Use of Broadcasting Spectrum Allocations for fixed Relays in support of Broadcasting Operations

Government of Canada
Department of Communications

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Ministère des Communications

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USE OF BROADCASTING SPECTRUM ALLOCATIONS FOR FIXED RELAYS IN SUPPORT OF BROADCASTING OPERATIONS

INTRODUCTION

Recently the number of applications submitted to the Department for the use of broadcasting channels in areas essentially devoid of population solely for carriage of broadcast programming on a point-to-point basis to feed one or more broadcast repeaters has increased substantially. In this paper, such systems will be referred to as broadcast relays. This increase in applications is partially a result of the CBC Accelerated Coverage Plan (ACP) to extend national radio and television services. In addition, there are other initiatives to provide commercial TV services for distribution by cable TV systems or by off-air TV repeaters.

As a result of this thrust to introduce broadcast services primarily in the more remote areas of Canada, there is a danger that any non-standard use of broadcast spectrum for relay purposes may eventually hamper the future development of the Canadian broadcasting system. There is a further concern that proliferation of broadcast relays may delay or frustrate the extension of high quality microwave telecommunications services into remote areas of Canada. On the other hand, there may be some areas of Canada which may not be served by such facilities for some time. For such areas, the use of broadcast spectrum for relay purposes may prove to be an attractive intermediate-term solution.

The objective of this paper is to assess the factors related to this usage and to suggest a policy related to the use of broadcasting spectrum for relay purposes taking into account the needs of those Canadians living in remote areas. In the paper, criteria are proposed which the Department would utilize to assess applications for the use of such broadcast relays vis-à-vis the use of other more conventional means of satisfying the relay requirement. The Department invites comments on this proposed policy for the authorization of broadcast relays following the instructions given in the notice to be published in the Canada Gazette contained in Appendix "A" of this paper.

BACKGROUND

Activity to date with regard to the authorization of broadcasting relays can be summarized as outlined below:

Recently, the Department received the first application for use of the FM broadcast band (88-108 MHz) for a point-to-point relay to carry broadcast programming to a remote broadcast repeater. On review of the allocation policy issues related to this application, it appeared that the usage (fixed point-to-point service) was not consistent with the allocation (broadcasting service). Subsequently, the applicant withdrew the proposal and obtained the service from an extension of the common carrier microwave facility in the area.

The use of the television broadcasting bands for relay operation has been permitted in the past on a case-by-case basis when there was good economic justification, or if there were operational difficulties in using microwave or other fixed service allocations, and when the relay was limited in length. Under such circumstances, broadcast relays have been authorized to carry signals for re-transmission by off-air broadcast repeaters usually situated in relatively remote localities.

The use of either FM radio or television broadcasting spectrum for relay operations in support of broadcast receiving (cable television) undertakings has not been permitted.

FACTORS RELATING TO THE USE OF SPECTRUM ALLOCATED TO THE BROADCASTING AND FIXED SERVICES

a. Performance

VHF-TV, UHF-TV or FM radio rebroadcast transmitters employ the heterodyne principle for converting from one frequency to another. There is successive degradation added on each re-transmission and it has been found that no more than 5 relay hops can be employed in series without unacceptable degradation. On the other hand, in conventional fixed point-to-point systems, the signal is modulated for transmission over the radio relay carrier system, and then demodulated and retransmitted on the appropriate broadcasting frequencies for reception by the general public. This modulation/demodulation process can also cause some slight degradation to signal quality. Overall, however, it has been found that with the use of broadcast relays, each successive hop degrades performance more than that when fixed relay equipment using a modulation/demodulation process is employed.*

b. Cost

Historically, financial considerations have been quoted as the prime motivation for employing broadcast relays as opposed to microwave or other fixed spectrum options. Depending on the type of equipment employed to operate in bands allocated to the fixed service, and on the options specified (e.g. output power level, protection, status and monitoring features etc.), the capital cost can vary substantially. It is, therefore, difficult to compare the costs of "typical" microwave equipment and "typical" broadcasting equipment.

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*In the past, the type of fixed relay equipment employed was that used for single hop studio transmitter links which requires demodulation and remodulation at each intermediate repeater. Less complex heterodyne type repeaters are currently available where the modulation/demodulation process occurs only when access to the base band signal is required.

As part of the public consultation process, the Department requests comment on the capital and operations and maintenance costs for the transmission of television and/or radio signals in remote areas by each of the following means:

a) the use of broadcasting equipment for point-to-point relays

b) the use of equipment designed to operate in the bands allocated to the fixed service

c) the use of satellite distribution

d) any other means.

c. Maintenance

One aspect of maintenance, in addition to costs as discussed above, concerns the familiarity of the staff of broadcasting undertakings with broadcasting equipment. The use of broadcasting equipment (and the same spare parts inventory) for both broadcast relays as well as the off-air broadcast repeaters facilitates maintenance. This is particularly true in remote areas where specialist technicians, familiar in servicing fixed point-to-point equipment, and an extensive spare parts inventory are largely non-existent.

d. Non-Standard Use of Spectrum

Article 1 of the International Radio Regulations provides the internationally recognized definitions for the fixed and broadcasting services as noted below:

> Fixed Service: A service of radiocommunication between specified fixed points.
>
> Broadcasting Service: A radiocommunication service in which the transmissions are intended for direct reception by the general public. This service may include sound transmissions, television transmissions or other types of transmissions.

From a review of these definitions, the prime objective of broadcast relays as described earlier in this paper would seem to categorize such operations as falling within the fixed service rather than the broadcasting service and, more appropriately, should use spectrum allocated to the fixed service. Spectrum is allocated among services to accommodate the needs of each service, a proliferation of relay operations in broadcasting allocations could eventually result in a shortage of broadcasting spectrum and disrupt the normal development and extension of the national broadcasting system. Although broadcasting relays would be authorized on a non-protected, non-interfering basis, relay operations continuing over a period of time might be difficult to displace thus perhaps precluding or at least delaying standard use of broadcast spectrum in the future in these areas.

e. Network Development

One of the responsibilities of the Minister of Communications outlined in Section 4.(1)(b) of the Radio Act is to issue licences, and technical construction and operating certificates for such terms and subject to such conditions as he considers appropriate for ensuring the orderly development and operation of radiocommunications in Canada.

One of the objectives of the Department of Communications is to further the development and extension of reliable telecommunication services for Canadians in all areas of Canada. In remote areas, proliferation of relay operations in broadcasting allocations for the limited purpose of delivery of broadcast signals may thwart this objective of network development. Authorization of broadcast relays while providing a broadcasting signal to a remote area does nothing to satisfy the other telecommunication needs of the residents. In fact, it may fragment the revenue base required to efficiently and economically develop and extend facilities providing a range of telecommunication services. Therefore, the use of broadcasting relays may retard the development of high quality telecommunication facilities into remote areas.

f. Summary

Taking the above factors into account, it would appear that there may be some short to intermediate-term advantages in some situations to the use of broadcasting spectrum for relay purposes. In the longer term, the situation is not so clear and the Department will have to continue to review the potential impact of the proliferation of any continuing non-standard usage of broadcast spectrum in remote areas.

OPTIONS

In dealing with this matter, the Department could permit the operation of only conventional broadcasting stations in broadcasting spectrum in all parts of Canada thereby prohibiting the use of broadcast spectrum for broadcast relay purposes. This option may provide a stimulus to the expansion and/or development of higher quality telecommunication facilities in remote areas; however, not permitting broadcast relays in these areas would mean foregoing the operational and economic advantages of such systems.

As a second option, the Department could grant all applications for the use of broadcasting spectrum for relay purposes on a non-protected, non-interfering basis in remote areas of Canada. While broadcast relays may be operationally attractive, particularly in remote areas where specialist technicians and large spare parts inventories are non-existent for the maintenance of fixed point-to-point equipment, proliferation of broadcast relays for the limited purpose of bringing broadcast signals to remote areas may thwart the development and/or extension of high quality telecommunication facilities and additional broadcast services into these same areas.

Neither of these two extremes would appear to contain the basis of a solution to the problem of providing a low cost, efficient method for the transmission of broadcasting signals to remote areas of Canada.

A third option lying within the range set by the above two options has been identified. It embodies a set of criteria to govern authorization of broadcasting spectrum for relay purposes. Such criteria are proposed below, and if satisfactorily met, then authorization of the relay would proceed as outlined. If the criteria were not met, then the application for licensing would be returned to the applicant for further consideration with the recommendation that the proposal be resubmitted requesting frequencies in bands allocated to the fixed service.

Applicants for broadcast relays would complete and submit a brief as proposed in Annex 1 which outlines in detail the information needed for assessment.

Generally, the Application Brief for Broadcasting Relay Systems would be required for VHF or UHF television applications or for FM radio applications where the sole intent of the proposed station is its use for relay purposes. In such applications, the sole intent of the proposed station would be determined from a review of the proposed coverage contour. In the case of television, if there were no people resident for at least a portion of the year within the proposed Grade B coverage contour, the applicant would be required to submit the Application Brief for Broadcast Relay Systems in addition to the documentation specified in the applicable broadcast procedure. Similarly in the case of FM radio, if there were no people resident within or transient through the proposed 500uV/m coverage contour, the application would be assessed as a broadcast relay and applicants would be required to submit the Application Brief for Broadcast Relay Systems.

It should be noted that for UHF or VHF television applications, where there are normally people resident within the Grade B coverage contour of the proposed station for at least a portion of the year, the application would be processed in accordance with the appropriate issue of one of the Department's broadcast procedures without the need for the Application Brief for Broadcast Relays.

Similarly for FM radio, where there are normally people resident within the 500uV/m contour of the proposed station for at least a portion of the year, the application would be processed in accordance with the current issue of broadcast procedure. In addition, in the case of FM radio, where the applicant demonstrates the existence of transient population within the coverage area of the station, the application would also be processed in accordance with the appropriate broadcast procedure. (This provision is to permit sound broadcasting to persons travelling along highways or waterways where no actual resident population would be included in the coverage contour.)

The Department reserves the right to judge the need for and to require the submission of an Application Brief for Broadcast Relays from any applicant.

Authorization Criteria

1. The proposed broadcast relay must carry only broadcasting and broadcasting related signals.

2. The signal carried by the broadcast relay must be transmitted on reception without artificial delay at the end of the relay link.

3. A broadcast relay may not be used to provide signals for direct distribution by a broadcast receiving (CATV) undertaking.

4 Technical standards of transmission will have to meet those for a conventional broadcasting transmitter according to the applicable broadcast procedure.

5. Broadcast relays would be authorized only where their use over the use of equivalent point-to-point fixed service relays has been clearly substantiated. Justification must outline the economic/operational advantages .

6. Broadcast relays once authorized would be afforded no protection from interference from conventional licensed broadcasting stations and must not cause interference to such operations. Should the operation of a relay cause interference to such broadcasting stations operating either on allotted (ie protected) channels or on a non-protected basis and whether established before or after the relay system, remedial measures would have to be taken even to the extent of terminating relay operations. Conversely, the relay system is not entitled to protection from interference from conventional broadcasting stations whether operating on allotted channels or on a non-protected basis. In addition, broadcast relays would not be afforded protection from the operations of any other radio service to which the spectrum may be allocated internationally or in Canada. Relay systems would only be entitled to protection from other relay systems established at a later date.

7. The use of broadcast relays will generally be limited to the transmission of the first and second television services for any area and for no more than two sound broadcast signals. Any exceptions would depend on the demand for broadcasting services in the community to be served, the level of spectrum congestion in the vicinity, and the existing and future requirements for broadcasting or other telecommunications service in the community or in other communities in the same area. Subsequent applications for additional services following the same route by the same or other operators will require a full review of the existing and proposed structures with a view towards use of conventional fixed service facilities in the earliest practical

time frame. Applications for broadcast relays following a different route to service an area already served by broadcast relays will generally be denied unless there is a valid technical reason for the alternate route.

8. Broadcast relays would only be authorized in areas where suitable point-to-point telecommunication common carrier facilities capable of carrying the broadcast signal are not available nor likely to become available in the immediate future.

9. The introduction of telecommunication facilities capable of carrying the broadcasting signal during the licence period of operation of the broadcast relay system, will generally result in a conditional licence renewal for the broadcast relay requiring the transfer of the signal to such facilities by a specified date.

   - Notwithstanding the provisions of Points 8 and 9, the Department will treat the authorization of broadcast relays on a special case basis, where the broadcasting entity operating the relay can demonstrate significant economic/operational advantages over leasing fixed point-to-point circuits from the common carrier.

10. If approved, the system shall be designed so as to minimize potential interference to existing or future stations in the same area. In the case of relays for television programming, the frequency assigned will generally be in the UHF TV band with the higher channels being selected first.

11. A system composed of one or more broadcasting relays terminated by a conventional broadcasting transmitter must be operated for the exclusive purpose of providing a broadcasting service in one or more areas.

The required information in support of each application would be supplied in accordance with the proposed format indicated in Annex 1.

SUMMARY

It is the Department's objective to promote the development of high quality telecommunication facilities thereby ensuring the supply of a full range of services to all areas of Canada as technology and economics permit. In this regard, any use of spectrum allocated to broadcasting used for relay purposes should be considered an interim step in the attainment of the above objective. At the same time, however, it is hoped that this proposed policy will aid in satisfying the legitimate telecommunication needs of Canadians living in remote areas of the country and will encourage the timely development and extension of both the Canadian broadcasting system and the telecommunication networks into these areas.

Draft Application Brief for Broadcast Relay Systems

The data requested below represents the minimum information required to assess applications for the use of spectrum allocated to the broadcasting service for relay purposes. In some cases, it may be necessary for the Department of Communications to obtain further information from the applicant. The Regional Director for the region in which the broadcast relay is proposed would indicate to any applicant if further information must be submitted. It should be noted that each application will be treated on a case-by-case basis.

a) The purpose of the radio facilities proposed. It should be stipulated whether the proposal involves the construction of new facilities and/or the augmentation or modification of existing facilities. This should include the precise requirement for the relay facilities.

b) A precise statement of the reasons why radio relays in spectrum allocated to the fixed service should not be used. The applicant should identify his particular objectives and explain in specific terms how the proposed system will meet these objectives better than the use of equivalent facilities in fixed spectrum allocations.

c) The nature, origin and destination of the signals that will be carried on the proposed facilities and a statement that the signals will be retransmitted without artificial delay at the end of the relay link.

d) A statement on the forecast lifetime of the broadcast relay equipment versus the lifetime of equivalent equipment using spectrum allocated to the fixed service.

e) A forecast of additional services which might be introduced by the applicant along the same route and the probable year of introduction. This is a request for a forecast only. In future, should additional services be requested, applications would have to be submitted to the Department as per this format.

f) A comparison of the anticipated performance in terms of signal to noise ratio at the termination of the relay between the broadcast relay facilities and the equivalent fixed spectrum facilities. In addition, applicants should provide information concerning the expected reliability for each type of system in terms of hours or days per year of expected downtime.

g) A comparison showing the total estimated capital cost of the proposed facilities using broadcast spectrum versus the capital cost of equivalent facilities using fixed spectrum. The major cost elements should be itemized with cost components corresponding to those shown in Table 1. The capital cost for the broadcast relay facilities and for the fixed facilities should be supported by an itemized estimate from equipment suppliers.

h) A comparison showing the estimated total annual operations and maintenance cost for the facilities using broadcast spectrum versus that using fixed spectrum. The major elements should be itemized with cost components corresponding to those shown in Table 2.

i) The cost of capital currently employed by the applicant.

j) An engineering-economic cost analysis employing the information presented in items g), h), and i) should be presented showing the cost comparisons over the economic lifetime of the equipment having the longest life, broadcast relay or fixed point-to-point equipment as specified in d). Costs for equipment to carry additional services forecast in e) should also be incorporated in the study.

k) Any other information supporting the proposal.

Acceptance of Conditions

The applicant must agree to the following three conditions in writing in the application, prior to departmental consideration:

1. acceptance by the operator of the broadcast relay that the Department will not afford any protection from interference to the broadcast relay system caused by any existing or future licensed conventional broadcasting operations or from any other services to which the spectrum may be allocated either internationally or within Canada.

2. acceptance that if the applicant's proposed broadcast relay causes interference to any existing or future conventional broadcasting service whether that service is operating on a protected or unprotected channel, or to any other services to which the spectrum may be allocated either internationally or within Canada, the applicant will rectify the interference problem at his own expense as expeditiously as possible or cease operation of his broadcast relay.

3. acceptance that the renewal of the station's Technical Construction and Operating Certificate (TCOC) will be judged in accordance with the departmental policy on the use of broadcast spectrum for relay links as it exists at the time of renewal.

Note on the use of Cost information

The cost information required is designed to permit a comparison between the applicant's annual cost of owning and operating a broadcast relay system versus a private point-to-point radio relay system using spectrum in the fixed service.

Where the use of spectrum allocated to the broadcasting service is not approved by the Department, consideration will be subsequently given to authorization of a system to provide equivalent service in appropriate bands allocated to the fixed service. If the service can be accommodated in spectrum below 890 MHz, the applicant will be requested to submit the appropriate licence application to the responsible regional office. If the service can only be accommodated above 890 MHz, the applicant will be requested to contact the regional office to discuss with the Regional Director whether any additional information is required to support an application for a private microwave system. In either case, the information contained in the proposed Application Brief for Broadcast Relays would be utilized in any subsequent licensing assessment as a portion of the information required for submission under Radio Standards Procedure 113 - Application Procedures for Planned Radio Stations Above 890 MHz in Terrestrial Fixed Service.

TABLE 1: ITEMS FOR CAPITAL COST COMPARISON ANALYSIS

BROADCAST RELAY	FIXED SPECTRUM LINK
receive antennas	receive antennas
receive transmission lines	receive transmission lines
translator	modulation/demodulation components
transmit transmission lines	transmitter
transmit antenna(s)	transmit transmission lines
electrical generator (if applicable)	transmit antenna(s)
towers	electrical generator (if applicable)
other components	towers
	other components

TABLE 2: ITEMS FOR ANNUAL OPERATIONS AND MAINTENANCE COST COMPARISON ANALYSIS

BROADCAST RELAY	FIXED SPECTRUM LINK
electrical generation costs	electrical generation costs
periodic inspection and maintenance costs	periodic inspection and maintenance costs
other similar costs incurred on a regular basis	other similar costs incurred on a regular basis

APPENDIX "A"

NOTICE PUBLISHED IN THE

CANADA GAZETTE, PART I

DEPARTMENT OF COMMUNICATIONS

Ref: DGTN-004-79

Subject: Release of a Discussion Paper:

Use of Broadcasting Spectrum Allocations for Fixed Relays in Support of Broadcasting Operations

Recently the number of applications submitted to the Department for the use of broadcasting channels in areas devoid of population solely for carriage of broadcast programming on a point-to-point basis to feed one or more broadcast repeaters has increased substantially. Since this non-standard use of broadcast spectrum for relay purposes may in time have an adverse impact on the development and extension of the Canadian broadcasting system and Canadian telecommunication networks, the Department has prepared a discussion paper which proposes for public comment a policy under which such systems would generally be authorized.

Copies of this paper, entitled Use of Broadcasting Spectrum Allocations for Fixed Relays in Support of Broadcasting Operations, may be obtained from Information Services, Department of Communications, 300 Slater Street, Ottawa, Ontario K1A 0C8 or from DOC regional offices in Vancouver Winnipeg , Toronto , Montreal and Moncton.

The Department now invites submissions from all interested parties on this discussion paper. Submissions should be addressed to the Director General, National Telecommunications Branch, at the above address and, to ensure consideration, 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.

Dated at Ottawa, this 8th day of December, 1979.

V. Hill
Acting Director General
National Telecommunications Branch