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A discussion paper on Canadian spectrum allocations in the 406-960 MHz frequency band

Government of Canada
Department of Communications

Gouvernement du Canada
Ministère des Communications

A DISCUSSION PAPER ON CANADIAN SPECTRUM ALLOCATIONS IN THE 406-960 MHz FREQUENCY BAND

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A Discussion Paper on Canadian Spectrum Allocations in the 406-960 MHz Frequency Band

I INTRODUCTION

The Department of Communications is reviewing the spectrum allocations in the 406-960 MHz frequency band with a view to providing adequate spectrum for all of the radio services using that band. Policies for this band will provide a basis for the Canadian position at the 1979 World Administrative Radio Conference (WARC). On August 21, 1976, by notification in the Canada Gazette, the Department invited submissions, and comments on these submissions, from interested parties concerning spectrum allocations in Canada in the 406-960 MHz frequency band. Briefs and comments submitted to the Department are available for viewing in the Department of Communications' library, 300 Slater Street, Ottawa.

This paper briefly outlines and discusses the issues raised in the submissions made to the Department and proposes a policy to satisfy Canada's domestic spectrum requirements in this band. Background reports and references used in the preparation of this document can also be viewed in the DOC library. The Department invites comments on the proposed policy following the instructions given in the notice to be published in the Canada Gazette December 17, 1977. (See Appendix "A")

II BACKGROUND

The Canadian Table of Frequency Allocations for the 406-960 MHz band, as shown in Appendix "B", contains allocations to the amateur, broadcasting, fixed, mobile, radio astronomy, mobile-satellite and radiolocation services and to Industrial-Scientific-Medical (ISM) usage. In addition, footnotes permit the use of various space operations.

The extent of use of the 406 to 960 MHz band varies among services and regions of the country. In general, however, only the land mobile and broadcasting services are experiencing congestion and then only in certain major urban centres. Studies undertaken by the Department confirm the need for additional spectrum allocations for land mobile to meet mobile needs in certain Canadian cities. Due to the large allocation of spectrum in the UHF band available to the broadcasting service, compared to that available to other services, attention has focused on alternate uses of portions of this band to alleviate the developing problems of land mobile congestion. Alternatives are complicated by the fact that the most pronounced demands for land mobile tend to occur in those urban areas where the supply of spectrum for additional television services is most limited.

In the late 1960s, and well before land mobile congestion became an issue in Canada, saturation of available allocations to this service had been

encountered in several cities in the United States. After exhaustive deliberation over many years, the Federal Communications Commission (FCC), in 1974, selected two courses of action to solve the U.S. land mobile spectrum shortage problem. In the short-term, FCC docket 18261 allowed immediate sharing of certain UHF TV channels from channel 14 to channel 20 (i.e., 470 to 512 MHz) in 13 selected major metropolitan areas. Often referred to as "holes", these channels are ones which cannot be used for television in those areas under their present channel allocation plan as a result of restrictions known as "taboos", which result from present UHF TV receiver characteristics. For the longer term, the FCC, in docket 18262, reallocated on a nation-wide primary basis UHF TV channels 70 to 83 (806 to 890 MHz) plus 890 to 902 MHz and 928 to 947 MHz to the land-mobile service. A large portion of this spectrum will be used for the cellular public mobile telephone system currently under development in the U.S.

In 1974, the Canadian Radio Technical Planning Board (CRTPB) submitted a report to the Department on the use of the 470 to 960 MHz band in Canada. In brief, the CRTPB recommended that Canada adopt largely the same allocation plan as that adopted by the U.S. (i.e., to reallocate the top 14 UHF TV channels, to allow land mobile/fixed service sharing of 806-960 MHz and to allow land mobile/broadcasting/fixed service sharing of UHF TV channels 14 to 20). It went further and proposed a means whereby certain actions could be taken to increase the number of usable TV channels possible below channel 70. Its proposal, simply stated, was that television receivers could, through improved design, be manufactured so that several of the existing "taboos" could be reduced.

The matter of "taboos" is quite complex but for the purpose of this paper may be briefly explained as follows. At present, only a limited number of television stations may be assigned in a given area in the UHF television band. For each assignment made in a specific city, up to a maximum of 19 channels may be rendered unusable over specified distances from the given assignment. All but one of these "taboos" are due to the technical performance of TV receivers equipped to receive UHF channels which are now available on the domestic market. Improvements in the performance of television receivers could permit the reduction of some of the "taboos" and thus permit the employment of TV channels which cannot now be used permitting new flexibility in UHF TV channel assignment planning and facilitating the accommodation of more TV channels in a given block of spectrum. The net effect would be to improve the utilization efficiency of the UHF broadcasting spectrum.

III FACTORS CONSIDERED IN THE DEVELOPMENT OF A PROPOSED POLICY

A listing of the parties submitting comments and reply comments to the August 21, 1976, notice in the Canada Gazette is given in Appendix "C". Although all comments and reply comments have been considered, and will continue to receive attention as further domestic policy is being developed, no attempt will be made to summarize their content in this document. Instead, the following discussion deals with those major points

which have arisen in the briefs and in particular comments on those issues on which there is substantial disagreement.

1. Broadcasting

In Canada, the entire UHF TV spectrum from channel 14 to 83 (except channel 37) has been utilized for regular television channel allocations[1]. The demand for new broadcasting stations has been increasing every year and this has steadily diminished the number of available channels. In southern Ontario, there are several locations where no more additional allocations can be found using present criteria. In the current Canadian Television Allocation Plan, there are a significant number of channel 70 to 83 allocations in Canada and some assignments have already been made for these channels which, in the U.S., have been reallocated to land mobile. Channels 70 to 83 were largely reserved for low power translators in the U.S.

Retention of the existing broadcasting allocations is strongly supported in briefs from the Canadian Association of Broadcasters (CAB), the Canadian Broadcasting Corporation (CBC), the Agency for Tele-Education in Canada (ATEC), the Ontario Educational Communications Authority (OECA) and others. The Canadian Radio-television and Telecommunications Commission (CRTC), at the request of the Department has also provided a report entitled "UHF Broadcasting Spectrum Requirements for Canada: A Long-Range Forecast"[2]. This report forecasts substantial additional TV service requirements beyond those currently accommodated in the UHF and VHF allocation plans.

The arguments in favour of the retention, and even the possible expansion of the broadcasting spectrum, are based in part upon the unique requirements of Canadian broadcasting (as compared to the U.S.) for bilingual, multicultural, educational, commercial and public services. The CBC made reference to its mandate under the Broadcasting Act, pointing out that the Corporation interprets the Act to say that "CBC spectrum requirements merit 'paramount consideration'".

In brief, the broadcasters have indicated a requirement, in most communities, for a number of basic services including CBC English and French, educational and one commercial service. Further, the CRTC report forecasts, over the next 25 years, a demand for "off-air" local television services of from four in smaller communities to a high of 14 in Montreal. To this forecast, it may be necessary to add further requirements for future FM aural broadcasting. The forecasts do not, however, take into account technological changes, such as broadcasting satellites, nor potential changes in social patterns which might alter the traditional television viewing habits of the public.

2. Mobile Radio

In Canada's major urban centres, the users are already facing congestion in the present bands allocated to the land mobile service.

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[1] Satellite broadcasting is permitted within a portion of the UHF television band (620 to 790 MHz) but for several reasons, including the extent of terrestrial UHF broadcasting in North America, serious consideration has not been given to satellite broadcasting at these frequencies.

[2] Available by mail from Printing and Publishing, Supply and Services Canada, Ottawa. K1A 0S9 - Catalogue No. BC92-14/1977/SBN 0-660-01446-7

Several technical solutions such as the use of more closely spaced channels and the use of frequencies mid-way between normally spaced channels have been and are being applied to alleviate the situation. The Department has initiated special spectrum management techniques aimed at further improving the selection and assignment of land mobile channels.

Briefs in support of providing additional spectrum for land mobile were received from a wide range of interests including small businessmen, school boards, commercial users, manufacturers and telecommunications common carriers. The spectrum demands for land mobile were justified on the basis of growth requirements and economic benefits. The latter included energy, time and capital conservation, management and cost control, safety and security of goods in transit, and productivity and employment. Growth figures of 10 to 12 per cent annually were predicted based on historical trends leading to saturation of the existing land mobile allocations in major urban centres by the early to mid-1980s. Needs for the year 2000 were quantified to 129 MHz of spectrum by the Electrical and Electronic Manufacturers Association of Canada (EEMAC) although another industry spokesman, Canadian Motorola, considered this figure too conservative. More specifically, the Canadian Telecommunications Carriers Association (CTCA) requested 40 MHz for new technology cellular mobile telephone systems.

In general, the land mobile supporters advocated the sharing of the lower UHF TV band (470 to 512 MHz) with fixed and broadcasting services, and the exclusive allocation of the upper portion of that band (806 to 890 MHz) for fixed and land mobile services. Studies confirm the need for additional spectrum for land mobile and, in fact, a shortage of mobile channels in Toronto is a reality today. However, the dramatic developments in mobile technology (digital, cellular, etc.) promise to provide spectrum-efficient techniques in the future which may reduce the amounts of spectrum as forecasted with today's knowledge.

The future of the General Radio Service has not appeared as a major factor in the 406-960 MHz briefs. However, in the United States consideration is being given to future personal radio services in the 900 MHz band. In view of the widespread public appeal of these kinds of services, and the rate at which social adaptation to personal radio services is taking place, consideration will need to be given to the development of similar services in Canada.

3. Fixed

Fixed service allocations in the 406-960 MHz band are employed by a diverse group of users for low capacity point-to-point systems, particularly in rural areas. As can be seen from the present Table of Frequency Allocations in Appendix "B", the fixed service shares the 410-420 MHz band with the mobile service on either a primary or

secondary basis, depending upon the location within this band. The fixed service is secondary to the mobile service in the 450-470 MHz band, but Broadcast Studio Transmitter Links (STLs) are given primary status by footnote in the bands 450.0-451.0 MHz and 455.0-456.0 MHz. In the 890-960 MHz band, the fixed service is exclusively allocated 942-960 MHz and shares on a primary basis 890-942 MHz with the radiolocation service. Radio systems operating in 902-928 MHz must accept any interference from ISM equipment. Also, the space research service may operate in the 900-960 MHz band on a secondary basis for experimental purposes. In Canada, FM STLs are assigned frequencies in the 956-960 MHz band.

Briefs in support of the fixed service were presented by the telecommunications common carriers, industrial associations and broadcasters (for STLs). The CTCA expressed the need for fixed links in the 406.1-420 MHz and 450-470 MHz bands although recognizing potential problems near the U.S. border. It also proposed sharing the 806-890 MHz band with mobile if this band was reallocated. EEMAC, Canadian Radio Common Carriers Association (CRCCA) and two manufacturers favoured the retention of the fixed services in the 890-960 MHz band on a shared basis.

The CBC has proposed the continuation, on a primary basis for STLs, in the two sub-bands 450.0-451.0 MHz and 455.0-456.0 MHz and the addition of Remote Pickups for broadcast use in these bands. They also propose that high quality audio Studio Transmitter Links in the sub-band 956-960 MHz be given primary status.

4. Amateur

In the International Telecommunication Union (ITU) Regions 2 and 3, the amateur service shares the 420-450 MHz band on a secondary basis to the radiolocation service. (In ITU Region 1, the band limits for amateur operations are 430 to 440 MHz.) Frequencies in this band are employed for simplex and repeater operation, repeater linking and control, satellite communication, fast scan television and "moon bounce" with a major part of the activity by Canadian amateur taking place above 430 MHz.

The amateur service was supported by the Canadian Amateur Radio Federation (CARF) which recommended the exclusive allocation on a world-wide primary basis of the 430-440 MHz band, and the retention on a secondary basis of the 420-430 MHz and 440-450 MHz bands in Regions 2 and 3. The Canadian Radio Relay League (CRRL) requested the extension of the frequency band covered by the footnote permitting amateur satellite operations over the entire 420-450 MHz band. Some non-amateur interests recommended the reduction but not the total elimination of the amateur allocation. The CRRL also requested the reallocation on a secondary basis of the band 902-928 MHz to the amateur service.

5. Radiolocation

Radiolocation has primary status in the 420-450 MHz band. It also shares the 890 to 942 MHz band with the fixed service, both services having a primary status. Present radiolocation operations in these bands in Canada are minimal. However, one brief and subsequent correspondence related to WARC activities reveal the possibility of significant increases in domestic radiolocation particularly in the 430-450 MHz band.

6. Radio Astronomy

The radio astronomy service has allocations in two portions of the 406 to 960 MHz band. The band 406.1 to 410 MHz in ITU Region 2 is allocated to the fixed, mobile (except aeronautical mobile) and radio astronomy services. Although all of these services are on a primary basis, under footnote 233B, administrations are "urged to take all practicable steps to protect radio astronomy observations from harmful interference". In the Canadian Table of Frequency Allocations, this band is allocated to the radio astronomy service only. In the UHF broadcasting band, UHF TV channel 37 (608 to 614 MHz) is reserved exclusively for the radio astronomy service until the first Administrative Radio Conference after January 1, 1974, which is competent to review this provision. The 1979 World Administrative Radio Conference will have this competence.

The 406.1-410 band is for continuum observations (i.e., observations which must be made at intervals throughout the entire spectrum), at Lake Traverse, Ont., and Penticton, B.C. In the U.S., mobile stations in the government service have been permitted in this band, although they are prohibited from certain areas to protect the radio astronomy service. This has given rise to the suggestion that action might be taken in Canada to permit land mobile into this band on the basis of non-interference with radio astronomy and preliminary technical studies have shown this to be feasible. The National Research Council/Canadian Astronomical Society has cautioned that any sharing of this allocation with other services should be accompanied by a separation distance of 200 miles ($-189 dBw/m^2$) to protect the radio astronomy operations.

Several briefs have commented on the use of TV channel 37 for the radio astronomy service. The CBC noted that, if radio astronomy continues to have exclusive use of this channel, then it should be removed from the television allocation plan and the other channels rearranged in the television plan for optimum utilization.

7. Industrial, Scientific and Medical (ISM)

By footnote 340 in the International Table of Allocations (Region 2 only), the band 902 to 928 MHz is designated for ISM purposes. While

fixed and radiolocation services may operate within this band, they must accept any interference that may result from ISM equipment. The extent of ISM operations is difficult to quantify as these devices are not licensed by the Department. Microwave ovens and industrial drying equipment operate in this band. However, the use by home microwave ovens is thought to be small as most of these devices employ higher-frequency ISM bands. The use of ISM, and the possibilities of sharing with other services, are matters that will require further attention.

8. Space Services

Several footnotes now exist between 406 and 960 MHz which permit space telecommand, space research, space operations, meteorological-satellite, earth exploration-satellite and broadcasting satellite services.

The government has been studying the concept of an operational multi-service UHF satellite system, operating below 400 MHz, to satisfy government requirements. Use of such a system by the private sector in remote areas of Canada is desirable and could be achieved by an increase in spectrum allocations to the mobile-satellite service in the vicinity of 400 MHz. A mobile-satellite system of the type envisaged could share spectrum with terrestrial mobile services and the uplink frequencies could share with radio astronomy.

The operational multi-service UHF Satellite now being planned may be the forerunner of future systems operating in bands above 400 MHz. A preference has been indicated for 602-620 MHz and 806-824 MHz as uplink and downlink frequencies respectively.

9. Aeronautical and Maritime Mobile

Requirements have been identified for maritime mobile and maritime mobile-satellite to accommodate the growth now being experienced in the 156-174 MHz band. In addition, it has been proposed that the band 806-890 MHz be reallocated to the mobile service with the distinct understanding that maritime mobile requirements such as distress and safety, using satellite communication techniques where necessary, would be met in this band.

10. Views of Provincial Governments

Briefs from provincial governments, in addition to commenting on the services described above, have raised a number of issues. It was pointed out that the requirements in the UHF band cannot be viewed in isolation from those in the VHF band, since many of the services use both bands. Sharing of some of the broadcast band with land mobile and fixed services was proposed, provided that such sharing does not result in a reduction of TV allocations. In this connection, the

improvement of TV receivers and an equitable sharing of allocations between the U.S. and Canada within the co-ordination zone was recommended. Finally, the Department was reminded that any reallocation policy must be sufficiently flexible in its implementation to allow for regional and provincial differences.

11. 1979 World Administrative Radio Conference

There is a direct relationship between the domestic spectrum policy considerations in the 406 to 960 MHz band and the Canadian preparations for the 1979 ITU World Administrative Radio Conference (WARC) at which time the entire International Table of Frequency Allocations will be open to revision. The national policy which is formulated for this portion of the UHF spectrum will form an important contribution to the Canadian position for this conference. It is important to note that, while countries attempt to have their domestic tables of allocations in agreement with the International Table, any nonconforming use of the spectrum must not interfere with services operating in accordance with the International Table.

IV CONCLUSIONS

Consideration of the foregoing factors and other points raised in briefs and comments submitted to the Department leads to the following conclusions:

1. The predicted demands for spectrum to the end of the decade in the band 406-960 MHz greatly exceed the amount of spectrum available;

2. The predicted demands are largely based on existing patterns of usage of the radio frequency spectrum;

3. Technological and social changes can be expected to alter the pattern of usage of the radio frequency spectrum and create an uncertain environment within which to make long-term domestic spectrum allocations. Predictions, while useful, cannot be taken as necessarily indicative of future needs;

4. There is an immediate problem to be resolved to meet the short-term requirements of the land mobile service in urban areas;

5. Because of the uncertain environment, a domestic spectrum allocation providing the maximum flexibility to chose among emerging options is in the best interest of Canada.

V DEVELOPMENT OF A POLICY

A. Discussion

Based on the preceding conclusions, the Department has developed an

approach to formulating a policy which would provide spectrum allocations to satisfy Canadian requirements with minimal disruption to existing users of the spectrum.

1. Broadcasting

Attention had already been focussed on the fact that poor receiver design has caused the imposition of allocation "taboos", or restraints, which have resulted in the comparatively inefficient use of the UHF broadcasting spectrum. The Department has therefore explored various ways by which the present number of usable channels shown in the allocation plan could be accommodated more efficiently in a smaller block of spectrum. Some techniques such as the use of high, medium and low power transmitters, combined with a partial reduction of "taboos" would permit substantially the same number of TV allocations to be accommodated in the reduced 470-806 MHz band. However, the elimination of "taboos" would permit virtually all present and forecast service requirements to be accommodated in spectrum now available for TV broadcasting at VHF and from 470 to 806 MHz at UHF. A reduction in "taboos" (but not necessarily a total elimination) combined with new allocation techniques would permit, as a minimum, the present number of usable channels to be accommodated.

In August of this year, a spokesman for Texas Instruments, at a discussion on broadcasting and new technologies of the House Communications Subcommittee in the United States, indicated that Texas Instruments has developed a prototype of a new TV set. This set, developed as a result of a contract with the FCC, is claimed to meet the FCC's goals of high performance in interference reduction and increased sensitivity. Were such a receiver to become available, reductions in "taboos" would be quite feasible. Even without such a receiver, reduction in some "taboos" appears to be quite possible. Studies on this matter have been made available to the broadcasting industry.[3] The Department anticipates that further clarification on this complex issue can be obtained during the period of consultation on this proposed policy and would welcome views on the matter.

Channels gained as a result of reductions in taboos can only be used if the existing TV Allocation Plan is modified. Modifications in the Plan would permit a more effective use of the spectrum available to broadcasters and, from a spectrum policy viewpoint, this is a desirable objective. The problem, then, is to provide a balance between the objective of spectrum efficiency and the need to provide maximum benefits (with minimum disruption) to the broadcasters. If all reasonable requirements for broadcasting could be accommodated in the "taboo free" spectrum 470-806 MHz, this would provide the opportunity, in the long term, to permit use of the 806-890 MHz band for other spectrum-dependent services. Accommodation of broadcasting in a reduced spectrum should, however, permit the broadcasters access to all of the spectrum in the band 470-806 MHz, including all channels which become

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[3] Available in the DOC H.Q. Library, Ottawa.

available as a result of reduced "taboos". The sole exception to this is the band 608-614 MHz (TV Channel 37) which is now shown in the Canadian Table of Frequency Allocations as radio astronomy. In view of Canada's international role in the field of radio astronomy, the Department proposes that this allocation remain unchanged. With this exception, the band 470-806 MHz should be retained exclusively for broadcasting. The Department is unable to agree with those briefs recommending the addition or sharing of other services in this band.[4]

2. Mobile Radio

The Department recognizes the need for immediate relief of land mobile congestion in urban areas. Additional spectrum for this service cannot immediately be provided within 470-890 MHz, for reasons already outlined. The spectrum from 890-960 MHz is now heavily used by the fixed service and, in any event, allocation changes in that band cannot be made until the future spectrum needs for the General Radio Service or new personal radio services become clearer.

From 406 to 470 MHz, two options are available. The first is to extend the existing 450-470 MHz mobile band. It cannot be extended upwards because of the broadcasting allocations and extending downwards would conflict with amateur usage of the 430-450 MHz band and with the potential growth of radiolocation. The second option is to extend the existing 410-420 MHz band. An extension downwards to 406.1 is possible provided acceptable sharing criteria can be worked out with the radio astronomy service. Such an extension could also be used for mobile satellite. An extension upward to 430 MHz does not conflict with any major Canadian usage and a proposal has already been made in the Canadian first draft WARC proposals to reallocate the 420-430 MHz band to mobile (except aeronautical) and fixed services.

In the longer term, into the 1980s and beyond, the Department is faced with a problem of allocating sufficient spectrum to permit both the continued growth of conventional mobile systems and the evolution of sophisticated new forms of mobile services. Failure to provide sufficient flexibility in the Canadian Table of Frequency Allocations for such developments would make it difficult, perhaps impossible, to satisfy future public demand for such services. Some of these, such as cellular radio-telephone systems and digital radio are already under development. In view of the potential for reduction of TV "taboos", and the allocations made domestically in the U.S., the band 806-890 MHz becomes particularly attractive to serve these needs and could also be used for future generations of mobile satellites.

As has already been noted, current spectrum predictions for the land mobile services will undoubtedly need to be revised to reflect the rapid changes in the technology becoming available to

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[4] Studies are now underway in the Department into the possible addition of broadcasting or mobile-satellite to the 608-614 MHz band. In the event that mobile-satellite (earth-to-space) could be accommodated, the corresponding space-to-earth downlink would be in the 806-890 MHz band.

these services. The Department is therefore led to the conclusion that it is premature to allocate new spectrum to mobile for the longer term. However, to provide flexibility, so that the option of allocating spectrum to the best use can be made when the need is clearer, it is proposed that the 806-890 MHz band be placed on reserve. This will allow the Department to evaluate the options in light of developments over the next few years affecting radio services and, in particular, the broadcasting and mobile services. Clearly, it will be necessary, in order to retain flexibility for future domestic use, to establish sharing schemes in Canada/US border areas which will not unduly restrict the future options for Canada.

3. Other Services

The Department is continuing to study the needs of the fixed service and will consider, among other options, the possibilities of sharing this service with other services in the 806-890 MHz band on a geographic sharing basis. Also under consideration is the addition of fixed service in the domestic table in the 406.1-410 and 420-430 MHz bands. This would include, among other things, consideration of spectrum for STL and remote pickups for broadcast use. It should be noted that the Department is now reviewing the fixed service allocations in the 1-10 GHz band and is also studying matters concerning sub-allocations in Canadian usage of the radio frequency spectrum. Both of these activities can be expected to deal with questions of concern to users of the fixed services.

Recognizing the difference in ITU regional allocations to the amateur service, the Canadian first draft proposals for the 1979 WARC have already proposed the deletion of amateur between 420-430 MHz and the upgrading to a primary basis of amateur in the 430-450 MHz band. It now appears unlikely that radiolocation and amateur can share on a primary basis and it is therefore necessary to retain the present secondary amateur allocation in the 430-450 MHz band, resulting in a net loss to the amateur service of 10 MHz. The Department is proposing, however, an amateur allocation on a secondary basis, of the band 902-928 MHz. Such an allocation might provide for new types of uses such as digital and packet radio techniques, which might appeal to a wider public than is now possible in the amateur service.

The use of radiolocation, as has been noted, is expected to grow in the future and it is proposed therefore to retain that service as primary in the 430-450 MHz band. Its use in 420-430 MHz is, however, subject to further review and it is proposed to reduce that service to secondary states in 890-942 MHz.

As mentioned earlier, the radio astronomy service is proposed as primary in 608-614 MHz and it is also proposed to retain this service in its primary status in 406.1-410 MHz although on a shared but protected basis with mobile and mobile-satellite. The latter, because of its ability to share with mobile, is accorded spectrum by footnote in the 806-890 MHz band.

Provision of spectrum allocations for the aeronautical and maritime mobile services involve international considerations which will require further examination. Certain issues concerning sub-allocations will be addressed as part of the Department's ongoing review of this topic.

B. Objectives

Based upon presently available information, it appears that spectrum in the 406-960 MHz band in Canada can be reallocated in an optimum manner if the objectives described below can be achieved. The Department is satisfied that these objectives are both feasible and reasonable, and is prepared to take the necessary steps to move toward their realization.

1. To provide for a more efficient use of the television broadcasting spectrum by revising the existing "taboos" to reflect present day TV receivers' performance and, at the same time, incorporating new TV allocation techniques. Further, to bring about the introduction of a TV receiver of improved design which would virtually eliminate the present day UHF "taboos" and result in a substantial increase in usable channels in a reduced UHF broadcast band;

2. To provide a Canada/U.S. television allocation plan so that, at least as a minumum, the same number of UHF-TV allocations will be maintained in a reduced broadcasting band as is presently available in each locality in the existing UHF broadcasting spectrum. Such a plan would be reflected in a suitable Canada/U.S. understanding, similar to the present working arrangements;

3. To provide an equitable sharing scheme for any spectrum reallocated by the Department to mobile service use in the border vicinity. Such a scheme must be based on a reservation of spectrum for eventual use by either country, not on a "first-come-first-served" basis.

It is proposed, to facilitate the attainment of these objectives and to protect the reserve status of the spectrum affected, that no new technical certificates will be granted for broadcasting stations in the 806-890 MHz band except in those cases where channels are unavailable in the 470-806 MHz band at the location requested. Such new assignments as well as the assignments of existing stations will be protected for a period of up to 10 years from a date to be established after the introduction of a new TV allocation plan based upon improved TV receivers. Such a TV allocation plan will be introduced as early as possible in order to minimize the eventual number of changes to station assignments which might be necessary at the time of future implementation of such a plan. Not all allocations would be usable at the time of introduction of this plan and, therefore, future implementation will await a reasonable penetration

of improved TV receivers to ensure minimal inconvenience to the public.

C. Licensing in Reallocated Spectrum

The proposed domestic allocations are presented in Appendix "D". The major changes to the existing Canadian Table of Frequency Allocations are as follows:

a) 406.1-410[5] MHz - Mobile (except aeronautical) and mobile satellite except aeronautical (earth-to-space) services will be added on a primary basis to the existing primary radio astronomy allocation for sharing on a geographic basis.

b) 420-430 MHz - Radiolocation and amateur services are deleted from the Table. The mobile (except aeronautical) service is added on a primary basis.

c) 806-890 MHz - Mobile (except aeronautical) service is added on a primary basis to the existing broadcasting allocation and mobile-satellite service is added in the band by footnote. This spectrum is placed on reserve pending further assessment in light of developments affecting these services over the next few years.

d) 902-928 MHz - Amateur is added on a secondary basis.

It should be noted that these new allocations will only be made available for use when required. It is proposed that the Department request potential users of this spectrum to indicate, in detail, their predictions and proposed plans for using the new bands. Procedures will be established to evaluate such proposals.

D. Further Reallocations

The Department is prepared to consider further reallocation proposals to respond to public demand for services. In addition to the fixed service requirements previously mentioned, the Department would be interested in views on future allocations in the 890-902 and 928-942 MHz bands. In particular, an indication of requirements for personal radio services similar to or as a further development of the General Radio Service would be useful.

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[5] The corresponding mobile-satellite downlink would be outside of the 406-960 MHz band.

APPENDIX "A"

NOTICE TO BE PUBLISHED IN THE

CANADA GAZETTE, PART I

DEPARTMENT OF COMMUNICATIONS

Ref: DGTN-003-77
DGTR-014-77

Subject: Release of A Discussion Paper on Canadian Spectrum Allocations in the 406-960 MHz Frequency Band

On August 21, 1976, the Department invited submissions from all interested parties concerning spectrum allocations in Canada in the 406 to 960 MHz frequency band.

The Department has reviewed the submissions received and has prepared a paper entitled A Discussion Paper on Canadian Spectrum Allocations in the 406-960 MHz Frequency Band. Copies of this paper may be obtained from the Director General, National Telecommunications Branch, Department of Communications, 300 Slater Street, Ottawa, Ontario, K1A 0C8 (phone 613-995-8185), or from DOC regional offices in Vancouver (phone 604-666-8530), Winnipeg (phone 204-985-4144), Toronto (phone 416-966-6276), Montreal (phone 514-238-2177) and Moncton (phone 506-858-2094).

The Department now invites submissions from all interested parties on the proposed spectrum allocations in the 406-960 MHz band.

Submissions should be addressed to the Director General, National Telecommunications Branch, at the above address and must be postmarked not later than 90 days from the date of publication of this notice. 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 DOC regional offices as listed above.

Dated at Ottawa, this 17th day of December, 1977.

J. deMercado
Director General
Telecommunication Regulatory Service

K.T. Hepburn
Director General
National Telecommunications Branch

A P P E N D I X "B"

TABLE OF PRESENT ITU REGION 2 AND CANADIAN ALLOCATIONS

ITU REGION 2	CANADA
406 - 406.1 MHz MOBILE-SATELLITE (Earth-to-Space) 314 317A 317B	406 - 406.1 MHz MOBILE-SATELLITE (Earth-to-Space) 317A
406.1 - 410 MHz FIXED MOBILE (except aeronautical mobile) RADIO ASTRONOMY 233B 314	406.1 - 410 MHz RADIO ASTRONOMY 233B
	410 - 414 MHz MOBILE (except aeronautical mobile) Fixed
410 - 420 MHz FIXED MOBILE (except aeronautical mobile) 314	414 - 415 MHz FIXED Mobile (except aeronautical mobile)
	415 - 419 MHz MOBILE (except aeronautical mobile) Fixed
	419 - 420 MHz FIXED Mobile (except aeronautical mobile)
420 - 450 MHz RADIOLOCATION Amateur 318 319A 319B 320A 323 324	420 - 450 MHz RADIOLOCATION Amateur 318 319A 320A
450 - 460 MHz FIXED MOBILE 318B 318C 318 319A	450 - 470 MHz MOBILE 318B 318C Fixed C28 C43 C44 C45 C46 318 319A
460 - 470 MHz FIXED MOBILE 318B 318C Meteorological-Satellite (Space-to-Earth) 318A 324B	

ITU REGION 2	CANADA
470 - 890 MHZ BROADCASTING 329A 332 332A	470 - 608 MHz BROADCASTING 608 - 614 MHz RADIO ASTRONOMY 332 614 - 890 MHz BROADCASTING 332A
890 - 942 MHz FIXED RADIOLOCATION 339A 340	890 - 942 MHz FIXED RADIOLOCATION C47 340 339A
942 - 960 MHz FIXED 339A	942 - 960 MHz FIXED C47 339A

CATEGORIES OF SERVICES:

1. Services the names of which are printed in capital letters, e.g. FIXED, are primary services.

2. Services the names of which are printed in lower case letters, e.g. Fixed, are secondary services. Stations of a secondary service:

   a) shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date;

   b) cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date;

   c) can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date.

INTERNATIONAL FOOTNOTES

233B - In making assignments to stations of other services to which the bands 37.75-38.25 MHz, 150.05-153 MHz, 406.1-410 MHz, 2690-2700 MHz and 4700-5000 MHz are allocated, administrations are urged to take all practicable steps to protect radio astronomy observations from harmful interference.

314 - In the United Kingdom, the band 400.05-420 MHz is also allocated to the radiolocation service; however, between 400.05 and 410 MHz, the allocation to the radiolocation service is on a secondary basis.

317A - The band 406-406.1 MHz is reserved solely for the use and development of low-power (not to exceed 5 W) emergency position-indicating radiobeacon (EPIRB) systems using space techniques.

317B - In Austria, Bulgaria, Chile, Cuba, Ethiopia, Hungary, India, Iran, Kenya, Kuwait, Liechtenstein, Malaysia, Uganda, Poland, the United Arab Republic, Rwanda, Sweden, Switzerland, Syria, Tanzania, Czechoslovakia and in the U.S.S.R., the band 406-406.1 MHz is also allocated to the fixed service and the mobile, except aeronautical mobile, service.

318 - Radio altimeters may also be used until 31 December 1974 in the band 420-460 MHz. However, after this date, they may be authorized to continue to operate on a secondary basis except in the U.S.S.R. where they will continue to operate on a primary basis.

318A - In Bulgaria, Cuba, Hungary, Poland, Romania, Czechoslovakia and the U.S.S.R., the band 460-470 MHz may be used, on a primary basis, by the meteorological-satellite service subject to agreement among administrations concerned and those having services, or intending to introduce services, operating in accordance with the Table, which may be affected.

318B - In the maritime mobile service, the frequencies 457.525 MHz, 457.550 MHz, 457.575 MHz, 467.525 MHz, 467.550 MHz and 467.575 MHz may be used by on-board communication stations. The use of these frequencies in territorial waters may be subject to the national regulations of the administration concerned. The characteristics of the equipment used shall conform to those specified in Appendix 19A. (1974 WARC-MM)

318C - In the territorial waters of Canada, the United States and the Philippines, the preferred frequencies for use by on-board communication stations shall be 457.525 MHz, 457.550 MHz, 457.575 MHz and 457.600 MHz paired, respectively with 467.750 MHz, 467.775 MHz, 467.800 MHz and 467.825 MHz. The characteristics of the equipment used shall conform to those specified in Appendix 19A. (1974 WARC-MM)

319A - The band 449.75-450.25 MHz may be used for space telecommand and space research (Earth-to-space) subject to agreement between the administrations concerned and those having services, operating in accordance with the Table which may be affected.

319B - In France and the French Department of Guayana (Region 2), the frequency 434 MHz $\pm$ 0.25 MHz may be used for space operation (Earth-to-space) subject to agreement between the administrations concerned and those having services operating in accordance with the Table, which may be affected.

320A - In the band 435-438 MHz, the amateur-satellite service may be authorized, on condition that no harmful interference shall be caused to other services operating in accordance with the Table. Administrations authorizing such use shall ensure that any harmful interference caused by emissions from an amateur satellite is immediately eliminated in accordance with the provisions of No. 1567A.

323 - In Indonesia, the band 420-450 MHz is also allocated on a secondary basis to the fixed service and mobile, except aeronautical mobile service.

324 - In Australia, the band 420-450 MHz is also allocated to the fixed service until the frequency assignments in this band for the fixed service stations are transferred to another band.

324B - Earth exploration-satellite service applications, other than the meteorological-satellite service, may also be used in the bands 460-470 MHz and 1690-1700 MHz for space-to-earth transmissions on condition that no harmful interference is caused to stations operating in accordance with the Table.

329A - In Argentina and Uraguay, the band 602-608 MHz is allocated to the radio astronomy service.

332 - In Region 1, except the African Broadcasting Area, the band 606-614 MHz, and in Region 3, the band 610-614 MHz may be used by the radio astronomy service. Administrations shall avoid using the band concerned for the broadcasting service as long as possible and, thereafter, as far as practicable, shall avoid the use of such effective radiated powers as will cause harmful interference to radio astronomy observations.

In Region 2, the band 608-614 MHz is reserved exclusively for the radio astronomy service until the first Administrative Radio Conference after 1 January 1974 which is competent to review this provision; however, this provision does not apply to Cuba.

332A - Within the frequency band 620-790 MHz, assignments may be made to television stations using frequency modulation in the broadcasting-satellite service subject to agreement between the administrations

concerned and those having services, operating in accordance with the Table, which may be affected (see Resolutions Nos.Spa2-2 and Spa2-3). Such stations shall not produce a power flux density in excess of the value-129 dBw/m2 for angles of arrival less than 20° (see Recommendation No. Spa2-10) within the territories of other countries without the consent of the administrations of those countries.

339A - Specific portions of the frequency band 900-960 MHz may also be used on a secondary basis for experimental purposes in connection with space research.

340 - In Region 2, the frequency 915 MHz is designated for industrial, scientific and medical purposes. Emissions must be confined within the limits of $\pm$ 13 MHz of that frequency. Radiocommunication services operating within these limits must accept any harmful interference that may be experienced from the operation of industrial, scientific and medical equipment.

CANADIAN FOOTNOTES

C28 - Test and demonstration frequencies 30.58, 49.94, 154.49 and 460.950 MHz are available for brief on-the-air test and demonstration. 32.48, 32.52 and 32.56 MHz are available for temporary services low power (five watts or less). 34.060, 41.420, 138.405, 142.395, 167.730, 170.940, 462.500, 467.650 are available for temporary service.

C43 - Land Mobile and low-capacity fixed except 457.125 to 457.175 MHz and 462.925 to 462.975 MHz with 25 kHz channelling.

C44 - Broadcast Studio Transmitter Links (STL) Primary service 450.0 to 451.0 MHz and 455.0 to 456.0 MHz.

C45 - Common Carrier Air/Ground - Ground stations 454.675 to 454.975 MHz Aircraft 459.700 to 459.975 MHz. Calling frequency 454.675 MHz.

C46 - Radio Paging - For common carriers providing a land telephone wireline service on 454.1 and 454.35 MHz. For all other common carriers including restricted common carriers, 459.1 and 459.35 MHz are available with an ERP not exceeding 500 watts.

C47 - Low capacity fixed for systems having a capacity of six to 48 voice channels or equivalent and for high-quality audio Studio Transmitter Links (STLs).

ALPHABETICAL INDEX 406-960 MHz BRIEFS APPENDIX "C"

NAME	DATE
Access Alberta Television South	Dec. 21, 1976
ATEC - Agency for Tele-Education in Canada	Dec. 14, 1976
Canadian Electrical Association	Nov. 19, 1976
Canadian Amateur Radio Federation	Dec. 21, 1976
Canadian Association of Fire Chiefs	Dec. 10, 1976
Canadian Association of Broadcasters	Dec. 20, 1976
The Canadian Broadcasting Corporation	Dec. 8, 1976
The Canadian Broadcasting Corporation	Jan. 27, 1977
Canadian Cable Television Association	Dec. 20, 1976
Canadian Industrial Communications Assembly	Dec. 14, 1976
The Canadian Manufacturers' Association	Nov. 29, 1976
The Canadian Radio Relay League	Aug. 30, 1976
Candian Radio Technical Planning Board	Dec. 8, 1976
Canadian Telecommunications Carriers Association	Dec. 17, 1976
Canadian Trucking Association	Nov. 12, 1976
Canfor Ltd.	Dec. 21, 1976
Domtar Chemicals Ltd.	Dec. 1, 1976
Electrical & Electronics Manufacturers Assoc. of Canada	Dec. 3, 1976
Hamel, Yves R.	Dec. 17, 1976
Keller & Heckman Law Offices	Dec. 6, 1976
Maximum Services Telecasters	Nov. 1, 1976
Metro Toronto Police	Dec. 13, 1976
Montreal, City of	Dec. 13, 1976
Motorola	Dec. 17, 1976
Multitone Electronics	Dec. 17, 1976
Nechako School District No. 56	Dec. 14, 1976
Netherlands Overseas Mills	Dec. 17, 1976
Newfoundland & Labrador, Gov't of	Jan. 10, 1977
Ontario Educational Communications Authority	Dec. 14, 1976
Ontario Gov't, Ministry of Government Services	Dec. 20, 1976
Association of Municipal Electrical Utilities of Ontario	Jan. 4, 1977
Plateau Mills	Dec. 16, 1976
Prince George Fire Dept.	Dec. 13, 1976
Prince George Regional Hospital	Dec. 16, 1976
Québec, Gouvernement du	Dec. 15, 1976
Radio Common Carriers Association RCCA	Dec. 21, 1976
Radio Phones Ltd.	Dec. 8, 1976
Radio Southern Manitoba	Sept.10, 1976
The Railway Association of Canada Ltd.	Dec. 17, 1976
Rustad Bros. & Co. Ltd.	Dec. 15, 1976
Switzer Engineering Services Limited	Nov. 20, 1976
Switzer Engineering Services Limited	Nov. 21, 1976
Transport Canada	Dec. 15, 1976
Weldwood of Canada Ltd.	Dec. 1, 1976

ALPHABETICAL INDEX OF REPLY COMMENTS 406-960 MHz BRIEFS APPENDIX "C"

NAME	DATE
Atlantic Television System (ATV)	Feb. 3, 1977
Canadian Association of Broadcasters	Mar. 4, 1977
Canadian Broadcasting Corporation	Feb. 21, 1977
CFRB Ltd.	Feb. 10, 1977
CHBC Okanagan Television	Feb. 9, 1977
CJVI/900	Feb. 7, 1977
CKCL Radio Colchester Broadcasting Co. Ltd.	Feb. 7, 1977
CKLG - FM & AM	Feb. 4, 1977
CKNW/98	Feb. 24, 1977
CKOM Broadcast House	Feb. 8, 1977
CKY-TV MTV Limited	Feb. 4, 1977
Canadian Telecommunications Carriers Association	Feb. 21, 1977
CTV Television Network	Feb. 3, 1977
Fraser Valley Broadcasters Ltd.	Feb. 24, 1977
Motorola	Feb. 21, 1977
Multitone	Jan. 6, 1977
National Research Council	Feb. 15, 1977
Radio Nord	Feb. 10, 1977
RCMP	Feb. 2, 1977
Transport Canada	Feb. 18, 1977

PRESENT DOMESTIC ALLOCATIONS	PROPOSED DOMESTIC ALLOCATIONS
406 - 406.1 MHz	406 - 406.1 MHz
MOBILE-SATELLITE (Earth-to-Space)	MOBILE-SATELLITE (Earth-to-Space)
317A	317A
406.1 - 410 MHz	406.1 - 410 MHz
RADIO ASTRONOMY	RADIO ASTRONOMY
	MOBILE (except aeronautical mobile)
	MOBILE-SATELLITE except aeronautical mobile (Earth-to-Space)
233B	233B
410 - 414 MHz	410 - 414 MHz
MOBILE (except aeronautical mobile)	MOBILE (except aeronautical mobile)
Fixed	Fixed
414 - 415 MHz	414 - 415 MHz
FIXED	FIXED
Mobile (except aeronautical mobile)	Mobile (except aeronautical mobile)
415 - 419 MHz	415 - 419 MHz
MOBILE (except aeronautical mobile)	MOBILE (except aeronautical mobile)
Fixed	Fixed
419 - 420 MHz	419 - 420 MHz
FIXED	FIXED
Mobile (except aeronautical mobile)	Mobile (except aeronautical mobile)
420 - 450 MHz	420 - 430 MHz
RADIOLOCATION	MOBILE (except aeronautical mobile)
Amateur	
	318
	430 - 450 MHz
	RADIOLOCATION
	Amateur
318 319A 320A	318 319A 320A
450 - 470 MHz	450 - 470 MHz
MOBILE 318B 318C	MOBILE 318B 318C
Fixed	Fixed
C28 C43 C44 C45 C46 318 319A	C28 C43 C44 C45 C46 318 319A
470 - 608 MHz	470 - 608 MHz
BROADCASTING	BROADCASTING
608 - 614 MHz	608 - 614 MHz
RADIO ASTRONOMY	RADIO ASTRONOMY
332	332

PRESENT DOMESTIC ALLOCATIONS	PROPOSED DOMESTIC ALLOCATIONS
614 - 890 MHz BROADCASTING	614 - 806 MHz BROADCASTING
332A	332A
	806 - 890 MHz BROADCASTING MOBILE
	XX
890 - 942 MHz FIXED RADIOLOCATION	890 - 902 MHz FIXED Radiolocation
C47 340 339A	339A C47
	902 - 928 MHz FIXED Radiolocation Amateur
	339A 340 C47
	928 - 942 MHz FIXED Radiolocation
	339A C47
942 - 960 MHz FIXED	942 - 960 MHz FIXED
C47 339A	C47 339A

FOOTNOTES

ADDED

XX - In Region 2, the band 806-890 MHz is also allocated to the mobile-satellite service for the use and development of systems using space radiocommunications techniques. Such use and development is subject to agreement and co-ordination between the administrations concerned and those having services, operating in accordance with the table, which may be affected.