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Spectrum allocations in the 406 - 960 MHz frequency band

Department of Communications
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A BACKGROUND PAPER ON SPECTRUM ALLOCATIONS IN THE 406 - 960 MHZ FREQUENCY BAND

I INTRODUCTION

The Department is currently considering possible changes in policies for the use of the 406 to 960 MHz band. The purpose of this background paper is to briefly outline the issues involved and to invite public comment on these issues and their resolution.

The demand for commercial land mobile radio services (transportation, police, shipping, fire, etc.) has increased to the point where existing spectrum allocations to this service could become saturated in major Canadian urban centres by the 1980's. The problem for Canada is to develop policies for the use of the UHF band which will provide a reasonable allocation of spectrum for Canadian mobile, broadcasting and other services.

II BACKGROUND

The 406 - 960 MHz band in Canada contains, as shown in Appendix "A", allocations to the radiolocation, amateur, mobile, broadcasting, radio astronomy, fixed, and Industrial-Scientific-Medical (ISM) services. This range of spectrum provides convenient limits within which to consider several urgent spectrum policy issues since all reasonable options to solve these problems can be contained within these limits. Below 400 MHz, the allocations are largely to government fixed and mobile services and cannot be easily changed. Similar considerations affect the frequencies immediately above 960 MHz where the allocation is to aeronautical radionavigation and thus is fairly rigidly constrained by international agreements affecting civil aviation. Between 400 and 406 MHz, allocations to many space and scientific services in 5 bands is similarly constrained and in any event do not offer significant bandwidths.

Some years before the problem of land mobile congestion was emerging in Canada, saturation of available allocations to this service had been encountered in several cities in the United States. Finally after exhaustive deliberation over many years, the FCC 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 the 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 13 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, however, than the U.S. and proposed a means whereby certain actions could be taken to increase the number of 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 the present time, only a limited number of television stations may be assigned in a given area in the UHF television band. For each assignment that is made in a specific city, up to a maximum of nineteen 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 spectrum.

III FACTORS

In addition to the historical information presented in the preceding background section, it is useful to consider some of the salient factors involved in this matter.

(1) Existing Services in the 406 - 960 MHz band.

i) Broadcasting

In Canada, the entire UHF TV spectrum from channel 14 to 83 has been utilized for regular television assignments. In fact, in the current Tables of Allocations under the Canada/U.S.Television Agreement, there are a significant number of channel 70 to 83 allocations for Canada and some assignments have already been made in this frequency range. The U.S.A. has largely reserved channels 70 to 83 for low-power translators.

A further point concerning broadcasting allocations in the UHF band is the fact that, while satellite broadcasting is permitted within a portion of the UHF television band (620 to 790 MHz.), 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.

ii) Mobile

In Canada's major urban centres, congestion in the present bands allocated to the land mobile service is growing. Several technical solutions such as the use of more narrowly 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.

In Canada/U.S. border areas, congestion is further complicated by the fact that often urban centres on both sides of the border place demands on the same spectrum with one country's requirements often preceding the other's.

iii) Fixed

In Canada, 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 Table of Allocations in Appendix "A", 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. 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. Non-ISM 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 studio-to-transmitter links (STL's) are assigned frequencies in the 956 - 960 MHz band.

iv) Amateur

As can be seen from the Table of Allocations in Appendix "A", in ITU Regions 2 and 3 the amateur service shares the 420 to 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). While to date, extensive use has not been made of this band by Canadian amateurs, frequencies in this band are employed by the amateur satellite service.

v) Radiolocation

As noted above, radiolocation has primary status in the 420 to 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.

vi) Radio Astronomy

The radio astronomy service has allocations in two portions of the 406 to 960 MHz band. As can be seen from Appendix "A", 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 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.

vii) 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 the 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 low radiated-power devices are not licensed by the Department as are most other equipments utilizing the radio spectrum. Microwave ovens and industrial drying equipment operate in this band. The use by home microwave ovens is thought to be small as most of these devices employ higher-frequency ISM bands. Several new uses have been proposed in the U.S. for this 900 MHz ISM band such as video disc systems, amateur, citizen's band radio and automatic vehicle location systems.

In addition to the above mentioned existing services in the 406 to 960 MHz band, consideration must be given to services which may wish to make use of the band in the future but which at the present time are not allocated spectrum in this band.

(2) Related Factors

There is a direct relationship between these 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 non-conforming use of the spectrum must not interfere with services operating in accordance with the International Table.

The Department is also actively involved in preparing for the 1977 ITU WARC for the planning of the Broadcasting-Satellite service in the 11.7 to 12.2 GHz band. Since such a service, if implemented, could provide yet another means of delivery for broadcast signals, the planning of this service at 12 GHz could have an impact on the allocations to the broadcasting and broadcasting-satellite services in the UHF band.

IV DEVELOPMENT OF A POLICY

In presenting the information in this paper, the Department invites submissions from all interested parties outlining in detail what the Canadian policy for the use of this UHF spectrum should be. While these recommendations will probably largely focus upon the allocation table, they need not restrict themselves solely to allocation matters.

Regarding changes to the allocation table, a wide range of possibilities arise. These extend from making no changes to undertaking a complete revision of the Canadian allocations in this band. Certain combinations of changes that can be identified as possible options include i) making no changes ii) making the same changes as have been made in the U.S. iii) adopting the 1974 recommendations of the CRTPB or iv) making some other set of changes to the allocation table. Quite obviously, advantages and disadvantages of all options that may present themselves must be carefully weighed in developing a policy that is in Canada's best interest.

In preparing submissions on this matter, interested parties should provide as much detail as possible. Submissions may include but not necessarily restrict themselves to a discussion of -

1. Revisions to the present Table of Allocations as justified by a presentation of past and expected future requirements for spectrum in this band including some idea of when and where these requirements are likely to arise.

2. System considerations i.e. types of systems in use or planned, bandwidth requirements, etc.

3. Methods of improving spectrum utilization efficiency.

4. Techniques other than allocation table changes for relieving spectrum congestion.

5. The impact of new technological developments and new services.

6. The implementation process and timing for any changes proposed including considerations of amortization costs, equipment availability, block allocations to specific types of users within a given service, ownership considerations, etc.

7. Relevant social considerations.

Instructions for the transmittal of submissions was given in a notice published in the Canada Gazette, a copy of which is given in Appendix "B".

APPENDIX A

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	470 - 608 MHz BROADCASTING
470 - 890 MHz BROADCASTING 329A 332 332A	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

CATEROGIES OF SERVICES:

1. Services whose names are printed in capital letters e.g. FIXED are primary services.

2. Services whose names 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, Roumania, 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 Guyana (Region 2) the frequency 434 MHz ± 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 (5 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 6 to 48 voice channels or equivalent and for high quality audio Studio Transmitter Links (STL's).

APPENDIX "B"

GAZETTE NOTICE

DEPARTMENT OF COMMUNICATIONS

OTTAWA August 21, 1976.

The Department invites submission from all interested parties concerning spectrum allocations in Canada in the 406 to 960 MHz. frequency band. These submissions will be used to arrive at the final policy for the use of this band including, if necessary, consideration of any changes to the present allocations. At the present time, the following types of services are allocated spectrum in the band.

- Broadcasting
- Mobile
- Fixed
- Amateur
- Radiolocation
- Radio Astronomy
- Industrial, Scientific and Medical

A background paper containing information on the allocations in this band in Canada may be obtained from the Department of Communications, Director-General, National Telecommunications Branch, 300 Slater Street, Ottawa, Ontario, K1A 0C8 or from DOC Regional offices in Vancouver, Winnipeg, Toronto, Montreal and Moncton.

Submissions should be addressed to the Director-General, National Telecommunications Branch at the above address and must be postmarked not later than 120 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. Those wishing to respond to these submissions may do so in writing to the afore-mentioned Director-General, National Telecommunications Branch within a further 60 day period.

Dated at Ottawa, this 21st day of August , 1976.

K T Hepburn

K. T. Hepburn
Director-General
National Telecommunications Branch