadian Usage

There are 78 transponder (RF channel) assignments to domestic fixed satellites (Telesat services) and some assignments to experimental satellites in the band 11.7-12.2 GHz. There are no assignments to the fixed service.

5. Bilateral Protection

Appropriate action is taken to ensure Canadian stations do not receive harmful interference from nor cause harmful interference to U.S. and other space system stations which may be in operation in the band 11.7-12.2 GHz.

POTENTIAL DEMAND

The 11.7-12.2 GHz band will continue to be used for Canadian domestic fixed satellites.

The RARC'83 has established the lower band limit for the broadcasting-satellite service at 12.2 GHz. In addition, the Final Acts of the 1983 RARC preclude any other use of 12.2-12.7 GHz except as provided by radio regulation 846 as modified by RARC 83 which is noted as well in footnote C20.

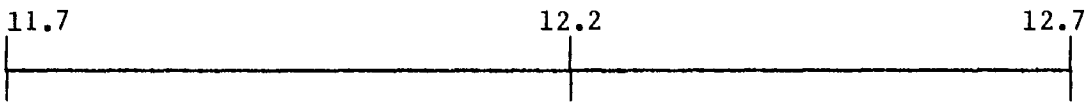
POLICY OPTIONS

Based on potential demand, usage and allocation, and the outcome of RARC'83, there are no new options to be examined in this band at this time.

DISCUSSION

The status quo, as established through consultations on the Canadian Table of Frequency Allocations subsequent to WARC'79 appear to satisfy existing and future spectrum usage demands.

11.7-12.7 GHZ
SPECTRUM UTILIZATION PROPOSAL



DOMESTIC & SUB-REGIONAL FIXED SATELLITE	See notes below

1. There are no proposals at this time for the use of the band 12.2-12.7 GHz by the fixed or fixed-satellite service.

2. Users of the spectrum should note:

   a) The fixed service is on a non-interference basis to broadcasting-satellite. See C18.

   b) The broadcasting-satellite service may operate in the band 11.7-12.2 GHz under the conditions specified in footnote C17;

   c) The fixed-satellite service in the band 11.7-12.2 GHz is not allowed to operate on an inter-regional basis (footnote 839).

   d) The fixed-satellite service may operate in the band 12.2-12.7 GHz under the conditions specified in footnote C20.

6.3 12.7-13.25 GHz

CURRENT STATUS AND USAGE

1. Allocation (see Appendix 2)

2. Current Utilization Policy

A proposed licensing policy covering VHCM systems operating in the 12.7-12.95 GHz band was issued for public comment on November 30, 1974 through notification in the Canada Gazette. As a result of the proposed policy, the CATV community was able to proceed with the implementation of one or two hop point to multipoint microwave systems for carriage of television programming known as Very High Capacity Microwave or VHCM. At the same time, telecommunication carriers contended that the 12.2-13.25 GHz band was essential to the future development of inter-regional digital microwave systems.

Following a period of full consultation with the various parties involved, the Department concluded that it would not be in the best national interest, at the time, to agree to the long-term licensing of VHCM systems in the band 12.7-12.95 GHz, which might create a situation that would interfere with the development of the inter-regional telecommunication network. Recognizing however that licensing on a short-term or interim basis was necessary, the department decided to adopt a radio licensing policy as detailed in the document entitled - "Radio Licensing Policy for Short-Haul Microwave Systems in the Band 12.7-12.95 GHz" dated July 14, 1976. The policy proposed specific cut-off dates for the licensing of VHCM systems[1] after which such requirements would be met on a long-term basis in the band 14.5-15.35 GHz.

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1. "Licences for the operation of such systems will be granted up to January 1, 1978. The licensees of such systems must accept as a condition of licence that they may not be permitted to use this band beyond January 1, 1983. The Department may continue to review these licences beyond January 1, 1983 only if the continued operation of the systems does not interfere with the establishment and/or operation of long-haul telecommunication systems. Such licence renewals will be only on a yearly basis."

Following further public consultation the policy was revised somewhat in December, 1977. In particular the cut-off date for licensing of VHCM systems was relaxed to take into account the delay in the requirement of the telecommunications carriers for the 12 GHz band. The December, 1977 policy stated that licencees of VHCM systems were required to "accept, as a condition of licence that they may not be permitted to use the band beyond January 1, 1988". The policy further stated "The Department may continue to renew these licences beyond January 1, 1988 only if the continued operation of the systems does not interfere with the establishment and/or operation of (the inter-regional telecommunication network). Furthermore, "the Department will after June 3, 1979, no longer licence new VHCM systems in this band which can be expected to conflict with (the inter-regional telecommunication network)."

In light of the uncertainties surrounding the future development of systems in the 12.7-12.95 GHz band, the Department at the time advised its intention to review the policy in 1979. This has not transpired and the Department is currently considering licence applications on a case by case basis.

RARC'83 determined a potential out of band interference to DBS receivers in the top DBS channel caused by systems using the lower part of the 12.7-12.95 GHz band. There may also be an adjacent band problem related to local oscillator radiation (12.2-12.7 GHz plus or minus 1 GHz) and image frequency rejection (12.2-12.7 GHz plus or minus 2 GHz), depending upon the local oscillator frequency chosen for the DBS receiver.

3. Technical Standards

Licences are granted under Guidelines entitled "Technical Guidelines for Very High Capacity Microwave (VHCM) CATV Distribution Systems Operating in the 12.7-12.95 GHz Band", released on December 22, 1975 and with an effective date of January 5, 1976. The

plan provides for FML and AML (VSB) systems. The FML system has the potential for 20 channels while the AML system has a capacity of 34 TV channels.

4. Current Canadian Usage

Current Canadian usage is for AML and FML VHCM systems in many areas of Canada using the 12.7-12.95 GHz band. The largest systems are located in Vancouver and the more densely populated areas of Ontario and Quebec with many smaller systems in other parts of the country.

Since the Department has discouraged assignments in the 12.95-13.25 GHz band there are only 8 assignments in B.C. for in-plant systems and 2 in Winnipeg and Montreal for TV pick-up.

5. Bilateral Protection

Appropriate action is taken to ensure Canadian stations do not receive harmful interference from nor cause harmful interference to U.S. microwave, mobile or space system stations.

POTENTIAL DEMAND

1. An 18 Km wide corridor for a digital system across Canada as part of the system identified in the 10.7-11.7 GHz band, except possibly in the prairies where fibre optics might be used. In general the system would not enter metropolitan areas.

2. The establishment and expansion of VHCM systems in the band 12.7-13.2 GHz for cable television distribution purposes.

3. Microwave systems for the linking of CATV systems.

4. Television pick-up systems.

5. Future expansion of Canadian domestic satellite services and international satellite systems.

6. If approved, mobile satellite (MSAT demonstration system) feeder links.

POLICY OPTIONS

1. Reaffirm the 1977 policy.

2. Accommodate to the extent possible existing and other new potential demands on the band.

DISCUSSION

In the discussion of the 10.7-11.7 GHz band, it was concluded there was not likely an immediate need for an expansion band above 10 GHz to handle growth beyond the capacity of the 4 and 8 GHz bands until the post-1995 period. If this growth were then to occur in the 10.7-11.7 GHz band it should be capable of satisfying these traffic needs to beyond the year 2000. It may therefore be concluded that the need foreseen in the 1977 policy to provide for inter-regional systems in the 12.7-13.25 GHz is no longer valid within a reasonable time frame primarily as a result of developments at 4 GHz. There is an immediate need to expand existing VHCM systems in several cities, where the limit of about 35 channels has been reached or will be reached shortly, and also to accommodate the anticipated growth of specialized broadcast channels.

The demand for expansion of VHCM systems can be accommodated by:

- expanding the existing 12.7-12.95 GHz allocation

- the use of additional sites and directive antennas, expanding the number of available RF channels through frequency re-use

- relocating the expansion to higher bands

- as proposed in the 1977 policy, relocate all VHCM to 15 GHz

- restrict the carriage of signals on VHCM systems to program material only, and only that program material which cannot be received off-air at the cable sub-head end.

Each of these various methods should be considered in their ability to satisfy the likely demand for RF channels. As mentioned, the existing allocation in some locations is now reaching saturation. In the short term, any one of the available options would provide enough channels but at some cost and technical complexity.

Since the CATV industry is still in a formative period there is difficulty in forecasting CATV channel distribution requirements in the long term. VHCM system capacities of approximately 80 channels are possible with the use of the 12.7-13.2 GHz band and in excess of 100 channels are achievable with an allocation of 12.7-13.2 GHz and frequency re-use with the aid of dual sites and antennas as has been demonstrated in some U.S. cities. If these approaches are taken sequentially as demand warrants expansion will be possible for the foreseeable future.

The alternative of expanding at 14.5-15.35 GHz or totally relocating existing 12.7-12.95 MHz operations to that band requires examination of several factors. The first is the need for the 12 GHz band for other purposes. It has been suggested the transcontinental need foreseen in 1977 will not occur for some time, while the VHCM need is imminent.

The 15 GHz band channelling plan as contained with SRSP-312 is based on FM systems. If all the available channels were used, 68 (12.5 MHz wide) channel units would be available in the 850 MHz (14.5-15.35 GHz) bandwidth. This band is used by fixed and mobile systems in the U.S. and coordination could prove quite difficult over any large number of channels. The higher equipment costs of 15 GHz VHCM equipment and increased coordination problems are not justified since the alternative use of the 12.7-13.2 GHz band, high capacity digital, can be satisfied elsewhere for a long period of time. Additionally, the 6 MHz AML channelling of the 12 GHz band (potentially 83 channels in the 500 MHz bandwidth) is more spectrum efficient than the 15 GHz plan.

While it is not justifiable to relocate existing 12 GHz VHCM to 15 GHz, SRSP 312 does not prohibit such use in that band. In terms of requiring VHCM expansion to take place at 15 GHz, the cost of operating equipment at both 12 and 15 GHz and the limited utility of 12.95-13.2 GHz for other purposes, suggests this is not desireable.

A need has developed to provide for the linking of VHCM systems. There is a particular advantage to designating the 12.7-13.2 GHz band for this, in that users of VHCM linking systems and VHCM are the same, which should result in the choice of frequencies and sites being optimized for both purposes. The urban and

multidirectional nature of VHCM could however create some difficulty in sharing with wide cross-section digital systems which would need to enter or approach cities. It is also desirable, if possible, to place VHCM linking and other inter-urban systems in separate bands to avoid route conflicts.

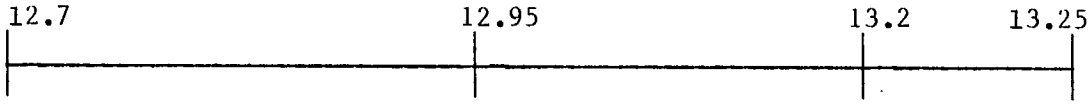
An allocation of spectrum in the band 12.7-13.25 GHz for TV Pick-ups has been requested by certain users mainly because of the availability of equipment in the band. The shared use of 13.2-13.25 GHz by TV Pick-ups and a system such as MSAT appears feasible since MSAT earth stations will be located in only a few cities. All MSAT assignments will have protection from TV Pick-up if the latter were treated as a secondary service. In addition, a suitable power limit would be placed on TV Pick-up emissions.

Fixed Satellite

The uses of the fixed satellite allocations from 12.7 to 13.25 GHz were discussed under the preceding section dealing with this service in the band 10.7-11.7 GHz.

12.7-13.25 GHZ

SPECTRUM UTILIZATION PROPOSAL



VHCM AND VHCM LINKING

TV PICK-UP

DOMESTIC AND INTERNATIONAL FIXED-SATELLITES

1. Fixed-satellite Earth to space links in this band may be paired with space to Earth links in the band 10.7 to 11.7 GHz.

2. The band 13.2-13.25 GHz is being planned for mobile satellite feeder links in several metropolitan areas. If approved, MSAT may be assigned feeder links in this band.

3. VHCM linking (i.e. systems which either connect or feed VHCM systems) and VHCM systems will share assignments to the extent possible.

4. TV Pick-up operation will not cause harmful interference to the fixed-satellite service, nor claim protection from harmful interference from that service. The EIRP of TV Pick-ups will be limited to 55 dBw.

5. The linking of VHCM systems (by multi-hop video systems) is normally limited to this band and the 8275-8500 MHz band.

6.4 14-14.5 GHz

CURRENT STATUS AND USAGE

1. Allocation (see Appendix 2)

POTENTIAL DEMANDS

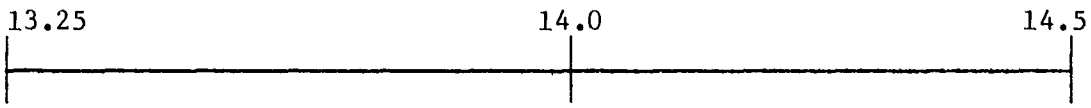
POLICY OPTIONS

DISCUSSION

See the preceding discussion on fixed-satellites in 10.7-11.7 GHz section of this paper.

13.25-14.5 GHz

SPECTRUM UTILIZATION PROPOSAL



NO ALLOCATION TO FIXED OR FIXED-SATELLITE

INTERNATIONAL AND DOMESTIC FIXED-SATELLITES

1. Domestic fixed-satellite systems will have priority access to spectrum vis a vis international systems. Therefore, in the consideration of a Canadian domestic space system application and an international space system application, made at the same time, the Department will generally give priority to the domestic system.

6.5 14.5-15.35 GHz

CURRENT STATUS AND USAGE

1. Allocation (see Appendix 2)

2. Current Utilization Policy

A radio licensing policy for VHCM systems for television signal distribution in this band was issued in 1977. The policy did not establish minimum capacities and implied VHCM was limited to a maximum of 40 miles. Basically, the band was designated as the preferred alternative for 12 GHz VHCM systems, should that band become unavailable because of the "corridor" concept discussed earlier. Other systems (generally video) are licensable in this band.

3. Technical Standards

A technical guideline for VHCM was issued in 1977, establishing four sub-bands, one pair of which would typically be used for multichannel video systems, the other pair for systems using a small number of channels. VHCM was designated as being a maximum of about 65 km, which generally could be achieved by two hops.

In 1983, a revision of SRSP-312 was released (SRSP-314.5), which designated a fifth sub-band (50 MHz) for one-way operation. Emphasis was removed from the VHCM type of operation and the SRSP was broadened to add such operations as point-to-point and multipoint voice, video, data or equivalent in urban or rural settings. There is no distance limitation. Channels are 12.5 MHz wide, multiples or sub-multiples thereof. The manufacturer support of equipment which could be used in accordance with SRSP-312 Draft, appears to be good.

There is concern in some quarters that the proposed DBS receiver standard will result in a receiver image frequency falling in this band, raising the possibility of interference to the reception of DBS signals.

4. Current Canadian Usage

There are over 100 assignments in Canada, primarily for VHCM systems. The average path length is 30 km.

5. Bilateral Protection

Appropriate action is taken to ensure Canadian stations do not receive harmful interference from nor cause harmful interference to U.S. microwave or mobile stations.

POTENTIAL DEMANDS

1. An additional band for CATV program distribution (VHCM) and for the linking of VHCM systems.

2. TV Pick-up and other video-based systems with a small number of RF channels one or two way.

3. Systems of "lower spectral efficiency" than proposed for 10.7-11.7 GHz band, which cannot be accommodated in higher bands because of system length.

POLICY OPTIONS

1. VHCM

A. Reserve band exclusively for VHCM.

B. Share band between VHCM and other systems.

C. Rechannel for other uses - VHCM to be accommodated at 12 GHz.

2. VHCM Linking

   A. Encourage linking at 12 GHz and 15 GHz.

   B. Remove distance limitation on VHCM such that VHCM, in effect, is also linking system.

3. TV pick-up and Temporary TV Links

   A. Designate user-coordinated channels.

   B. These operations should take place in other bands.

4. System types and capacities

   A. Limit to high efficiency systems, similar to the 10.7-11.7 GHz band.

   B. Provide lower efficiency option band to 10.7-11.7 GHz band for example, permitting lower and higher capacity and unbalanced systems.

DISCUSSION

The proposal to extend the 12.7-12.95 VHCM band up to 13.2 GHz will satisfy any known or foreseeable demands for increasing the capacity of systems operating at 12 GHz. Without this expansion, this growth may have been expected to occur at 15 GHz. At 15 GHz it is necessary to continue the support of existing systems and to permit their expansion. It is further assumed that new VHCM systems will be implemented at 12 GHz, rather than 15 GHz as the 12 GHz band has long been identified by users as their preferred choice. Thus, while provision must be made for some growth at 15 GHz, the band may also be utilized for other purposes.

These other purposes could include those systems which would not qualify as "high efficiency" systems in the 10.7-11.7 GHz band but would fit the 12.5 MHz RF channel building block of Draft SRSP 312.

The carriage of program channels for CATV between cities (VHCM linking) has been proposed at 12 GHz in this paper, and it should also be decided if linking systems should have access to the 15 GHz band. The 12 GHz linking proposal is particularly attractive because it could result in the two uses of the band (VHCM and VHCM linking) being made by the same user or users. This form of usage tends to be more spectrum efficient, in that user will tend to optimize his systems in order to ensure future spectrum availability. Another alternative would be to remove any distance limitation on the intra-city type of VHCM system so that it could be expanded to cover a very large area. The original distance limitation was employed for two reasons, one dealing with Canadian telecommunications network policy, and the other related to the quality limitations of more than two-hop so called "AML" VHCM system. A policy released by the Department recently*, has in

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*Canada Gazette, March 19, 1983. DGTN-002-83 "Microwave Licensing Policy respecting Carriage of Program Services to Broadcasting Undertakings".

effect, eliminated the generality of the original policy restriction and of course, the quality limitation factor does not apply to the FM VHCM system predominant in the 15 GHz band. There remains a reason however to retain a distance restriction on the VHCM type of system to not permit very large area coverage in this band: basically this type of demand should be satisfied by the proposal at 12 GHz. This restriction would enable other users of the 15 GHz band greater flexibility and opportunity for growth since networking of VHCM systems would not occur at 15 GHz.

The 1-10 GHz policy identified unfulfilled needs for video systems up to 65 km in length (e.g. stand-alone systems or spurs) which was deleted from the 8275-8500 MHz band, TV STL's shorter than 16 km and camera to mobile studio links (TV Pick-ups and Temporary TV Links). SRSP 314.5 accommodates these in a fashion which is compatible to the CATV distribution systems just discussed. With regard to the TV operations, it is proposed that certain channels in the SRSP be identified for these functions, and that actual operations are coordinated among the users themselves. The Department would not specifically assign or coordinate the domestic use of a channel. This concept should be examined for application to all TV Pick-up and Temporary TV Link bands other than the 6930-7125 MHz band.

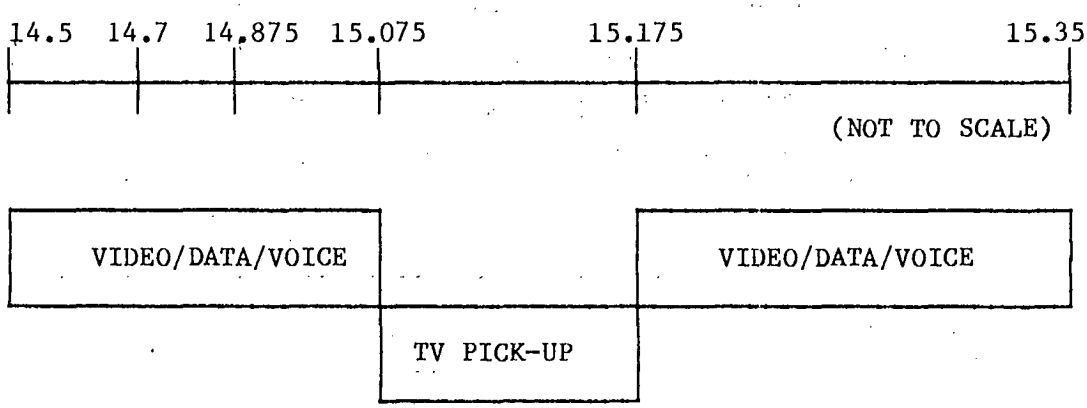
The flexibility of SRSP 314.5 is demonstrated by its ability to handle the aforementioned services. It is also flexible enough to handle more than just the radio systems already discussed. In view of the 850 MHz of spectrum available, consideration should be given to accommodating as wide a range of compatible systems as possible, including point to point and multipoint video, data and voice. Such systems would generally be those which cannot be accommodated within the 10.7-11.7 GHz band, but which do conform to SRSP 314.5

Fixed-Satellite

The Region 2 allocation to the fixed-satellite service (Earth-to-space) is not reflected in the Canadian allocation table because of the restriction of international footnote 863 which allocates the band to DBS feeder links, which have already been planned at 17 GHz by RARC'83. It is within the realm of possibility that this footnote will be changed at the next competent conference to free some needed fixed-satellite frequencies.

14.5-15.35 GHz

SPECTRUM UTILIZATION PROPOSAL



1. Both Multipoint Communications Systems (MCS) and point-to-point systems may carry video/data/voice in the bands 14.5-15.075 and 15.175-15.35 GHz.

2. TV Pick-up and Temporary TV Link users in the band 15.075 GHz-15.175 GHz will be licensed on a per-system basis, but will be required to coordinate scene of event frequencies with other licensed users of the band.

3. Existing 15 GHz VHCM systems and growth to existing 15 GHz VHCM systems are standard in this band. New VHCM systems are non-standard.

4. The linking of 12 GHz VHCM systems is non-standard in this band.

5. As stated in Draft SRSP 312 Issue 1, frequency diversity is not permitted in this band.

6.6 17.3-20.2 GHz

CURRENT STATUS AND USAGE

1. Allocation (see Appendix 2)

2. Current Utilization Policy

There is no formal utilization policy in this band, although there are many experimental authorizations, and approval has been given to a potentially large system in Alberta on a non-standard basis.

3. Technical Standards

No SRSP or technical guideline exist. Technical criteria may be needed to protect passive sensors in the band 18.6-18.8 GHz, and to protect the geostationary orbit. Channelling now in use may require changes in frequency should a new channelling plan be created.

4. Current Canadian Usage

Non-standard authority has been given for a fixed system, appropriately named "Pole Line" in the band 18.58-18.82 GHz. The small size of equipment at this frequency reduces site costs and permits the development of microwave systems where traffic volumes would not otherwise justify them. In the area where it would be used, propagation will permit repeaters at approximately 10-15 km, which is the same magnitude of distance as traffic drop requirements. One such system may have the potential for 200 hops in this decade. A small number of systems are also in use which operate along railroad right of ways.

5. Bilateral Protection

Appropriate action is taken to ensure Canadian stations do not receive harmful interference from nor cause harmful interference to U.S. microwave or space system stations.

POTENTIAL DEMANDS

1. Support lower capacity digital systems (LC, MC) such as the Pole Line concept discussed above.

2. Provide future growth of fixed and fixed-satellite systems (including feeder links for DBS).

POLICY OPTIONS

1. System types and capacities

   A. Permit a wide range of digital system capacities.

   B. Permit either high or low digital system capacities.

   C. Permit analog in addition to the digital system alternatives in options A and B.

   D. Provide specific expansion channels to the 12.7-13.2 GHz VHCM band, in addition to A through C, above.

DISCUSSION

The CCIR have recommended digital channelling arrangements and the current trend for new radio systems to be digital also favors an all digital plan in terms of normal point to point services. CCIR and North American channelling proposals also favor a wide range of system capacities. While spectrum efficient techniques should be used, the number of possible channelling schemes is large enough to suggest technical detail should be left to the public consultation of the SRSP.

The U.S. is considering the addition of 6 MHz channels (18.18-18.36 and 19.52-19.7 GHz) for video which would partially offset the negative effect of their proposal to increase the sharing of the 12.7-13.2 GHz band. This sharing between analogue/digital and AM video systems is not foreseen in Canada.

Fixed-satellite Service

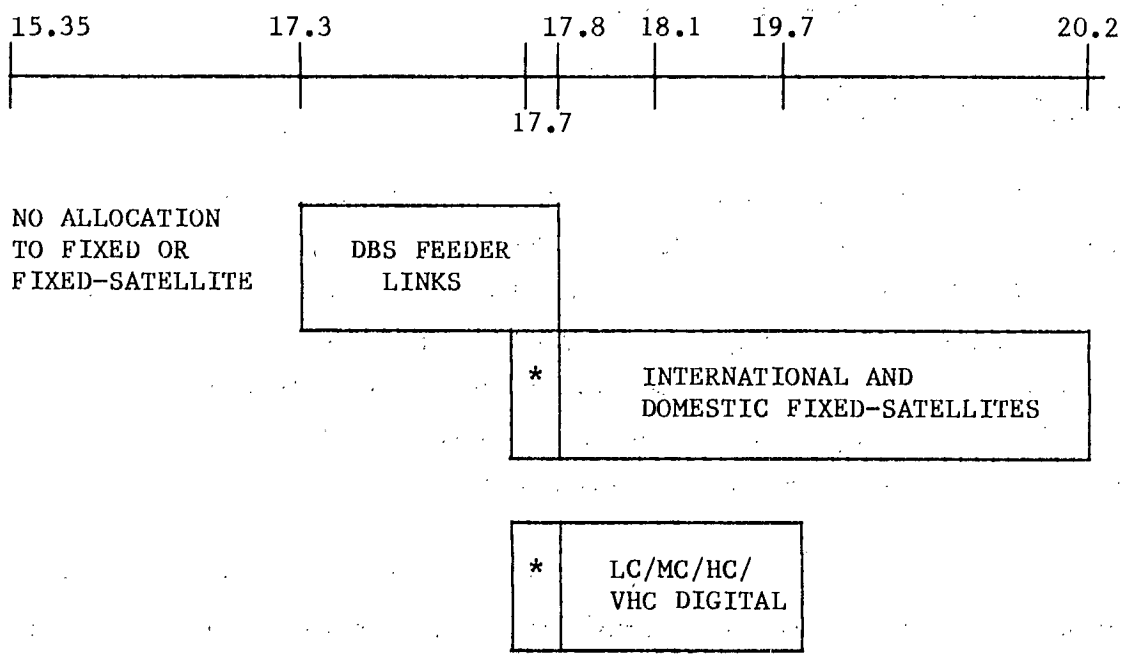
The "20/30" GHz satellite bands are composed of the 17.7-21.2 GHz downlink (3.5 GHz) and the 27-31 GHz uplink (4 GHz) bands. The 17.7-18.1 GHz band is shared with broadcasting-satellite (DBS) feeder links but only 17.7-17.8 GHz will be used by feeder links in conjunction with 17.3-17.7 GHz in the foreseeable future. The bands 20.2-21.2 and 30-31 GHz are governed by footnote C21 which allocates them to exclusive Government of Canada usage.

The bands 17.7-19.7 GHz (2 GHz) and 27-29.5 GHz (2.5 GHz) are shared between space and terrestrial systems. The bands 19.7-20.2 GHz (500 MHz) and 29.5-30 GHz (500 MHz) are allocated on an primary basis only to the fixed-satellite service.

RARC'83 did not decide specific locations for feeder link sites and Canada may therefore implement them in a wide number of locations. In terms of the implementation of fixed or fixed-satellite (Space-to-Earth) in the band 17.7-17.8 GHz, a choice can be made to restrict the flexibility given by the RARC for feeder link locations through the approval of these other systems. In view of the large amount of spectrum available for the other systems, and the lack of any plans to implement them, it is proposed to place a reserve on the use of the sub-band 17.7-17.8 GHz until feeder link sites are determined for a Canadian DBS project or until the need for other services can no longer remain unsatisfied, at which time a further policy review can be undertaken.

15.35-20.2 GHz

SPECTRUM UTILIZATION PROPOSAL



1. *Use of the band 17.7-17.8 GHz by the fixed service and fixed-satellite (space-to-earth) service is reserved until the feeder link requirements for a Canadian DBS are known, or until a future policy review.

2. Frequency diversity (1 for 1) is standard only if the applicant has successfully demonstrated that the desired level of reliability cannot be achieved by hot standby.

6.7 20.2-23.6 GHz

CURRENT STATUS AND USAGE

1. Allocation (see Appendix 2)

2. Current Utilization Policy

There is no specific utilization policy, although a licence has been granted on a non-standard basis to several users.

3. Technical Standards

No Canadian technical standards exist for systems in this band.

4. Current Canadian Usage

Existing use and proposals for usage have been for video and data links and for video surveillance cameras.

5. Bilateral Protection

Appropriate action is taken to ensure Canadian stations do not receive harmful interference from nor cause harmful interference to U.S. microwave or space system stations.

POTENTIAL DEMAND

1. Single hop, short distance video and data transmission systems.

2. Future growth of networks or systems which are now using lower bands.

POLICY OPTIONS

A. Regard this band as a logical expansion band for the fixed service in the band 17.7-19.7 GHz.

B. As above, but in addition provide for low-cost systems in a portion of the fixed service band for video, voice and data.

DISCUSSION

There is no pressing demand to utilize this band if it were to be regarded as an expansion band to 17.7-19.7 GHz, which will not be congested in the foreseeable future. If the principle of the highest possible frequency band (see page 12) is adopted, this band could on occasion, serve that purpose, but it would require channelling plans compatible with the 10.7-11.7 GHz band.

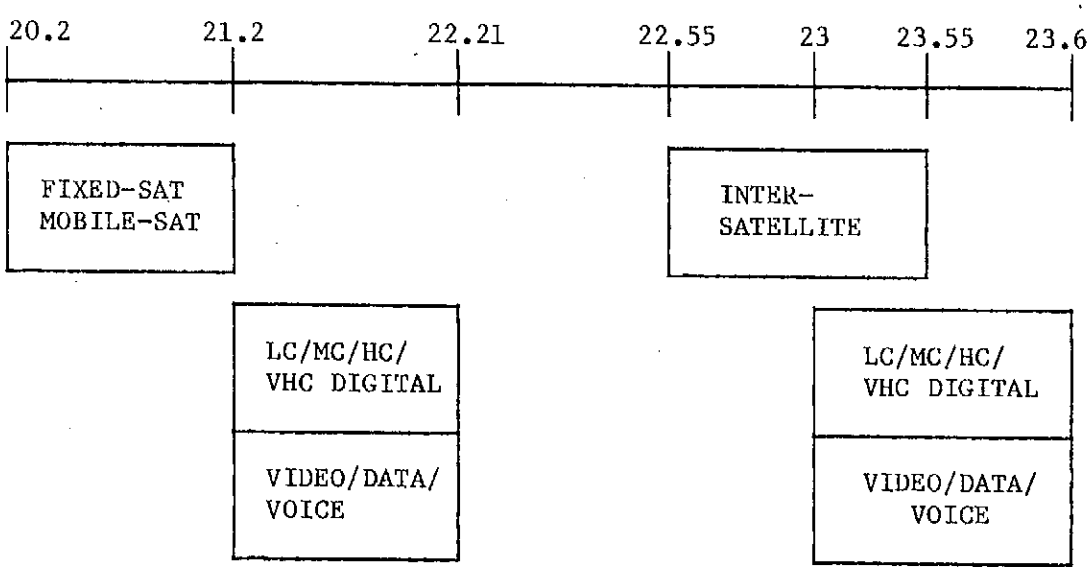
The current demand seems to be for the low cost equipment now available, which appears competitive to other radio and non-radio alternatives of voice, video and data transmission.

The allocation to 22.5-23 GHz, broadcasting-satellite, may be required some time in the future possibly for high definition television. Until this need is better understood, and until there is a more pressing demand for the fixed service, this portion of the spectrum could be reserved for future policy review.

See also "Fixed-Satellite Service" discussion in the 17.3-20.2 GHz band.

20.2-23.6 GHz

SPECTRUM UTILIZATION PROPOSAL



1. The band 22.21-23.0, which is allocated to research purposes and broadcasting-satellite, as well as the fixed service, is not proposed for use by the fixed services at this time.

2. Fixed system capacities and RF channelling plans are to be determined during the creation of a relevant SRSP at the appropriate time.

3. A portion of the bands for fixed service might not be used until the need to do so is identified in a future policy review.

4. Use of the fixed-satellite and mobile-satellite services in the band 20.2-21.2 GHz or a portion thereof is reserved for the Government of Canada.

5. Frequency diversity (1+1) is standard only if the applicant has successfully demonstrated that the desired level of reliability cannot be achieved by hot standby.

6.8 25.25-31.0 GHz

CURRENT STATUS AND USAGE

1. Allocation (see Appendix 2)

2. Current Utilization Policy

There is no specific utilization policy and there are no systems or proposals for this band.

3. Technical Standards

Canada has no domestic standard, however general criteria may be found within the ITU Radio Regulations.

4. Current Canadian Usage

None.

5. Bilateral Protection

Appropriate action will be taken to ensure Canadian stations do not receive harmful interference from nor cause harmful interference to U.S. microwave, mobile or space system stations.

POTENTIAL DEMANDS

There are no known requirements for the immediate use of this band.

POLICY OPTIONS

A. Establish utilization policy as and when required.

B. Establish utilization guidelines until firm demand arises.

C. Establish policy for a full range of capacities for point to point and possibly multipoint analogue and digital systems.

D. Reserve a portion of the band for future policy making.

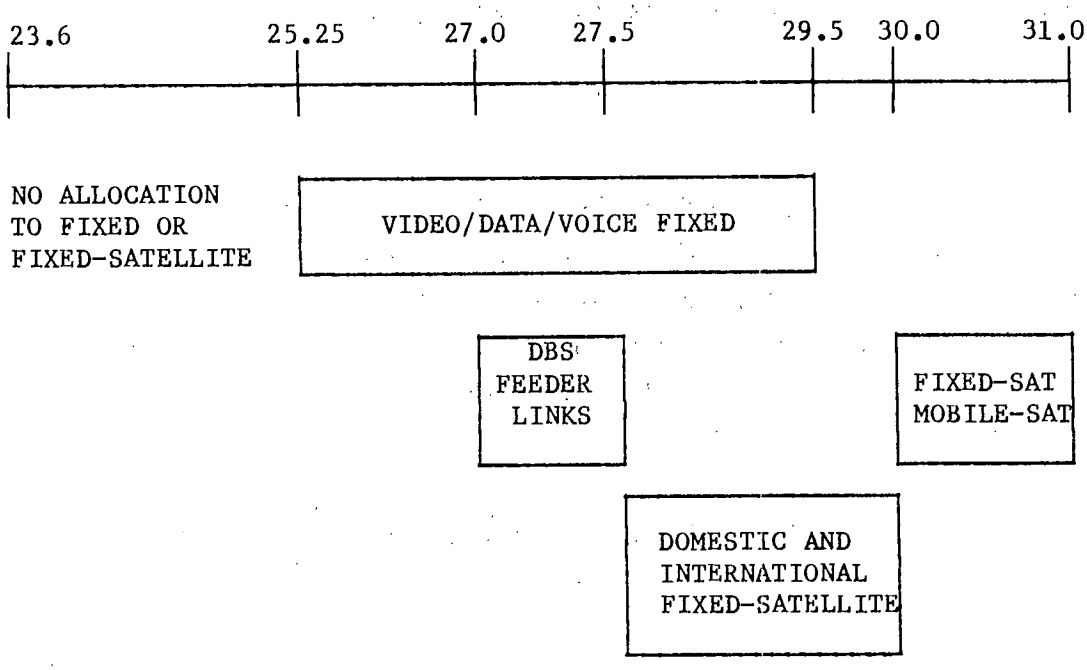
DISCUSSION

The Department is interested in public comment in this and higher frequency bands. Although it may be premature to determine final utilization policy, equipment is becoming available for these higher bands. The information gained even in the event a policy cannot be established will be useful in determining the Department's response to future applications.

See also "Fixed-Satellite Service" discussion in the 17.3-20.2 GHz band.

23.6-31.0 GHz

SPECTRUM UTILIZATION PROPOSAL



1. Fixed system capacities are to be determined.

2. The band 27-29.5 GHz might not be used until the need to do so is identified in future policy reviews.

3. The band 27-27.5 GHz is regarded as the feeder link band for broadcasting-satellite in the 22.5-23 GHz band.

4. Use of the fixed-satellite and mobile-satellite services in the band 30-31 GHz or a portion thereof is reserved for the Government of Canada.

5. Frequency diversity (1+1) is standard only if the applicant has successfully demonstrated that the desired level of reliability cannot be achieved by hot standby.

Excerpts from the 1-10 GHz Policy*

Frequency Diversity

The term "frequency diversity" in this paper refers to the simultaneous transmission of the same traffic information over two RF microwave channels operating at different frequencies to provide equipment redundancy and improved propagation reliability. In systems having more than one RF working channel a similar form of protection is provided whereby one protection RF channel acts as backup for several working channels. This is commonly referred to as 1 for N operation, i.e., one protection channel for N working channels.

In the past, when spectrum utilization was much lower than at present, the 1 for 1 type of operation was permitted in several bands for end to end system operation. The current high level of spectrum demand makes this practice no longer acceptable. In the 890-960 MHz, 1427-1525 MHz and 1710-1900 MHz bands frequency diversity becomes non-standard with the public release of this paper.

General Arrangement for Non-standard Systems, Including the Modification or Replacement of Existing Non-standard Systems

Considerable public comment resulted from a recommendation in the July 1981 paper that existing radio systems in certain frequency bands would be subject to modification after a five-year period if their use of frequency diversity blocked the entry or expansion of a system without frequency diversity. Many respondents were concerned over the economic impact of this proposal and suggested that a minimum advance notification of two years should be given if system modification or replacement were necessary, that exceptions should be made for remote areas where frequencies were not congested, and that systems installed to an earlier departmental standard should be protected against change for the duration of their service life. These are matters which go beyond frequency diversity to include any non-standard feature of the system.

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*Department of Communications, Policy for the utilization of the 0.890-10.68 GHz radio spectrum by the fixed service, Ottawa, 1982.

The SRSP documents do not attempt to establish comprehensive technical standards for a radio system but only those standards which are necessary for efficient spectrum usage. Technical standards specified in the SRSPs are therefore considered beneficial to all users of the radio spectrum, and it must be expected that revisions will occur when made necessary by changing circumstances. In introducing new or revised standards, the Department has always taken every step possible to protect radio systems already licensed, and this practice will continue. As spectrum usage increases, however, it would be unreasonable to assume that every single licensed system could be guaranteed a full service life, which may be 20 years or longer. Inevitably, there will be occasions when an existing system at a particular location might have to be modified or replaced to make way for new systems that are more efficient in their use of spectrum. To take care of this eventuality, it is planned to make a common provision for non-standard systems in all SRSPs as they are reissued.

A microwave radio system is classed as non-standard if it does not conform to the most recent issue of the SRSP for the frequency band in question, or if no SRSP has been issued for the frequency band. (See Section 3 for an interim arrangement which will be followed with respect to this policy as it affects existing SRSPs.) Such radio systems are subject to modification or replacement if their non-standard aspects block the entry of a proposed new or extended system which is standard, i.e., a system conforming to the most recent issue of the SRSP.* In this eventuality, the parties involved will be encouraged to reach agreement among themselves. Failing such agreement, the Department will consult with the parties involved and determine what modification or replacement of non-standard systems is warranted in the particular circumstances, taking full account of the equipment investments in place, the service requirements of the user, reasonable time frames and any other factors bearing on the matter.

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* It may be noted that "standard" is not the exact opposite of "non-standard", i.e., a standard system conforms to the SRSP but a non-standard system is either non-conforming to the SRSP or authorized before the SRSP is first issued.

This recourse, to be used sparingly and as a last resort, is considered necessary if spectrum management is to avoid the straightjacket of obsolete planning and technology. A minimum advance notification of two years will be given for any system change required, and no system change will be required before five years have elapsed from the date on which the system became non-conforming. Alternative spectrum will be identified if a change in frequency is involved.

Based on the Department's experience with the entry of new standard systems after the modification of an SRSP, very few non-standard systems have been affected. It is therefore anticipated that very few non-standard systems will be affected by these provisions and the majority of non-standard systems will be able to continue operation without modification or replacement, for the duration of their service life.

GHz

ITU ALLOCATION TO SERVICES

Region 1	Region 2	Region 3
10.7–11.7 FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 835 MOBILE except aeronautical mobile	10.7–11.7 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	
11.7–12.5 FIXED BROADCASTING BROADCASTING- SATELLITE Mobile except aeronautical mobile 838 840	11.7–12.1 FIXED 837 FIXED-SATELLITE (space-to-Earth) Mobile except aeronautical mobile 836 839 840 12.1–12.3 FIXED 837 FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile BROADCASTING BROADCASTING- SATELLITE 839 840 841 842 843 844 12.3–12.7 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING- SATELLITE 839 840 843 844 846	11.7–12.2 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING- SATELLITE 838 840 12.2–12.5 FIXED MOBILE except aeronautical mobile BROADCASTING 838 840 845
12.5–12.75 FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 840 848 849 850	12.7–12.75 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE except aeronautical mobile 840	12.5–12.75 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile BROADCASTING- SATELLITE 847 840

GHz

CANADIAN ALLOCATION TABLE

10.7–11.7	FIXED FIXED-SATELLITE (space-to-Earth) C16
11.7–12.2	FIXED-SATELLITE (space-to-Earth) 839 840 C17
12.2–12.7	FIXED BRDADCASTING BROADCASTING-SATELLITE 839 840 C18 C19 C20
12.7–12.75	FIXED FIXED-SATELLITE (Earth-to-space) 839

GHz

ITU ALLOCATION TO SERVICES

Region 1	Region 2	Region 3
12.75–13.25	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Space Research (deep space) (space-to-Earth)	
13.25–13.4	AERONAUTICAL RADIONAVIGATION 851 852 853	
13.4–14	RADIOLOCATIDN Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research 713 853 854 855	
14–14.25	FIXED-SATELLITE (Earth-to-space) 858 RADIONAVIGATION 856 Space Research 857 859	
14.25–14.3	FIXED-SATELLITE (Earth-to-space) 858 RADIONAVIGATION 856 Space Research 857 859 860 861	

GHz

CANADIAN ALLOCATION TABLE

12.75–13.25 FIXED FIXED-SATELLITE (Earth-to-space)
13.25–13.4 AERONAUTICAL RADIONAVIGATION 851 852
13.4–14 RADIOLOCATION Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research 713
14–14.3 FIXED-SATELLITE (Earth-to-space)

GHz

ITU ALLOCATION TO SERVICES

Region 1	Region 2	Region 3
14.3–14.4 FIXED FIXED-SATELLITE (Earth-to-space) 858 MOBILE except aeronautical mobile Radionavigation-Satellite 859	14.3–14.4 FIXED-SATELLITE (Earth-to-space) 858 Radionavigation-Satellite 859	14.3–14.4 FIXED FIXED-SATELLITE (Earth-to-space) 858 MOBILE except aeronautical mobile Radionavigation-Satellite 859
14.4–14.47 FIXED FIXED-SATELLITE (Earth-to-space) 858 MOBILE except aeronautical mobile Space Research (space-to-Earth) 859		
14.47–14.5 FIXED FIXED-SATELLITE (Earth-to-space) 858 MOBILE except aeronautical mobile Radio Astronomy 859 862		
14.5–14.8 FIXED FIXED-SATELLITE (Earth-to-space) 863 MOBILE Space Research		
14.8–15.35 FIXED MOBILE Space Research 720		

GHz

CANADIAN ALLOCATION TABLE

14.3–14.47 FIXED-SATELLITE (Earth-to-space)
14.47–14.5 FIXED-SATELLITE (Earth-to-space) Radio Astronomy 862
14.5–15.35 FIXED 720

GHz

ITU ALLOCATION TO SERVICES

Region 1	Region 2	Region 3
15.35–15.4	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 864 865	
15.4–15.7	AERONAUTICAL RADIONAVIGATION 733 797	
15.7–16.6	RADIOLOCATION 866 867	
16.6–17.1	RADIOLOCATION Space Research (Earth-to-space) (deep space) 866 867	
17.1–17.2	RADIOLOCATION 866 867	
17.2–17.3	RADIOLOCATION Earth Exploration-Satellite (active) Space Research (active) 866 867	
17.3–17.7	FIXED-SATELLITE (Earth-to-space) 869 Radiolocation 868	

GHz

CANADIAN ALLOCATION TABLE

15.35-15.4 RADIO ASTRONOMY EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) 864
15.4–15.7 AERONAUTICAL RADIONAVIGATION 733 797
15.7–16.6 RADIOLOCATION
16.6–17.1 RADIOLOCATION Space Research (Earth-to-space) (deep space)
17.1–17.2 RADIOLOCATION
17.2–17.3 RADIOLOCATION Earth Exploration-Satellite (active) Space Research (active)
17.3–17.7 FIXED-SATELLITE (Earth-to-space) 869 Radiolocation

GHz

ITU ALLOCATION TO SERVICES

Region 1	Region 2	Region 3
17.7–18.1	FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 869 MOBILE	
18.1–18.6	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE 870	
18.6–18.8 FIXED FIXED SATELLITE (space-to-Earth) 872 MOBILE except aeronautical mobile Earth Exploration-Satellite (passive) Space Research (passive) 871	18.6–18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 872 MOBILE except aeronautical mobile SPACE RESEARCH (passive) 871	18.6–18.8 FIXED FIXED-SATELLITE (space-to-Earth) 872 MOBILE except aeronautical mobile Earth Exploration-Satellite (passive) Space Research (passive) 871
18.8–19.7	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE	
19.7–20.2	FIXED-SATELLITE (space-to-Earth) Mobile-Satellite (space-to-Earth) 873	
20.2–21.2	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) Standard Frequency and Time Signal-Satellite (space-to-Earth) 873	
21.2–21.4	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive)	
21.4–22	FIXED MOBILE	

GHz

CANADIAN ALLOCATION TABLE

17.7–18.1	FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 869
18.1–18.6	FIXED FIXED-SATELLITE (space-to-Earth) 870
18.6–18.8	EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 872 SPACE RESEARCH (passive) 871
18.8–19.7	FIXED FIXED-SATELLITE (space-to-Earth)
19.7–20.2	FIXED-SATELLITE (space-to-Earth) Mobile-satellite (space-to-Earth)
20.2–21.2	FIXED-SATELLITE (space-to-Earth) C21 MOBILE-SATELLITE (space-to-Earth) C21 Standard Frequency and Time Signal-Satellite (space-to-Earth)
21.2–21.4	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile SPACE RESEARCH (passive)
21.4–22	FIXED MOBILE

GHz

ITU ALLOCATION TO SERVICES

Region 1	Region 2	Region 3
22–22.21	FIXED MOBILE except aeronautical mobile 874	
22.21–22.5	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) 875 876	
22.5–22.55 FIXED MOBILE	22.5–22.55 FIXED MOBILE BROADCASTING- SATELLITE 877 878	
22.55–23 FIXED INTER-SATELLITE MOBILE 879	22.55–23 FIXED INTER-SATELLITE MOBILE BROADCASTING-SATELLITE 877 878 879	
23–23.55	FIXED INTER-SATELLITE MOBILE 879	
23.55–23.6	FIXED MOBILE	

GHz

CANADIAN ALLOCATION TABLE

22–22.21 FIXED MOBILE except aeronautical mobile 874
22.21–22.5 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) 875 876
22.5–22.55 BROADCASTING-SATELLITE 877 FIXED MOBILE
22.55–23 BROADCASTING-SATELLITE 877 FIXED INTER-SATELLITE MOBILE 879
23–23.55 FIXED INTER-SATELLITE MOBILE 879
23.55–23.6 FIXED MOBILE

GHz

ITU ALLOCATION TO SERVICES

Region 1	Region 2	Region 3
23.6–24	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 880	
24–24.05	AMATEUR AMATEUR-SATELLITE 881	
24.05–24.25	RADIOLOCATION Amateur Earth Exploration-Satellite (active) 881	
24.25–25.25	RADIONAVIGATION	
25.25–27	FIXED MOBILE Earth Exploration-Satellite (space-to-space) Standard Frequency and Time Signal-Satellite (Earth-to-space)	
27–27.5 FIXED MOBILE Earth Exploration-Satellite (space-to-space)	27–27.5 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Earth Exploration-Satellite (space-to-space)	

GHz

CANADIAN ALLOCATION TABLE

23.6–24 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 880
24–24.05 AMATEUR AMATEUR-SATELLITE 881
24.05–24.25 RADIOLOCATION Amateur Earth Exploration-Satellite (active) 881
24.25–25.25 RADIONAVIGATION
25.25–27 FIXED MOBILE Earth Exploration-Satellite (space-to-space) Standard Frequency and Time Signal-Satellite (Earth-to-space)
27–27.5 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Earth Exploration-Satellite (space-to-space)

ITU ALLOCATION TO SERVICES

Region 1	Region 2	Region 3
27.5–29.5	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE	
29.5–30	FIXED-SATELLITE (Earth-to-space) Mobile-Satellite (Earth-to-space) 882 883	
30–31	FIXED-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space) Standard Frequency and Time Signal-Satellite (space-to-Earth) 883	
31–31.3	FIXED MOBILE Standard Frequency and Time Signal-Satellite (space-to-Earth) Space Research 884 885 886	
31.3–31.5	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 887	
31.5–31.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile 888 889	31.5–31.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 888	31.5–31.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile 888

CANADIAN ALLOCATION TABLE

27.5–29.5 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE
29.5–30 FIXED-SATELLITE (Earth-to-space) Mobile-satellite (Earth-to-space) 882
30–31 FIXED-SATELLITE (Earth-to-space) C21 MOBILE-SATELLITE (Earth-to-space) C21 Standard Frequency and Time Signal-Satellite (space-to-Earth)
31–31.3 FIXED MOBILE Standard Frequency and Time Signal-Satellite (space-to-Earth) Space Research 884 886
31.3–31.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 887 888

824 Additional allocation: in Austria, Bulgaria, Cuba, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the bands 8850-9000 MHz and 9200-9300 MHz are also allocated to the radionavigation service on a primary basis.

825 The use of the band 9300-9500 MHz by the aeronautical radionavigation service is limited to airborne weather radars and ground-based radars. In addition, ground-based radar beacons in the aeronautical radionavigation service are permitted in the band 9300-9320 MHz on condition that harmful interference is not caused to the maritime radionavigation service. In the band 9300-9500 MHz, ground-based radars used for meteorological purposes have priority over other radiolocation devices.

826 Different category of service: in Afghanistan, Algeria, Saudi Arabia, Austria, Bahrain, Bangladesh, Cameroon, the Republic of Korea, Egypt, the United Arab Emirates, Ethiopia, Guyana, India, Indonesia, Iran, Iraq, Israel, Jamaica, Japan, Jordan, Kuwait, the Lebanon, Liberia, Malaysia, Nigeria, Pakistan, Qatar, Singapore, Somalia, Sudan, Sri Lanka, Sweden, Thailand, Trinidad and Tobago, and Yemen (P.D.R. of), the allocation of the band 9800-10000 MHz to the fixed service is on a primary basis (see No. 425)

827 Additional allocation: in Bulgaria, Hungary, Mongolia, Poland the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 9800-10000 MHz is also allocated to the radionavigation service on a primary basis.

828 The band 9975-10025 MHz is also allocated to the meteorological-satellite service on a secondary basis for use by weather radars.

829 Additional allocation: in Costa Rica, Ecuador, Guatemala and Honduras, the band 10-10.45 GHz is also allocated to the fixed and mobile services on a primary basis.

830 Additional allocation: in the Federal Republic of Germany, Angola, China, Ecuador, Spain, Japan, Kenya, Morocco, Nigeria, Sweden, Tanzania and Thailand, the band 10.45-10.5 GHz is also allocated to the fixed and mobile services on a primary basis.

831 In the band 10.6-10.68 GHz, stations of the fixed and mobile, except aeronautical mobile, services shall be limited to a maximum equivalent isotropically radiated power of 40 dBW and the power delivered to the antenna shall not exceed -3 dBW. These limits may be exceeded subject to agreement obtained under the procedure set forth in Article 14. However, in Afghanistan, Saudi Arabia, Bahrain, Bangladesh, China, the United Arab Emirates, Finland, India, Indonesia, Iran, Iraq, Japan, Kuwait, the Lebanon, Nigeria, Pakistan, the Philippines, Qatar, Syria and the U.S.S.R.,the restrictions on the fixed and mobile except aeronautical mobile, services are not applicable.

832 In making assignments to stations of other services to which the band 10.6-10.68 GHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy services from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. 343 and 344 and Article 36).

833 All emissions in the band 10.68-10.7 GHz are prohibited, except for those provided for by No. 834.

834 Additional allocation: in Saudi Arabia, Bahrain, Bulgaria, Cameroon, China, Colombia, the Republic of Korea, Costa Rica, Cuba, Egypt, the United Arab Emirates, Ecuador, Hungary, Iran, Iraq, Israel, Japan, Kuwait, the Lebanon, Mongolia, Pakistan, Poland, Qatar, the German Democratic Republic, Roumania, Czechoslovakia, the U.S.S.R. and Yugoslavia, the band 10.68-10.7 GHz is also allocated to the fixed and mobile, except aeronautical mobile, service on a primary basis. Such use is limited to equipment in operation by 1 January 1985.

835 In Region 1, the use of the band 10.7-11.7 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service.

836 In Region 2, in the band 11.7-12.1 GHz, transponders on space stations in the fixed-satellite service may be used additionally for transmissions in the broadcasting-satellite service, provided that such transmissions do not have a maximum e.i.r.p. greater than 53 dBW per television channel and do not cause greater interference or require more protection from interference than the coordinated fixed-satellite service frequency assignments. With respect to the space services, this band shall be used principally for the fixed-satellite service. The upper limit of this band shall be modified in accordance with the decisions of the 1983 regional administrative radio conference for Region 2 (see No. 841).

837 Different category of service: in Canada, Mexico and the United States, the allocation of the band 11.7-12.2 GHz to the fixed service is on a secondary basis (see No. 424).

838 In the band 11.7-12.5 GHz in Regions 1 and 3 the fixed, fixed-satellite, mobile, except aeronautical mobile, and broadcasting services, in accordance with their respective allocations, shall not cause harmful interference to broadcasting-satellite stations operating in accordance with the provisions of Appendix 30.

839 The use of the band 11.7-12.7 GHz in Region 2 by the fixed-satellite and broadcasting-satellite services is limited to national and sub-regional systems and is subject to previous agreement between the administrations concerned and those having services, operating or planned to operate in accordance with the Table, which may be affected (see Articles 11, 13, 14 and Resolution 33).

840 For the use of the band 11.7-12.75 GHz in Regions 1, 2 and 3, see Resolutions 31, 34, 504, 700 and 701.

841 The 1983 regional administrative radio conference for Region 2 will divide the band 12.1-12.3 GHz into two sub-bands. It will allocate the lower sub-band to the fixed-satellite service and the upper sub-band to the broadcasting-satellite, broadcasting, mobile except aeronautical mobile, and fixed services, all services being on a primary basis.

842 Additional allocation: the bands 12.1-12.3 GHz in Brazil and Peru, and 12.2-12.3 GHz in the United States, are also allocated to the fixed service on a primary basis.

843 In the band 12.1-12.7 GHz, the Region 2 space services, existing or planned before the 1983 regional administrative radio conference for Region 2, shall not impose restrictions on the elaboration of the plan for the broadcasting-satellite service in Region 2 and shall be operated under the conditions set forth by that conference.

844 In Region 2, in the band 12.1-12.7 GHz, existing and future terrestrial radiocommunication services shall not cause harmful interference to the space services operating in accordance with the broadcasting-satellite plan to be prepared at the 1983 regional administrative radio conference for Region 2, and shall not impose restrictions on the elaboration of such a plan. The lower limit of this band shall be modified in accordance with the decisions of that conference for Region 2 (see No. 841).

845 In Region 3, the band 12.2-12.5 GHz is also allocated to the fixed-satellite (space-to-Earth) service limited to national and sub-regional systems. The power flux-density limits in No. 2574 shall apply to this frequency band. The introduction of the service in relation to the broadcasting-satellite service in Region 1 shall follow the procedures specified in Article 7 of Appendix 30, with the applicable frequency band extended to cover 12.2-12.5 GHz.

846 In Region 2, in the band 12.3-12.7 GHz, assignments to stations of the broadcasting-satellite service made available in the plan to be established by the 1983 regional administrative radio conference for Region 2 may also be used for transmissions in the fixed-satellite service (space-to-Earth), provided that such transmissions do not cause more interference or require more protection from interference than the broadcasting-satellite service transmissions operating in accordance with that plan. With respect to the space services, this band shall be used principally for the broadcasting-satellite service. The lower limit of this band shall be modified in accordance with the decisions of that conference for Region 2 (see No. 841).

847 The broadcasting-satellite service in the band 12.5-12.75 GHz in Region 3 is limited to community reception with a power flux-density not exceeding -111 dB(W/m^2) as defined in Annex 8 of Appendix 30.

848 Additional allocation: in Algeria, Angola, Saudi Arabia, Bahrain, Cameroon, the Central African Republic, the Congo, the Ivory Coast, Egypt, the United Arab Emirates, Ethiopia, Gabon, Ghana, Guinea, Iraq, Israel, Jordon, Kenya, Kuwait, the Lebanon, Libya, Madagascar, Mali, Morocco, Mongolia, Niger, Nigeria, Qatar, Syria, Senegal, Somalia, Sudan, Chad, Togo, Yemen (P.D.R. of) and Zaire, the band 12.5-12.75 GHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis

849 Additional allocation: in the Federal Republic of Germany, Belgium, Denmark, Spain, Finland, France, Greece, Liechtenstein, Luxembourg, Monaco,Norway, Uganda, the Netherlands, Portugal, Roumania, Sweden, Switzerland, Tanzania, Tunisia and Yugoslavia, the band 12.5-12.75 GHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a secondary basis.

850 Additional allocation: in Austria, Bulgaria, Hungary, Poland, the German Democratic Republic, Czechoslovakia and the U.S.S.R., the band 12.5-12.75 GHz is also allocated to the fixed service and the mobile, except aeronautical mobile, service on a primary basis. However, stations in these services shall not cause harmful interference to fixed-satellite earth stations of countries in Region 1 other than those mentioned in this footnote. Coordination of these earth stations is not required with stations of the fixed and mobile services of the countries mentioned in this footnote. The power flux-density limit at the Earth's surface given in No. 2574 for the fixed-satellite service shall apply on the territory of the countries mentioned in this footnote.

851 The use of the band 13.25-13.4 GHz by the aeronautical radionavigation service is limited to Doppler navigation aids.

852 Subject to agreement obtained under the procedure set forth in Article 14, the band 13.25-13.4 GHz may also be used by the space research service (Earth-to-space) on a secondary basis.

853 Additional allocation: in Bangladesh, India and Pakistan, the band 13.25-14 GHz is also allocated to the fixed service on a primary basis.

854 Additional allocation: in Afghanistan, Algeria, Angola, Saudi Arabia, Bahrain, Cameroon, the Republic of Korea, Egypt, the United Arab Emirates, Finland, Gabon, Guinea, Indonesia, Iran, Iraq, Israel, Jordan, Kuwait, the Lebanon, Madagascar, Malaysia, Malawi, Mali, Malta, Morocco, Mauritania, Niger, Nigeria, Pakistan, Qatar, Syria, Senegal, Singapore, Sri Lanka, Sudan, Sweden, Chad, Thailand and Tunisia, the band 13.4-14 GHz is also allocated to the fixed and mobile services on a primary basis.

855 Additional allocation: in Austria, Bulgaria, Hungary, Japan, Mongolia, Poland, the German Democratic Republic, Roumania, the United Kingdom, Czechoslovakia and the U.S.S.R., the band 13.4-14 GHz is also allocated to the radionavigation service on a primary basis.

856 The use of the band 14-14.3 GHz by the radionavigation service shall be such as to provide sufficient protection to space stations of the fixed-satellite service (see Recommendation 708).

857 Additional allocation: in Afghanistan, Algeria, Angola, Saudi Arabia, Australia, Bahrain, Bangladesh, Botswana, Cameroon, China, the Republic of Korea, Egypt, the United Arab Emirates, Gabon, Guatemala, Guinea, India, Indonesia, Iran, Iraq, Israel, Japan, Kenya, Kuwait, Lesotho, the Lebanon, Malaysia, Malawi, Mali, Malta, Morocco, Mauritania, Niger, Pakistan, the Philippines, Qatar, Syria, Senegal, Singapore, Somalia, Sudan, Sri Lanka, Swaziland, Tanzania, Chad, Thailand and Yemen (P.D.R. of), the band 14-14.3 GHz is also allocated to the fixed service on a primary basis.

858 The band 14-14.5 GHz may be used, within the fixed-satellite service (Earth-to-space), for feeder links for the broadcasting-satellite service, subject to coordination with other networks in the fixed-satellite service. Such use of feeder links is reserved for countries outside Europe and for Malta.

859 The band 14-14.5 GHz is also allocated to the land mobile-satellite service (Earth-to-space) on a secondary basis.

860 Additional allocation: in the Federal Republic of Germany, Austria, Belgium, Denmark, Spain, Finland, France, Greece, Ireland, Iceland, Italy, Jordan, Libya, Liechtenstein, Luxembourg, Norway, the Netherlands, Portugal, the United Kingdom, Sweden, Switzerland, Turkey and Yugoslavia, the band 14.25-14.3 GHz is also allocated to the fixed service on a primary basis.

861 Additional allocation: in Japan, Pakistan, the United Kingdom and Thailand, the band 14.25-14.3 GHz is also allocated to the mobile, except aeronautical mobile, service on a primary basis.

862 In making assignments to stations of other services to which the band 14.47-14.5 GHz is allocated, administrations are urged to take all practicable steps to protect spectral line observations of the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. 343 and 344 and Article 36).

863 The use of the band 14.5-14.8 GHz by the fixed-satellite (Earth-to-space) is limited to feeder links for the broadcasting-satellite service. This use is reserved for countries outside Europe and for Malta.

864 All emissions in the band 15.35-15.4 GHz are prohibited, except those provided for by No. 865.

865 Additional allocation: in Afghanistan, Saudi Arabia, Bahrain, Cameroon, Egypt, the United Arab Emirates, Guinea, Iran, Iraq, Israel, Kuwait, the Lebanon, Libya, Pakistan, Qatar, Syria, Somalia and Yugoslavia, the band 15.35-15.4 GHz is also allocated to the fixed and mobile services on a secondary basis.

866 Additional allocation: in Afghanistan, Algeria, Angola, Saudi Arabia, Austria, Bahrain, Bangladesh, Cameroon, Costa Rica, Egypt, El Salvador, the United Arab Emirates, Finland, Guatemala, India, Indonesia, Iran, Kuwait, Libya, Malaysia, Malawi, Malta, Morocco, Mozambique, Nepal, Nicaragua, Oman, Pakistan, Qatar, Singapore, Somalia, Sudan, Sri Lanka, Sweden, Tanzania, Chad, Thailand, Yemen (P.D.R. of) and Yugoslavia, the band 15.7-17.3 GHz is also allocated to the fixed and mobile services on a primary basis.

867 Additional allocation: in Israel, the band 15.7-17.3 GHz is also allocated to the fixed and mobile services on a primary basis. These services shall not claim protection from, or cause harmful interference to services operating in accordance with the Table in countries other than those included in No. 866.

868 Additional allocation: in Afghanistan, Algeria, the Federal Republic of Germany, Angola, Saudi Arabia, Austria, Bahrain, Bangladesh, Cameroon, Costa Rica, El Salvador, the United Arab Emirates, Finland, Guatemala, Honduras, India, Indonesia, Iran, Iraq, Israel, Japan, Kuwait, Libya, Nepal, Nicaragua, Pakistan, Qatar, Sudan, Sri Lanka, Sweden, Thailand and Yugoslavia, the band 17.3-17.7 GHz is also allocated to the fixed and mobile services on a secondary basis. The power limits given in Nos. 2505 and 2508 shall apply provisionally (see Resolution 101).

869 The use of the band 17.3-18.1 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service.

870 The band 18.1-18.3 GHz is also allocated to the meteorological-satellite service (space-to-Earth) on a primary basis. Its use is limited to geostationary satellites and shall be in accordance with the provisions of No. 2578.

871 In making assignments to stations in the fixed and mobile services, administrations are invited to take account of passive sensors in the earth-exploration satellite and space research services operating in the band 18.6-18.8 GHz. In this band, administrations should endeavour to limit as far as possible both the power delivered by the transmitter to the antenna and the e.i.r.p. in order to reduce the risk of interference to passive sensors to the minimum.

872 In assigning frequencies to stations in the fixed-satellite service in the direction space-to-Earth, administrations are requested to limit as far as practicable the power flux-density at the Earth's surface in the band 18.6-18.8 GHz, in order to reduce the risk of interference to passive sensors in the earth exploration-satellite and space research services.

873 Additional allocation: in Afghanistan, Algeria, Angola, Saudi Arabia, Bahrain, Bangladesh, Brazil, Cameroon, China, the Congo, the Republic of Korea, Costa Rica, Egypt, the United Arab Emirates, Gabon, Guatemala, Guinea, India, Indonesia, Iran, Iraq, Israel, Japan, Kenya, Kuwait, Malaysia, Mali, Morocco, Mauritania, Nepal, Niger, Nigeria, Pakistan, the Philippines, Qatar, Syria, Singapore, Somalia, Sudan, Sri Lanka, Tanzania, Chad, Thailand, Togo, Tunisia and Zaire, the band 19.7-21.2 GHz is also allocated to the fixed and mobile services on a primary basis. This additional use shall not impose any limitation on the power flux-density of space stations in the fixed-satellite service.

874 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the spectral line observations of the radio astronomy service in the band 22.01-22.21 GHz from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. 343 and 344 and Article 36).

875 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference in the band 22.21-22.5 GHz. Emissions from space or airborne stations can be particulary serious sources of interference to the radio astronomy service (see Nos. 343 and 344 and Article 36).

876 The use of the band 22.21-22.5 GHz by the earth exploration-satellite (passive) and space research (passive) services shall not impose constraints upon the fixed and mobile, except aeronautical mobile, services.

877 In Regions 2 and 3, the broadcasting-satellite service is authorized in the band 22.5-23 GHz, subject to agreement obtained under the procedure set forth in Article 14.

878 Additional allocation: in Japan, the band 22.5-23 GHz is also allocated to the broadcasting service on a primary basis.

879 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the spectral line observations of the radio astronomy service in the bands 22.81-22.86 GHz and 23.07-23.12 GHz from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. 343 and 344 and Article 36).

880 All emissions in the band 23.6-24 GHz are prohibited.

881 The band 24-24.25 GHz (centre frequency 24.125 GHz) is designated for industrial, scientific and medical (ISM) applications. Radiocommunication services operating within this band must accept harmful

interference which may be caused by these applications. ISM equipment operating in this band is subject to the provisions of No. 1815.

882 The band 29.95-30 GHz may be used for space-to-space links in the earth exploration-satellite service for telemetry, tracking, and control purposes, on a secondary basis.

883 Additional allocation: in Afghanistan, Saudi Arabia, Bahrain, Cameroon, China, the Republic of Korea, the United Arab Emirates, Ethiopia, India, Indonesia, Iran, Iraq, Israel, Japan, Kenya, Kuwait, the Lebanon, Malaysia, Mali, Morocco, Mauritania, Nepal, Pakistan, Qatar, Syria, Singapore, Somalia, Sudan, Sri Lanka, Chad and Thailand, the band 29.5-31 GHz is also allocated to the fixed and mobile services on a secondary basis. The power limits specified in Nos. 2505 and 2508 shall apply.

884 In the band 31-31.3 GHz the power flux-density limits specified in No. 2542 shall apply to the space research service.

885 Different category of service: in Bulgaria, Cuba, Hungary, Mongolia, Poland, the German Democratic Republic, Czechoslovakia and the U.S.S.R., the allocation of the band 31-31.3 GHz to the space research service is on a primary basis (see No. 425).

886 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference in the band 31.2-31.3 GHz. Emissions from space or airborne stations can be particulary serious sources of interference to the radio astronomy service (see Nos. 343 and 344 and Article 36).

887 All emissions in the band 31.3-31.5 GHz are prohibited.

888 In Regions 1 and 3, in making assignments to stations of other services to which the band 31.5-31.8 GHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (See Nos. 343 and 344 and Article 36).

In Region 2, all emissions in the band 31.5-31.8 GHz are prohibited.

889 Different category of service: in Bulgaria, Egypt, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the allocation of the band 31.5-31.8 GHz to the fixed and mobile, except aeronautical mobile, services is on a primary basis (see No. 425).

890 Different category of service: in Australia, Spain and the United States, the allocation of the band 31.8-32.3 GHz to the space research service (deep space) in the space-to-Earth direction is on a primary basis (see

CANADIAN FOOTNOTES

C1 Users of frequencies below 9 kHz shall ensure that no harmful interference is caused to the services to which the bands above 9 kHz are allocated.

C2 Scientific researchers using frequencies below 9 kHz are urged to advise the Department in order that such research may be afforded all practicable protection from harmful interference.

C3 Provided no harmful interference is caused to the maritime mobile service, the frequencies between 2065 kHz and 2107 kHz may be used by stations of the fixed service communicating only within Canada's national borders, and whose mean power does not exceed 50 watts.

C4 Provided no harmful interference is caused to the maritime mobile service, the bands 6200-6213.5 kHz and 6220.5-6525 kHz may be used exceptionally by stations of the fixed service communicating only within Canada's national borders, and whose mean power does not exceed 50 watts.

C5 For the exlusive use of the Government of Canada.

C6 The band 10100-10150 kHz is allocated to the fixed service on a primary basis worldwide. In Canada, the band is allocated exclusively to the Amateur service. Canadian Amateur operations shall not cause interference to fixed service operations of other administrations and if such interference should occur, the Amateur service may be required to cease operations. The Amateur service in Canada may not claim protection from interference by the fixed service operations of other administrations.

C7 Subject to agreement obtained under the procedure set forth in Article 14, the bands 235-322 MHz and 335.4-399.9 MHz may be used by the mobile-satellite service.

C8 Radio astronomy observations are carried out in the band 322 - 328.6 MHz and such operations will be protected from interference to the extent possible.

C9 The allocation to the mobile-satellite except aeronautical mobile-satellite service (Earth-to-space) on a primary basis in the bands 405.5-406 MHz and 406.1-410 MHz is subject to agreement obtained under the procedure set forth in Article 14.

C10 On the condition that harmful interference is not caused to the mobile or the fixed services, the Department may authorize frequencies between 420 and 430 MHz for use on a non-protected basis by the radiolocation service in coastal and off-shore regions of Canada where such radiolocation operations may not be fully accommodated in the 430-450 MHz frequency band.

C11 Television broadcast stations licensed prior to January 1, 1979, to operate in the frequency band 806-890 MHz (channels 70 to 83) will continue to operate on a primary basis until their reassignment to a lower frequency.

C12 The use of the band 2310-2390 MHz by the aeronautical mobile service for telemetry has priority over other uses in the mobile service.

C13 Government of Canada radars may continue to operate in the band 2550-2690 MHz on a non-interfering basis.

C14 Maritime radionavigation operations in this band are limited to shore based radars.

C15 The allocation to the fixed-satellite and mobile-satellite services in this band are designated for the exclusive use of the Government of Canada.

C16 Users are urged, in their planning of operations in the band 10.7-10.95 GHz for the fixed-satellite service, to give all practicable protection to the passive operations in the adjacent band 10.6-10.7 GHz.

C17 In the band 11.7-12.2 GHz, transponders on space stations in the fixed-satellite service may be used additionally for transmissions in the broadcasting-satellite service, provided that such transmissions do not have a maximum e.i.r.p. greater than 53 dBW per television channel and do not cause greater interference or require more protection from interference than the coordinated fixed-satellite service frequency assignments. With respect to the space services, this band shall be used principally for the fixed-satellite service.

C18 In the band 12.2-12.7 GHz, existing and future terrestrial radiocommunication services shall not cause harmful interference to the space services operating in accordance with the broadcasting-satellite plan to be prepared at the 1983 Regional Administrative Radio Conference for Region 2, and shall not impose restrictions on the elaboration of such a Plan.

C19 In the band 12.2-12.7 GHz, space services, existing or planned before the 1983 Regional Administrative Radio Conference for Region 2, shall not impose restrictions on the elaboration of the Plan for the broadcasting-satellite service in Region 2 and shall be operated under the conditions set forth by the conference.

C20 In the band 12.2-12.7 GHz, assignments to stations of the broadcasting- satellite service made available in the Plan to be established by the 1983 Regional Administrative Radio Conference for Region 2 may be used for transmissions in the fixed-satellite service (space-to-Earth), provided that such transmissions do not cause more interference or require more protection from interference than the broadcasting-satel-

lite service transmissions operating in accordance with that Plan. With respect to the space services, this band shall be used principally for the broadcasting- satellite service.

C21 The allocations to the fixed-satellite and mobile-satellite services or a portion of these allocations will be designated for the exclusive use of the Government of Canada.

C22 In the band 164-168 GHz, all emissions are prohibited.

C23 The bands 250-251 GHz and 262.24-262.76 GHz are also allocated to the radioastronomy service on a primary basis for spectral line observations.

C24 In the band 250-252 GHz all emissions are prohibited.

APPENDIX 3

NOTICE PUBLISHED IN THE

CANADA GAZETTE, PART I

DEPARTMENT OF COMMUNICATIONS

RADIO ACT

Notice No. DGTP-005-84/DGTR-008-84

Proposed Utilization of the Radio Spectrum in the Range 10.68-31 GHz by the Fixed and Fixed Satellite Services

The intent of this notice is to announce the release of the above noted document and begin the process of public consultation on the proposals it contains. This policy review is intended to develop a spectrum utilization policy for the fixed and fixed satellite services from 10.68 to 31 GHz. Two stages are envisaged in this review. Stage 1, this paper, contains a mixture of policy proposals and policy alternatives for public comment. After the evaluation of public comment on this paper and of reply comments and the formulation of a final position, stage 2 will consist of the publication of a final policy. It should be noted that this spectrum utilization policy review does not affect or alter in any way the Canadian table of frequency allocations; changes to that document, resulting from international conferences or domestic need, will be dealt with as necessary in future and separate proceedings.

Since the Department intends to issue spectrum utilization policies based on this consultation for as many of the bands as possible, the public is encouraged to submit detailed comments. This will ensure that all interested parties are fully informed of all points of view expressed in the comments, and can then address these in reply comments if they so wish.

The Department now invites written submissions from all interested parties on the proposed spectrum utilization for the frequency bands between 10.68-31.0 GHz. This public consultation document may be obtained from Information Services, Department of Communications, 300 Slater Street, Ottawa, Ontario, K1A 0C8 (phone 613-995-8883) or from Departmental Regional Offices in Moncton, Montreal, Toronto , Winnipeg and Vancouver.

Submissions should be addressed to the Director General, Telecommunications Policy Branch, Department of Communications, 300 Slater Street, Ottawa, Ontario K1A 0C8 and to ensure consideration, must be postmarked on or before August 31, 1984 or received by other means by the same date. All representations must cite the Canada Gazette Part I publication date and the Notice reference number.

Interested parties are encouraged to review submitted comments and submit, as they feel necessary reply comments on any point or issue raised. These reply comments must be addressed as in the paragraph above, cite the Canada Gazette Part 1 publication date, the notice reference number and must be postmarked on or before September 30, 1984 or received by other means by the same date.

Comments and reply comments received in response to this Notice will be made available for public viewing at the Department of Communications Library, 300 Slater Street, Ottawa for a period of one year from the close of the reply comment period, and at the Regional Offices of the Department in Moncton, Montreal, Toronto, Winnipeg, and Vancouver for a period of six months from the close of the reply comment period.

Dated at Ottawa, this 12th day of March, 1984.

N. Ahmed
Director
Engineering Programs
Telecommunications Regulatory Service
Department of Communications

V. Hill
Director General
Telecommunications Policy Branch
Department of Communications